

# CAL POLY



# CATALOG 2013-2015



California Polytechnic State University  
**2013-2015 CATALOG**



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# President's Welcome

## A Message from President Armstrong



As the 21st Century unfolds, Cal Poly remains firmly committed to the values and traditions that have distinguished Cal Poly since it opened its doors more than a century ago. We seek to transform young adults into resourceful professionals and innovative leaders. At the core of our educational experience is our Learn by Doing philosophy, which provides students the opportunities to apply classroom learning theory to real-world problems. We strive to graduate whole-system thinkers who will be able to help solve the increasingly complex challenges that confront California and the global community.

**Undergraduate Emphasis:** As a predominantly undergraduate university, Cal Poly is known nationally for the quality of its baccalaureate degree programs in a variety of disciplines. We also offer outstanding master's degree programs.

**Residential Campus:** Cal Poly is a residential campus. Our students find that the campus environment affords them time, resources and settings in which to discover values and interests – whether in the classroom, academic-related clubs, residence halls, or other extracurricular activities.

**Polytechnic Mission:** From its inception, Cal Poly has given particular emphasis to instruction in polytechnic disciplines – science, technology, engineering, agriculture, and mathematics. At the same time, we recognize that liberal arts provide a critical and

indispensable foundation for all academic disciplines. We are proud of the comprehensive education Cal Poly provides to its students, who graduate as professionals ready to be leaders in industry and society.

**Information Technology to Support Teaching and Learning:** Cal Poly has been, and continues to be, a leader in the use of information technology to enhance teaching and learning. Students and faculty have access to Internet resources, to course information, to library resources, and to advanced software tools 24 hours a day.

**Educational Philosophy:** Cal Poly is committed to excellence in teaching and learning. In all disciplines, we seek to provide a student-centered, learner-focused education, facilitated by a low student-teacher ratio in classes conducted primarily by full-time, regular faculty. The cornerstone of our educational philosophy is our commitment to Learn by Doing whereby classroom instruction is complemented by practical, hands-on learning in the laboratory, the studio, and the field.

**Diversity:** As a campus, we welcome and nurture a rich array of different perspectives, ideas and cultures. We encourage international and multi-cultural education in order to prepare students for successful participation and competition in a diverse world and a global workforce. We believe that diversity of our students, faculty, and staff enlivens and enriches Cal Poly's educational environment.

We believe these values and our core educational philosophy will sustain us far into the future. Of course, these values alone do not constitute our greatest strength. That strength rests in the quality of the students, faculty, staff, alumni, and friends who make up and who, indeed, are the University.

Jeffrey D. Armstrong  
President

# About the Catalog

## The 2013-2015 Cal Poly Catalog

The *Catalog* is prepared in the Office of the Registrar, Cem Sunata. The Associate Registrar for Curriculum, Catalog and Scheduling is Susan Olivas, Curriculum Analyst is Michele Reynolds, and Catalog Editor is Shayna Bailey.

## A Guide to Using the Catalog

Academic terminology and a university catalog can be confusing to someone first entering the University. This section explains some of the jargon you will quickly come to know and explains briefly how the catalog is organized.

## Colleges and Departments

The faculty who supply instruction at Cal Poly hold positions in academic departments, which in turn are grouped into Colleges. All of the academic programs offered by the University are described in the catalog. A complete listing of academic programs at Cal Poly may be found on the Programs A-Z (<http://catalog.calpoly.edu/previouscatalogs/2013-15/programsaz>) page.

In the catalog, Colleges are listed in alphabetical order. Departments are also arranged alphabetically within their respective College.

## Degrees

A **degree** is an academic rank which the University confers on a student who satisfactorily completes a designated curriculum, or program of study. Cal Poly grants undergraduate degrees – also called baccalaureate degrees – as well as master's degrees.

## At the undergraduate level, Cal Poly grants the

- Bachelor of Arts (BA),
- Bachelor of Science (BS),
- Bachelor of Architecture (BArch),
- Bachelor of Fine Arts (BFA), and
- Bachelor of Landscape Architecture (BLA).

## At the graduate level, Cal Poly grants the

- Master of Arts (MA),
- Master of Science (MS),
- Master of Agricultural Education (MAgEd),
- Master of Business Administration (MBA),
- Master of City and Regional Planning (MCRP),
- Master of Public Policy (MPP)
- Master of Professional Studies (MPS)

## Majors

A **major** is a program of study that provides students with the knowledge, skills and experience necessary to pursue a specific career or advanced study and leads to an undergraduate degree in that subject. Each major is offered in an academic department or program.

Undergraduate applicants to Cal Poly select a major at the time they apply for admission.

General requirements for bachelor's degrees are outlined in General Requirements - Bachelor's Degree (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree>) and for master's degrees in Graduate Education (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation>). The specific requirements for a particular major degree program are listed under the academic department or program that offers the major.

The curriculum display for each bachelor's degree program shows courses arranged by *Major*, *Support*, *General Education* and *Electives*. These curriculum displays are useful guides, but students should consult with their academic advisors.

Information regarding academic advising is available on the Academic Advising (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/academicervicesandprograms/academicadvising>) page.

## Courses

Descriptions of Cal Poly courses are located in Courses A-Z (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz>), arranged alphabetically by subject area with its corresponding course prefix (an abbreviation that represents the subject or offering department). The courses in a bachelor's degree curriculum are identified as *Major Courses*, *Support Courses*, *General Education*, and *Electives*.

**Major Courses** are designed to provide competence in the professional field in which a degree is earned. They are usually offered by the academic department in which the degree program is offered, but they may include courses from other departments.

**Approved Electives** are courses that students can choose from within the parameters set by their departments.

**Support Courses** provide background needed for major courses and are offered by departments other than the department in which the major is offered. For example, most majors in engineering and in the sciences require support courses in mathematics. Some degree programs do not include support courses.

**General Education (GE)** courses provide a common foundation of knowledge for all undergraduate programs. GE requirements are described in detail on the General Education (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) page.

**Free Electives** are courses that students can choose simply to pursue their own interests.

**Prerequisites** are one or more courses that must be completed, or other knowledge, skills, or standards that must be demonstrated, before a student is permitted to take certain courses. Prerequisites (if any) for a course are listed in the course's description in the catalog.

Some prerequisites have their own prerequisites, forming a string of courses that must all be taken. The catalog course description shows the last course in the prerequisite string of courses. For example, ME 212 Engineering Dynamics has prerequisites of MATH 241; and ME 211 or ARCE 211. MATH 241 Calculus IV requires MATH 143, which requires MATH 142, which requires MATH 141. ME 211 Engineering Statics requires MATH 241; and PHYS 131 or PHYS 141. To enroll in ME 212 Engineering Dynamics, students must have successfully completed MATH 241, MATH 143, MATH 142, MATH 141 and ME 211 or ARCE 211 and PHYS 131 or PHYS 141.



Statements in the catalog course descriptions may also contain the words **“concurrent”** which means that two or more courses must be taken in the same term or **“corequisite”** which means that the course or courses may be taken prior to the course being described (prerequisite) or in the same term (concurrent).

If a student does not meet a requisite as outlined in a course’s description, but can demonstrate to an instructor that they have the necessary knowledge or skills through alternative means, then the instructor may grant the student permission to enroll in the course.

**Crosslisted courses** are shared by two or more academic units and have identical titles, descriptions, units, modes of instruction and prerequisites. They are interchangeable for degree requirements. They cannot be repeated for degree credit under separate prefixes. Example: HNRS 141 / MATH 141 Calculus I.

**Selected Advanced Topics (470s)** are generic courses that offer special topics on an “as needed basis.” The specific topic appears in the Schedule of Classes and on the students’ transcripts.

**Topic courses** are shown in the catalog with generic titles and are repeatable with different topics. Specific topic titles appear in the Schedule of Classes and on students’ transcripts. Example: ENGL 439 Significant British Writers, repeatable to 12 units with different topics (e.g., Jane Austen, Victorian Poets, Hardy).

Other statements in the course descriptions include, **“major credit limit”** (total number of units allowed toward the major) and **“total credit limit”** (total number of units students can take a course for credit).

## Course Numbering System

Courses are generally numbered according to the plan shown below.

- 010–099 Nondegree credit or short courses.
- 100–299 Courses primarily for freshman and sophomore students.
- 300–399 Courses primarily for advanced undergraduate students with prerequisite coursework.
- 400–499 Courses for advanced undergraduates. Certain 400-level courses can be used in graduate programs. See General Policies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation/#generalpoliciesgoverninggraduatestudies>) for Graduate Education.
- 500–599 Graduate courses.

## Credit Hour

As of July 1, 2011 federal law (Title 34, Code of Federal Regulations, sections 600.2 and 600.4) requires all accredited institutions to comply with the federal definition of the credit hour. For all CSU degree programs and courses bearing academic credit, the “credit hour” is defined as “the amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that reasonably approximates not less than:

1. One hour of classroom or direct faculty instruction and a minimum of two hours of out-of-class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time; or
2. At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution, including laboratory work, internships, practica,

studio work, and other academic work leading to the award of credit hours.”

A credit hour is assumed to be a 50-minute period. In courses in which “seat time” does not apply, a credit hour may be measured by an equivalent amount of work, as demonstrated by student achievement.

## Modes of Instruction

The mode of instruction is included in each course description; for supervision/independent study courses, no mode is indicated. Some courses have more than one mode of instruction.

## Mode and number of hours classes meet each week

**Activity:** 2 hours per unit of credit.

**Laboratory:** 3 hours per unit of credit.

**Lecture:** 1 hour per unit of credit.

**Seminar:** 1 hour per unit of credit.

**Supervision/Independent Study:** Courses involve independent work done by students under the guidance of the faculty and do not meet regularly in a classroom. 3 hours of independent study per week per unit of credit.

## Concentrations

A **concentration** is a group of courses designed to provide specialized knowledge within a bachelor’s degree program. Completion of a concentration is noted on the student’s transcript, but not shown on the diploma.

## Specializations

A **specialization** is a similarly specialized group of courses in a master’s degree program. Completion of a specialization is noted on the student’s transcript and shown on the diploma.

## Minors

A **minor** is an integrated, coherent group of courses designed to give a student knowledge in an academic area outside of the major field of study. The minor is completed along with the requirements for the bachelor’s degree. For more information and a list including available minors at Cal Poly, see Programs A-Z (<http://catalog.calpoly.edu/previouscatalogs/2013-15/programsaz>) . Completion of a minor is noted on the student’s transcript, but not shown on the diploma.

## Graduate Certificates

A **graduate certificate** is designed to provide a specialized area of study that meets the requirements for professional competence and to expand access to specialized knowledge. The subject matter is advanced and narrow in focus.

The programs are typically designed for working professionals who are seeking to advance their career opportunities by obtaining specialized knowledge in their field or in a new field. Completion of the graduate certificate program will be commemorated by a document bearing the University seal and signed by the program’s college dean(s) and is noted on the student’s transcript.

## Quarters and Quarter Units

Cal Poly’s academic calendar consists of four quarters – Fall, Winter, Spring and Summer (see Academic Calendar (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academiccalendar>) ).

Cal Poly’s **academic year** consists of Fall, Winter and Spring quarters.

The **university year** includes, and begins with, Summer quarter.

Each course offered by the University carries a value in **quarter units**, often referred to simply as units or credits.

To convert semester units to quarter units, multiply by 1.5. For example, 6 semester units  $\times$  1.5 = 9 quarter units.

## Changes in Rules and Policies

Although every effort has been made to assure the accuracy of the information in this catalog, students and others who use this catalog should note that laws, rules, and policies change from time to time and that these changes may alter the information contained in this publication. Changes may come in the form of statutes enacted by the Legislature, rules and policies adopted by the Board of Trustees of the California State University, by the Chancellor or designee of the California State University, or by the President or designee of the campus. It is not possible in a publication of this size to include all of the rules, policies and other information that pertain to students, the institution, and the California State University. More current or complete information may be obtained from the appropriate department, school, or administrative office.

Nothing in this catalog shall be construed as, operate as, or have the effect of an abridgment or a limitation of any rights, powers, or privileges of the Board of Trustees of the California State University, the Chancellor of the California State University, or the President of the campus. The Trustees, the Chancellor, and the President are authorized by law to adopt, amend, or repeal rules and policies that apply to students. This catalog does not constitute a contract or the terms and conditions of a contract between the student and the campus or the California State University. The relationship of students to the campus and the California State University is one governed by statute, rules, and policy adopted by the Legislature, the Trustees, the Chancellor, the President and their duly authorized designees.

# University Learning Objectives

## Mission Statement

A mission statement describes an organization's purpose. The Cal Poly Mission Statement describes the university's purpose as a comprehensive polytechnic, while affirming its historical commitment to Learn by Doing and stating its values as an academic community:

Cal Poly fosters teaching, scholarship, and service in a learn-by-doing environment where students, staff, and faculty are partners in discovery. As a polytechnic university, Cal Poly promotes the application of theory to practice. As a comprehensive institution, Cal Poly provides a balanced education in the arts, sciences, and technology, while encouraging cross-disciplinary and co-curricular experiences. As an academic community, Cal Poly values free inquiry, cultural and intellectual diversity, mutual respect, civic engagement, and social and environmental responsibility.

## University Learning Objectives

A Cal Poly education is the result of experiences taking place in the major and in general education, as well as in the curriculum and co-curriculum. The University Learning Objectives (ULOs) allow these experiences to be aligned to a common set of academic expectations.

The ULOs state that all students who complete an undergraduate or graduate program at Cal Poly should be able to:

1. Think critically and creatively.
2. Communicate effectively.
3. Demonstrate expertise in a scholarly discipline and understand that discipline in relation to the larger world of the arts, sciences, and technology.
4. Work productively as individuals and in groups.
5. Use their knowledge and skills to make a positive contribution to society.
6. Make reasoned decisions based on an understanding of ethics, a respect for diversity, and an awareness of issues related to sustainability.
7. Engage in lifelong learning.

Cal Poly shares some of these expectations with other universities (See ULO 1, 2 and 7). Others reflect Cal Poly's unique character as a comprehensive polytechnic that is characterized by a preponderance of professional degree programs (ULO 3-6).

## Diversity and Sustainability Learning Objectives

ULO 6 states that all Cal Poly graduates should be able to make reasoned decisions based on a respect and appreciation for diversity and an awareness of issues related to sustainability. Because of the complexity of these objectives, the Academic Senate adopted the Diversity Learning Objectives (DLOs) in 2008 and the Sustainability Learning Objectives (SLOs) in 2009, both as addenda to the ULOs.

Cal Poly defines diversity as inclusive of, but not limited to, an individual's race/ethnicity, sex/gender, socioeconomic status, cultural

heritage, disability, and sexual orientation. The DLOs state that all Cal Poly graduates should be able to:

1. Demonstrate an understanding of relationships between diversity, inequality, and social, economic, and political power both in the United States and globally.
2. Demonstrate knowledge of contributions made by individuals from diverse and/or underrepresented groups to our local, national, and global communities.
3. Consider perspectives of diverse groups when making decisions.
4. Function as members of society and as professionals with people who have ideas, beliefs, attitudes, and behaviors that are different from their own.

Cal Poly defines sustainability as the ability of the natural and social systems to survive and thrive together to meet current and future needs. The SLOs state that all Cal Poly graduates should be able to:

1. Define and apply sustainability principles within their academic programs.
2. Explain how natural, economic, and social systems interact to foster or prevent sustainability.
3. Analyze and explain local, national, and global sustainability using a multidisciplinary approach.
4. Consider sustainability principles while developing personal and professional values.

Both the DLOs and SLOs should be understood as operating at a level below the institutional level of the ULOs.

## Sustainability Practices

Cal Poly has been a signatory of the Talloires Declaration, a 10-point action plan, since April 2004. This plan commits Cal Poly to sustainability and environmental literacy in teaching, theory, and practice, and is summarized below.

### 1. Increase Awareness of Environmentally Sustainable Development:

In 2008 Cal Poly began SUSTAIN (Sino-US Strategic Alliance for Innovation), a partnership among faculty from Tongji University, Cal Poly and Stanford University. SUSTAIN ([www.sustainnow.org](http://www.sustainnow.org)) was formed as an institute committed to innovating for sustainable design in China and San Luis Obispo.

### 2. Create an Institutional Culture of Sustainability:

In 2010 the College of Agriculture, Food and Environmental Sciences created the CAFES Center for Sustainability which joined other sustainability-related centers in the College of Engineering and the College of Architecture and Environmental Design.

### 3. Educate for Environmentally Responsible Citizenship:

At Cal Poly, literacy in sustainability begins with a student's first on-campus experience through presentations and modeled sustainable activities such as zero waste meals. Students may elect to fulfill general education and major requirements by enrolling in courses that focus in sustainability. Over 170 courses are available to fulfill GE and major requirements (see [suscat.calpoly.edu](http://suscat.calpoly.edu)). For students wishing to specialize in a specific aspect of sustainability, there are currently twelve minors.

### 4. Foster Environmental Literacy For All:

In 2009 the Academic Senate proposed and the University accepted the addition of Sustainability Learning Objectives to Cal Poly's University Learning Objectives. As a result all faculty are encouraged to systematically incorporate sustainability into their courses.

5. **Practice Institutional Ecology:** Cal Poly has taken significant steps to reduce its environmental footprint. In 2009 Cal Poly opened Poly Canyon Village – a 1.4-million-square-foot mixed-use complex, which provides apartment-style housing for over 2,600 students – the largest LEED Gold project in the region and in the CSU. LEED certification is being achieved in all new buildings as well as selected retrofits.
6. **Involve All Stakeholders:** Cal Poly has reached out to others interested in learning how to contribute to a sustainable future. Cal Poly hosted the statewide 2008 UC/CSU/CCC Sustainability Conference, attended by some 1,100 people. The Graphic Communication Institute at Cal Poly partnered with SustainCommWorld in 2008 and 2009 to host the Business of Green Media Conference at Cal Poly. In partnership with California Certified Organic Farmers (CCOF), Cal Poly also hosts the annual Sustainable Agriculture Pest Management Conference which provides agriculture industry professionals with innovative strategies for controlling pests using sustainable agricultural practices.
7. **Collaborate for Interdisciplinary Approaches:** Several of the UNIV courses (university-level, co-taught by faculty from different colleges) address a wide range of sustainability issues. Numerous senior projects and courses reach across academic disciplines to engage students in learn-by-doing projects that address issues of sustainability and of meeting the needs of those less fortunate.
8. **Enhance Capacity of Primary and Secondary Schools:** Cal Poly's STRIDE Program has worked with schools and government agencies to design and assess novel, comprehensive community-based education and intervention programs for promoting healthy living.
9. **Broaden Service and Outreach Nationally and Internationally:** Empower Poly Coalition serves as the center for student engagement and unifies the voice of over 27 sustainability-related clubs and groups on campus.
10. **Maintain the Movement:** Cal Poly became the 13th California campus to found a chapter of the Alliance to Save Energy's "Green Campus Program". In 2010 the National Wildlife Federation's "National Report Card on Sustainability in Higher Education" rated Cal Poly as "Leading School for Environmental Sustainability Goal Setting" and "Leading Employer of Environmental Management and Sustainable Professionals."

Through the combined work of the President's Sustainability Advisory Committee, the Academic Senate's Sustainability Committee and the numerous faculty, staff and students involved with sustainability, the University's commitment to sustainability grows at all levels.

## Student Learning Assessment

To determine the effectiveness of various educational opportunities, Cal Poly asks students to participate in learning assessments at the course, program, and university levels. These assessments provide a measure of student achievement over the course of their academic careers of course, program, and university learning objectives/outcomes. They may include the direct assessment of student work (assignments, exams, projects, performances, and theses), perhaps using standardized rubrics, as well as surveys and other indirect methods of assessment.

While grades may measure individual student progress, course-, program-, and university-level assessments provide evidence of the effectiveness of educational opportunities for groups of students.

This information is intended primarily as the basis for program improvement, although it may also be used for accountability purposes, e.g., documenting educational effectiveness to accreditation agencies.

Students at Cal Poly should expect that their academic work may be used for assessment purposes.

# University Policies

## Statement on Commitment to Community

The Cal Poly community values a broad and inclusive campus learning experience where its members embrace core values of mutual respect, academic excellence, open inquiry, free expression and respect for diversity. Membership in the Cal Poly community is consistent with the highest principles of shared governance, social and environmental responsibility, engagement and integrity.

As students, faculty and staff of Cal Poly, we choose to:

- Act with integrity and show respect for ourselves and one another
- Accept responsibility for our individual actions
- Support and promote collaboration in University life
- Practice academic honesty in the spirit of inquiry and discovery
- Contribute to the university community through service and volunteerism
- Demonstrate concern for the well-being of others
- Promote the benefits of diversity by practicing and advocating openness, respect and fairness

Individual commitment to these actions is essential to Cal Poly's dedication to an enriched learning experience for all its members.

## Statement on Diversity

The following excerpts are taken from *The Cal Poly Statement on Diversity*<sup>1</sup>, which has been endorsed by the Cal Poly Academic Senate Resolution AS-506-98/DTF:

"At the heart of a university is the responsibility for providing its students with a well-rounded education, an education that fosters their intellectual, personal and social growth. The ultimate product of universities is education in the broadest sense, including preparation for life in the working world." In this regard, it is in the compelling interest of Cal Poly, the State, and the Nation to provide our students with an education that is rich with a diversity of ideas, perspectives, and experiences."

"Cal Poly's commitment to diversity signals an affirmation of the highest educational goals for this University, including mutual respect, civility, and engaged learning."

<sup>1</sup> The definition of diversity is specifically inclusive of, but not limited to, an individual's race/ethnicity, sex/gender, socioeconomic status, cultural heritage, disability, and sexual orientation.

## Policies on the Rights of Individuals

Cal Poly is a community enriched by individual differences. The University is committed to respecting and protecting the rights of individuals. This section presents a summary of University non-discrimination policies and procedures for pursuing complaints under these policies. The office of Employment Equity, working with the Inclusive Excellence Council, has been designated to oversee and coordinate implementation of campus non-discrimination policies.

Except where otherwise indicated, procedures for reporting incidents of discrimination can be found in "Reporting Guidelines."

## Non-discrimination Policy

### Race, Color, Ethnicity, National Origin, Age, Genetic Information, Religion and Veteran Status

The California State University does not discriminate on the basis of race, color, ethnicity, national origin, age, genetic information, religion or veteran status in its programs and activities, including admission and access. Federal and state laws, including Title VI of the Civil Rights Act of 1964 and the California Equity in Higher Education Act, prohibit such discrimination. Martha Cody, Employment Equity Director, has been designated to coordinate the efforts of Cal Poly to comply with all applicable federal and state laws prohibiting discrimination on these bases. Inquiries concerning compliance may be presented to the office of Employment Equity, Fisher Science (Bldg. 33), Room 290, 805.756.6770.

### Disability

The California State University does not discriminate on the basis of disability in its programs and activities, including admission and access. Federal and state laws, including sections 504 and 508 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990, prohibit such discrimination. Martha Cody, Employment Equity Director has been designated to coordinate the efforts of Cal Poly to comply with all applicable federal and state laws prohibiting discrimination on these basis of disability. Inquiries concerning compliance may be presented to the office of Employment Equity, Fisher Science (Bldg. 33), Room 290, 805.756.6770.

### Sex/Gender/Gender Identity/Gender Expression/Sexual Orientation

The California State University does not discriminate on the basis of sex, gender, gender identity, gender expression or sexual orientation in its programs and activities, including admission and access. Federal and state laws, including Title IX of the Education Amendments of 1972, prohibit such discrimination. Martha Cody, Employment Equity Director has been designated to coordinate the efforts of Cal Poly to comply with all applicable federal and state laws prohibiting discrimination on these bases. Inquiries concerning compliance may be presented to the office of Employment Equity, Fisher Science (Bldg. 33), Room 290, 805.756.6770.

The California State University is committed to providing equal opportunities to male and female CSU students in all campus programs, including intercollegiate athletics.

Title IX of the Education Amendments of 1972 protects all people regardless of their gender or gender identity from sex discrimination, which includes sexual harassment and violence:

- **Sexual discrimination** means an adverse act of sexual discrimination (including sexual harassment and sexual violence) that is perpetrated against an individual on a basis prohibited by Title IX of the Education Amendments of 1972, 20 U.S.C. §1681 et seq., and its implementing regulations, 34 C.F.R. Part 106 (Title IX); California Education Code §66250 et seq., and/or California Government Code §11135.
- **Sexual harassment** is unwelcome conduct of a sexual nature that includes, but is not limited to, sexual violence, sexual advances, requests for sexual favors, indecent exposure and other verbal,



nonverbal or physical unwelcome conduct of a sexual nature, if such conduct is sufficiently severe, persistent or pervasive that its effect, whether or not intended, could be considered by a reasonable person in the shoes of the individual, and is in fact considered by the individual, as limiting the individual's ability to participate in or benefit from the services, activities or opportunities offered by the university. Sexual harassment also includes gender-based harassment, which may include acts of verbal, non-verbal or physical aggression, intimidation or hostility based on sex or sex-stereotyping, even if those acts do not involve conduct of a sexual nature.

- **Sexual violence** means physical sexual acts (such as unwelcome sexual touching, sexual assault, sexual battery and rape) perpetrated against an individual without consent or against an individual who is incapable of giving consent due to that individual's use of drugs or alcohol, or disability.
- To see further information on sexual violence prevention and education statement, which includes facts and myths about sexual violence, visit the Safer ([http://studentlife.calpoly.edu/safer/learn\\_more/what.asp](http://studentlife.calpoly.edu/safer/learn_more/what.asp)) website.

## Whom to Contact If You Have Complaints, Questions or Concerns

Title IX requires the university to designate a Title IX Coordinator to monitor and oversee overall Title IX compliance. Your campus Title IX Coordinator is available to explain and discuss your right to file a criminal complaint (for example, in case of sexual assault); the university's complaint process, including the investigation process; how confidentiality is handled; available resources, both on and off campus; and other related matters. ***If you are in the midst of an emergency, please call the police immediately by dialing 9-1-1.***

Campus Title IX Coordinator:

Martha Cody  
Employment Equity Office, Fisher Science (Bldg. 33) Room 290  
Phone: 805.756.6770  
[mcody@calpoly.edu](mailto:mcody@calpoly.edu)  
<http://www.employeequity.calpoly.edu/>

University Police:  
Building 36  
<http://afd.calpoly.edu/police>  
Phone: 805.756.2281

U.S. Department of Education, Office for Civil Rights:  
Phone: 800.421-3481 or [ocr@ed.gov](mailto:ocr@ed.gov)  
If you wish to fill out a complaint form online with the OCR, you may do so at:  
<http://www2.ed.gov/about/offices/list/ocr/complaintintro.html> .

Title IX requires the university to adopt and publish complaint procedures that provide for prompt and equitable resolution of sex discrimination complaints, including sexual harassment and violence. CSU Executive Order 1074 (<http://www.calstate.edu/eo/EO-1074.pdf>) or its successor executive order is the systemwide procedure for all complaints of discrimination, harassment or retaliation made by students against the CSU, a CSU employee, other CSU students or a third party.

Except in the case of a privilege recognized under California law (examples of which include Evidence Code §§1014 (psychotherapist-patient); 1035.8 (sexual assault counselor-victim); and 1037.5 (domestic violence counselor-victim), any member of the University

community who knows of or has reason to know of sexual discrimination allegations shall promptly inform the campus Title IX Coordinator.

Regardless of whether an alleged victim of sexual discrimination ultimately files a complaint, if the campus knows or has reason to know about possible sexual discrimination, harassment or violence, it must review the matter to determine if an investigation is warranted. The campus must then take appropriate steps to eliminate any sex discrimination/harassment, prevent its recurrence, and remedy its effects.

## Safety of the Campus Community is Primary

The university's primary concern is the safety of its campus community members. The use of alcohol or drugs never makes the victim at fault for sexual discrimination, harassment or violence; therefore, victims should not be deterred from reporting incidents of sexual violence out of a concern that they might be disciplined for related violations of drug, alcohol or other university policies. Except in extreme circumstances, victims of sexual violence shall not be subject to discipline for related violations of the Student Conduct Code.

## Information Regarding Campus, Criminal and Civil Consequences of Committing Acts of Sexual Violence

Individuals alleged to have committed sexual assault may face criminal prosecution by law enforcement and may incur penalties as a result of civil litigation. In addition, employees and students may face discipline at the university. Employees may face sanctions up to and including dismissal from employment, pursuant to established CSU policies and provisions of applicable collective bargaining unit agreements.

Students who are charged by the university with sexual discrimination, harassment or violence will be subject to discipline, pursuant to the California State University Student Conduct Procedures (see Executive Order 1073 at <http://www.calstate.edu/eo/EO-1073.pdf> or any successor executive order) and will be subject to appropriate sanctions. In addition, during any investigation, the university may implement interim measures in order to maintain a safe and non-discriminatory educational environment. Such measures may include: immediate interim suspension from the university; a required move from university-owned or affiliated housing; adjustments to course schedule; and/or prohibition from contact with parties involved in the alleged incident.

### Additional Resources

- Sexual violence prevention and education statement, which includes facts and myths about sexual violence, at RISE (<http://riseslo.org>)
- U.S. Department of Education, regional office:  
Office for Civil Rights  
50 Beale Street, Suite 7200  
San Francisco, CA 94105  
(415) 486-5555  
TDD (877) 521-2172
- U.S. Department of Education, national office:  
Office for Civil Rights  
(800) 872-5327
- Know Your Rights about Title IX  
<http://www2.ed.gov/about/offices/list/ocr/docs/title-ix-rights-201104.html>

California Coalition Against Sexual Assault (<http://calcasa.org/>)  
1215 K. Street, Suite 1850  
Sacramento, CA 95814  
(916) 446-2520

- Domestic and Family Violence, Office of Justice Programs, United States Department of Justice
- National Institute of Justice: Intimate Partner Violence, Office of Justice Programs, United States Department of Justice
- National Domestic Violence Hotline: 1-800-799-SAFE (7233)
- Office of Violence against Women, United States Department of Justice
- Centers for Disease Control and Prevention: Intimate Partner Violence
- Defending Childhood, United States Department of Justice
- Local Community Resource Information:  
Safer  
805.756.2282  
[http://studentlife.calpoly.edu/safer/learn\\_more/what.asp](http://studentlife.calpoly.edu/safer/learn_more/what.asp)

## Protection from Retaliation

It is critical that individuals not be deterred from reporting possible prohibited harassment. CSU policy [Executive Order 927] prohibits retaliation against individuals who have or are believed to have filed a discrimination complaint, opposed a discriminatory act, or participated in a discrimination investigation or proceeding.

## Reporting Guidelines

Individuals with inquiries regarding the application of these laws, regulations and policies to programs and activities of California Polytechnic State University, or those wishing to file a complaint alleging a violation of these policies, may contact the office of Employment Equity, Fisher Science (Bldg. 33), Room 290, 805.756.6770, <http://employeequity.calpoly.edu>, or other designated campus offices as indicated in the following administrative guidelines.

- Students may obtain confidential, informal, impartial, and independent advice about any university-related concerns from Student Ombuds Services, Robert E. Kennedy Library (Bldg. 35), Room 113, 805.756.1380, <http://ombuds.calpoly.edu>. Working with Student Ombuds Services does not constitute official notice to the University of alleged policy violations.
- Complaints from or about students alleging violations of these policies by other students may be directed to the office of the Vice President for Student Affairs, Administration Building (Bldg. 01), Room 209, 805.756.1521; the office of the Dean of Students, Student Health Center (Bldg. 17), Room 113, 805.756.0327; or the office of Student Rights and Responsibilities, Student Services Building (Bldg. 124), 805.756.0327.
- Student disability-related complaints may be directed to the Disability Resource Center, Student Services (Bldg. 124), Room 119, 805.756.1395.
- Students wishing to seek additional information or file a complaint not previously addressed should contact the office of Employment Equity, Fisher Science (Bldg. 33), Room 290, 805.756.6770, for assistance.
- Complaints by or against employees who are covered by either collective bargaining agreements or CSU system-wide procedures shall be processed in accordance with the applicable collective bargaining agreement or systemwide procedures. Questions should be directed to the office of the Associate Vice Provost for Academic

Personnel, Administration (Bldg. 01), Room 314, 805.756.2844 for faculty matters; and the office of the Director of Human Resources, Administration (Bldg. 01), Room 110, 805.756.6564, for staff or management issues.

- Complaints from non-represented employees or Independent Contractors may be directed to the office of Employment Equity, Fisher Science (Bldg. 33), Room 290, 805.756.6770.
- Complaints by or against employees of the Cal Poly Corporation must follow the Corporation's "Procedures for Resolving Harassment Complaints." Any such complaints should be directed to either her or his supervisor or the Advisor on Harassment Concerns, Corporation Building (15), 805.756.1151. [www.calpolycorporation.org/docs/policies/pm207.pdf](http://www.calpolycorporation.org/docs/policies/pm207.pdf) (<http://www.calpolycorporation.org/docs/policies/pm207.pdf>)
- Employees and students of Associated Students, Inc., comply with University policies. Employees of Associated Students, Inc., or others who believe that they have been discriminated against can file a complaint using the ASI "Policy Prohibiting Harassment." [www.asi.calpoly.edu/forms\\_and\\_policies](http://www.asi.calpoly.edu/forms_and_policies) (Policy Manuals, ASI Personnel Policy Manual)
- If an act of discrimination is alleged to have occurred over the campus's information resources infrastructure—telephones, computers, network, etc.—redress may be through Information Technology Service's "Responsible Use Policy." Initial inquiries regarding violations should be directed to the office of the Vice Provost and Chief Information Officer, (Bldg. 14), Room 113, 805.756.5541.

Inquiries concerning the application of these laws to programs and activities of California Polytechnic State University may also be referred to the specific campus officers identified above or to the Regional Director of the Office for Civil Rights, United States Department of Education, 50 Beale Street, Suite 7200, San Francisco, California 94105.

Filing a complaint about discrimination with the University is not a prerequisite to filing a complaint with a federal or state agency.

## Academic Freedom

Cal Poly recognizes and supports the principle of academic freedom, by which each instructional faculty member, researcher, librarian and counselor has the right to teach, to conduct research, and to publish material relevant to that faculty member's discipline, even when such material is controversial.

The University also guarantees to its faculty the same rights shared by all citizens, which include:

- the right to free expression,
- the right to assemble, and
- the right to criticize and seek revision of the institution's regulations.

At the same time, the faculty should recognize an equally binding obligation to perform their academic duties responsibly and to comply with the internal regulations of the University.

Each faculty member is expected to recognize the right of free expression of other members of the university community; intolerance and personal abuse are unacceptable.

Faculty shall not claim to be representing the University unless authorized to do so.

Cal Poly endorses the nationally recognized definition of academic freedom from the American Association of University Professors (AAUP): The 1940 Statement of Principles on Academic Freedom and Tenure with 1970 Interpretative Notes, as follows:

1. Teachers<sup>1</sup> are entitled to full freedom in research and in the publication of results, subject to the adequate performance of their other academic duties; but research, for pecuniary return, should be based upon an understanding with the authorities of the institution.
  2. Teachers are entitled to freedom in the classroom in discussing their subject, but they should be careful not to introduce into their teaching controversial subject matter which has no relation to the subject.<sup>2</sup> Limitations of academic freedom because of religious or other aims of the institution should be clearly stated in writing at the time of appointment.
  3. College and university teachers are citizens, members of a learned profession, and officers of an educational institution. When they speak or write as citizens, they should be free from institutional censorship or discipline, but their special position in the community imposes special obligations. As scholars and educational officers, they should remember that the public may judge their profession and institution by their utterances. Hence, they should at all times be accurate, should exercise appropriate restraints, should show respect for the opinions of others, and should make every effort to indicate they are not speaking for the institution.
- <sup>1</sup> The footnote from the 1940 Statement states: "The word 'teacher' as used in this document is understood to include the investigator who is attached to an academic institution without teaching duties." Reference: AAUP: The 1940 *Statement of Principles on Academic Freedom and Tenure with 1970 Interpretative Notes*, adopted by the Council of the American Association of University Professors in April 1970 and endorsed by the Fifty-sixth Annual Meeting as Association policy, [www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm](http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm) (<http://www.aaup.org/AAUP/pubsres/policydocs/contents/1940statement.htm>)
- <sup>2</sup> The footnote from the 1970 Interpretative Notes on the AAUP Statement reads: "The intent of this statement is not to discourage what is 'controversial.' Controversy is at the heart of free academic inquiry which the entire statement is designed to focus. The passage serves to underscore the need for teachers to avoid persistently intruding material which has no relation to the subject."

## Student Academic Rights & Responsibilities

The classroom (including laboratories, field trips, independent study, etc.) is the essential part of any university where freedom to learn should flourish. The instructor has the responsibility for the manner of instruction and the conduct of the classroom. The instructor should not act in any way that denies the rights of students as set forth below:

Students are free to take reasoned exception to the data or views offered in courses. It is the responsibility of the instructor to take every precaution to ensure that what is presented is factual. If the instructor's presentation is in the area of opinion, belief, or debatable fact, it is the instructor's responsibility to make this clear to the students. Students may be required to know thoroughly the particulars set forth by the

instructor, but they are free to reserve personal judgment as to that which is presented in the classroom.

The student has the right to substantial presentations appropriate to the course. Unjustified failure of the instructor to meet or prepare for classes, which results in incompetent performance, is a legitimate ground for student complaints against the instructor.

The student has the right to a statement at the beginning of each quarter providing: instructor's name, office location, office telephone number, and office hours; texts and supplementary materials required for the course; purpose of the course; prerequisites; requirements for grading; frequency and types of tests; and other information to assure student's understanding of the nature and requirements of the course.

A **Fairness Board** has been established to hear grievances of students who believe their academic rights have been denied or violated. The legitimacy of the process and procedure of evaluation in the course shall be the sole criterion of the Fairness Board. Students may contact the Academic Senate at 805.756.1258, [www.academicssenate.calpoly.edu/](http://www.academicssenate.calpoly.edu/) for clarification of the description and procedures for the Fairness Board and the appeal process for grade disputes. Students should address grade disputes involving allegations of academic dishonesty to the Office of Student Rights and Responsibilities at 805.756.2794. Students may also contact the University Ombuds at 805.756.1380 for informal assistance with grade disputes.

## Academic Responsibilities

Students enrolled in a class are responsible for meeting standards of performance and conduct established by the University and the instructor. Students are responsible for registering and "adding" and "dropping" classes in a timely fashion, to ensure that others have an opportunity to take classes. Students are responsible for completing and submitting all class assignments, examinations, tests, projects, reports, etc., by scheduled due dates, or face penalties. If any problem arises regarding course work or attendance, the student is held responsible for initiating communication and contact with the instructor. In addition, students are held responsible for behavior and conduct adverse to the preservation of order as established by the University and the instructor. Students are responsible for meeting their degree requirements as provided in the university catalog.

## Cheating and Plagiarism

Cal Poly does not tolerate academic cheating or plagiarism in any form.

Learning to think and work independently is part of the educational process.

Cheating or plagiarism in any form is considered a serious violation of expected student behavior and may result in disciplinary action. All faculty and students are encouraged to review the formal policy on cheating and plagiarism (including definitions, sanctions, and appeal procedures) found in the Campus Administrative Manual, Section 684.

University policy can be summarized simply:

As a student, you are responsible for your own work and you are responsible for your actions.

## Use and Release of Student Information

[http://registrar.calpoly.edu/stu\\_info/ferpa.htm](http://registrar.calpoly.edu/stu_info/ferpa.htm)

The Family Educational Rights and Privacy Act (FERPA) affords students certain rights with respect to their educational records. This federal law applies to all schools that receive funding under most programs administered by the Department of Education. The primary rights afforded each student are the right to inspect and review his/her educational records, the right to seek to have the records amended, and the right to have some control over the disclosure of information from the records.

## Responsible Use of Information Technology Resources

<http://security.calpoly.edu/policies/rup/>

Information technology resources are provided to support the University's mission of education, research and service. To ensure that these shared and finite resources are used effectively to further the University's mission, each user has the responsibility to:

- use the resources appropriately and efficiently;
- respect the freedom and privacy of others;
- protect the stability and security of the resources; and
- understand and fully abide by established University policies and applicable public laws.

All students, faculty and staff are required to review the policy, which covers authorized use/access, data security, confidentiality and privacy, network and system integrity, commercial use, copyright infringement, and more.

The full policy describes consequences of non-compliance and procedures for reporting and responding to complaints. It includes definitions and examples of responsible and irresponsible use. The Vice Provost for Information Services / Chief Information Officer is responsible for policy oversight and compliance. For more information, call 805.756.2966 or email [it-policy@calpoly.edu](mailto:it-policy@calpoly.edu).

## E-Mail - an Official Means of Communication to Students

[www.servicedesk.calpoly.edu/content/email\\_calendar/policy/email\\_communications\\_students](http://www.servicedesk.calpoly.edu/content/email_calendar/policy/email_communications_students)

Students are responsible for receiving and reading official e-mail communications in a timely manner and for taking action where appropriate. Redirecting university e-mail to a non-university e-mail address does not absolve students from their responsibilities associated with official communications.

Campus policy permits colleges, departments and faculty to use electronic mail (e-mail) to send official communications to students, i.e., messages pertaining to the conduct of university business for academic or administrative purposes. Using e-mail for such purposes is at the discretion of the sender and in no way precludes the use of other communication methods. Official communications are sent to a student's university-assigned e-mail address ([username@calpoly.edu](mailto:username@calpoly.edu)).

For more information about the policy and related standards and practices, including frequently asked questions, see: [http://www.servicedesk.calpoly.edu/content/email\\_calendar/policy/guidelines\\_overview](http://www.servicedesk.calpoly.edu/content/email_calendar/policy/guidelines_overview).

## Accessibility of Cal Poly Electronic and Information Technology Resources

<http://accessibility.calpoly.edu>

The Americans with Disabilities Act (ADA) provides that no qualified individual with a disability be denied access to or participation in services, programs, and activities at Cal Poly. This act applies to virtually all aspects of campus activities, including employment, teaching and learning, and services provided to the campus community.

It is the policy of the California State University to make information technology resources and services accessible to all CSU students, faculty, staff, and the general public regardless of disability status. Cal Poly is committed to ensuring that university information and services delivered electronically are made accessible and the needs of individual students and employees with disabilities are accommodated. For more information regarding Cal Poly plans and policies and related standards and practices related to accessibility, visit <http://accessibility.calpoly.edu>.

## Copyright Infringement and File Sharing: What Students Need to Know

<http://security.calpoly.edu/content/faq/dmca-faqs>

In recent years, copyright holders, such as the Recording Industry Association of America (RIAA), have stepped up legal efforts to combat infringement, including targeting college students with increased numbers of copyright Infringement notices. As a student, you should be aware of the risks you take if you choose to participate in this activity. Four things you should know:

- Hundreds of Cal Poly students receive copyright Infringement notices each year.
- You can receive a notice for downloading or for allowing others to upload content from your computer. If you have file sharing software on your computer, you may be distributing copyrighted materials anytime your computer is on the network.
- If you receive a notice for inappropriate activity on the campus network, your network access will be temporarily disabled and you will be required to complete specific actions before access is reinstated.
- Repeat offenders will be referred to the Office of Student Rights and Responsibilities for further disciplinary action.

Please review these frequently asked questions to learn more about peer-to-peer file sharing and copyright infringement, the potential dangers and penalties you may incur from file sharing, and what you can do to protect yourself and your computer: <http://security.calpoly.edu/content/faq/dmca-faqs>

## Information Security Program

<http://security.calpoly.edu>

Information security is everyone's responsibility. Only you can protect your personal devices and information. By following some basic security practices, you can help protect any university data and devices you access as well as your own. This includes not responding to "phishing" emails; using anti-virus and other technical safeguards; keeping software, browsers and operating systems up-to-date; using a strong password, and never sharing your password with others or using the same password in more than one place; avoiding unsecured

network connections; backing up your data; securing your mobile devices, etc.

It is the collective responsibility of all users to ensure the

- Confidentiality of information which Cal Poly must protect from unauthorized access;
- Integrity and availability of information stored on or processed by Cal Poly information systems; and
- Campus compliance with applicable laws, regulations, and policies governing information security and privacy protection.

The Cal Poly Information Security Program and related standards and practices provide direction to the campus to accomplish the above while not inhibiting the sanctioned use of campus information assets as required to meet the university's core mission and academic and administrative goals.

To help safeguard and secure campus information and information resources, all users and campus departments are expected to adhere to these policies and standards where applicable. Please report suspected violations and direct comments, questions and other inquiries to [security@calpoly.edu](mailto:security@calpoly.edu).



# Accreditation

The University is fully accredited by the Western Association of Schools and Colleges (WASC), which may be contacted at:

Western Association of Schools and Colleges  
985 Atlantic Avenue, Suite 100  
Alameda, California 94501  
Phone: 510.748.9001

The School of Education offers teaching and service credentials which are fully accredited by California Commission on Teacher Credentialing (CCTC). The credentials are described in catalog sections Teaching Credential Programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/#teachingcredentialprogramtext>) and Graduate (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/#graduatetext>) in the School of Education (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation>) section of this Catalog.

Program	Accrediting Agency
Art and Design, BFA	National Association of Schools of Art and Design (NASAD)
Architecture, BArch	National Architectural Accrediting Board (NAAB)
Business Administration, BS, MBA	Association to Advance Collegiate Schools of Business (AACSB)
City and Regional Planning, BS, MCRP	Planning Accreditation Board (PAB)
Computer Science, BS	Computing Accreditation Commission of ABET <sup>1</sup>
Construction Management, BS	American Council for Construction Education (ACCE)
Dietetic Internship	Accrediting Council for Education and Dietetics (ACEND)
Economics, BS	Association to Advance Collegiate Schools of Business (AACSB)

## Engineering Programs:

Aerospace Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Architectural Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
BioResource and Agricultural Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Civil Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Computer Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Electrical Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Environmental Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>

Industrial Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Manufacturing Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Materials Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Mechanical Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Software Engineering, BS	Engineering Accreditation Commission of ABET <sup>1</sup>
Forestry and Natural Resources, BS	Society of American Foresters (SAF)
Graphic Communication, BS	Accrediting Council for Collegiate Graphic Communications (ACCGC)
Industrial Technology, BS	Association of Technology, Management, and Applied Engineering (ATMAE)
Landscape Architecture, BLA	American Society of Landscape Architects (ASLA), Landscape Architectural Accreditation Board (LAAB)
Music, BA	National Association of Schools of Music (NASM)
Nutrition, BS (Applied Nutrition Concentration)	Accreditation Council for Education in Nutrition and Dietetics (ACEND)
Recreation, Parks, and Tourism Administration, BS	Council on Accreditation of Parks, Recreation, Tourism and Related Professions (COAPRT)

<sup>1</sup> [www.abet.org](http://www.abet.org) (<http://www.ABET.org>)

# Academic Calendar

**Please note:** This is not intended to be construed as an employee work calendar.

## Summer Term 2013

Date	Event
June 24, Monday	Beginning of university year; Beginning of summer term - classes beginning
July 4, Thursday	Academic holiday – Independence Day observed
July 8, Monday	End of second week of instruction
July 15, Monday	End of third week of instruction – Census date
July 26, Friday	Last day of classes for first 5-week session; finals take place during last class meeting
July 29, Monday	First day of classes for second 5-week session; finals take place during last class meeting
August 12, Monday	End of seventh week of instruction
August 16, Friday	Last day of classes for 8-week session; finals August 19, 20, 21
August 30, Friday	Last day of classes for 10-week session, End of summer term
August 31 - September 15, Saturday-Sunday	Academic holiday

## Fall Term 2013

Date	Event
September 16, Monday	Beginning of fall term (faculty only)
September 23, Monday	Fall term classes begin
October 4, Friday	End of second week of instruction
October 11, Friday	End of third week of instruction – Census date
November 8, Friday	End of seventh week of instruction
November 11, Monday	Academic holiday – Veterans' Day observed
November 27-December 1, Wednesday-Sunday	Academic holiday – Thanksgiving
December 6, Friday	Last day of classes
December 9-13, Monday-Friday	Final examination period
December 14, Saturday	Mid-Year Commencement, End of fall term
December 15– January 5, Sunday-Sunday	Academic holiday

## Winter Term 2014

Date	Event
January 6, Monday	Beginning of winter term – classes begin
January 17, Friday	End of second week of instruction
January 20, Monday	Academic holiday – Martin Luther King, Jr.'s Birthday observed

January 21, Tuesday	Classes follow a Monday Schedule
January 27, Monday	End of third week of instruction – Census date
February 17, Monday	Academic holiday – Washington's Birthday observed
February 25, Tuesday	End of seventh week of instruction
March 14, Friday	Last day of classes
March 17–21, Monday-Friday	Final examination period
March 24, Monday	Evaluation Day (faculty workday; no classes), End of winter term
March 25–30, Tuesday-Sunday	Academic holiday

## Spring Term 2014

Date	Event
March 31, Monday	Academic holiday – Cesar Chavez's Birthday observed
April 1, Tuesday	Beginning of spring term – classes begin
April 14, Monday	End of second week of instruction
April 21, Monday	End of third week of instruction – Census date
May 19, Monday	End of seventh week of instruction
May 26, Monday	Academic holiday – Memorial Day observed
May 27, Tuesday	Classes follow a Monday Schedule
June 6, Friday	Last day of classes
June 9–13, Monday-Friday	Final examination period
June 14–15, Saturday-Sunday	Commencement; End of spring term; End of university year (faculty only)

## Summer Term 2014

Date	Event
June 19, Thursday	Beginning of university year; Beginning of summer term - classes begin for first 5-week, 8-week, and 10-week sessions
July 2, Wednesday	End of second week of term
July 4, Friday	Academic holiday – Independence Day observed
July 10, Thursday	End of third week of term – Census date
July 23, Wednesday	Last day of classes for first 5-week session; finals take place during last class meeting
July 24, Thursday	First day of classes for second 5-week session; finals take place during last class meeting
August 7, Thursday	End of seventh week of term
August 14, Thursday	Last day of classes for 8-week session; finals August 18, 19, 20
August 18-20, Monday-Wednesday	Final examination period for 8-week session

August 26, Tuesday	Last day of classes for second 5-week and 10-week sessions, End of summer term
August 27–29, Wednesday - Friday	Final examination period for 10-week session
August 29, Friday	End of summer term
August 30 - September 14, Saturday-Sunday	Academic holiday

## Fall Term 2014

Date	Event
September 15, Monday	Beginning of fall term (faculty only)
September 22, Monday	Fall term classes begin
October 3, Friday	End of second week of instruction
October 10, Friday	End of third week of instruction – Census date
November 7, Friday	End of seventh week of instruction
November 11, Tuesday	Academic holiday – Veterans' Day observed
November 26-30, Wednesday-Sunday	Academic holiday – Thanksgiving
December 5, Friday	Last day of classes
December 8–12, Monday-Friday	Final examination period
December 13, Saturday	Mid-Year Commencement, End of fall term
December 14– January 4, Sunday-Sunday	Academic holiday

## Winter Term 2015

Date	Event
January 5, Monday	Beginning of winter term – classes begin
January 16, Friday	End of second week of instruction
January 19, Monday	Academic holiday – Martin Luther King, Jr.'s Birthday observed
January 20, Tuesday	Classes follow a Monday schedule
January 26, Monday	End of third week of instruction - Census date
February 16, Monday	Academic holiday –Washington's Birthday observed
February 24, Tuesday	End of seventh week of instruction
March 13, Friday	Last day of classes
March 16-20, Monday-Friday	Final examination period
March 23, Monday	Evaluation Day (faculty workday; no classes), End of winter term
March 24–29, Tuesday-Sunday	Academic holiday

## Spring Term 2015

Date	Event
March 30, Monday	Beginning of spring term – classes begin
March 31, Tuesday	Academic holiday – César Chávez's Birthday observed
April 13, Monday	End of second week of instruction

April 20, Monday	End of third week of instruction – Census date
May 18, Monday	End of seventh week of instruction
May 25, Monday	Academic holiday – Memorial Day observed
June 5, Friday	Last day of classes
June 8-12, Monday-Friday	Final examination period
June 13-14, Saturday-Sunday	Commencement; End of spring term; End of university year (faculty only)

For the most current information, see the 2014-15 calendar via the Academic Calendar website ([http://registrar.calpoly.edu/content/acad\\_cal/index](http://registrar.calpoly.edu/content/acad_cal/index)).

# Admissions

## Undergraduate

Office of Admissions, Recruitment & Financial Aid  
Administration Building (01), Room 206  
Phone: 805.756.2311; Fax: 805.756.5400  
Tour Information Line: 805.756.5734  
Email: [admissions@calpoly.edu](mailto:admissions@calpoly.edu)  
[admissions.calpoly.edu/](http://admissions.calpoly.edu/)

## Admissions

Cal Poly comprehensively reviews all applications, seeking students who have strong academic records and are active in and outside the classroom. Admission to Cal Poly is highly competitive. Beyond the basic California State University qualifications, Cal Poly considers other factors for admission deemed important to the campus and does so in an objective format. Review the selection criteria for undergraduate applicants by starting here: <http://admissions.calpoly.edu/prospective/criteria.html>.

Regular Decision candidates are notified of a formal decision by April 1st and Early Decision candidates are notified in mid-December.

## First-Time Freshman Factors

When a freshman application is reviewed, the following are considered:

- The applicant's intended program of study (the major to which application is made)
- The applicant's college preparatory courses in secondary school
- GPA earned in college preparatory courses
- Standardized test scores
- The applicant's extra-curricular activities and work experience

For a comprehensive look at Cal Poly's selection criteria for a freshman applicant, including deadlines, visit <http://admissions.calpoly.edu/applicants/freshman/>.

## Upper-Division Transfer Factors

When an upper-division<sup>1</sup> transfer application is reviewed, the following are considered:

- The applicant's intended program of study (the major to which application is made)
- Number of units completed
- Completion of CSU and Cal Poly program required coursework with a grade of 'C' or better
- General Education (G.E. Breadth) or Intersegmental General Education Transfer Curriculum (IGETC) courses
- Academic performance in college courses (GPA)
- The applicant's extracurricular activities and work experience

For a comprehensive look at Cal Poly's selection criteria for a transfer applicant, including deadlines, visit <http://admissions.calpoly.edu/applicants/transfer/>.

The majors below have additional requirements:

- Art and Design – qualified freshman and transfer applicants will be requested to submit an electronic portfolio per specific instructions provided to the applicant
- Music – qualified freshman and transfer applicants will be requested to audition either in person or via specified media
- Architecture – qualified transfer applicants will be requested to submit a portfolio per specific instructions provided to the applicant

- <sup>1</sup> Cal Poly only considers transfer applicants at the junior level (60 or more transferable semester units or 90 quarter units by the time of transfer [end of previous spring term for Fall admission]). Cal Poly *does not* accept applications for these categories:
  - Lower-division transfer applicants (less than 60 transferable semester units or 90 transferable quarter units upon transfer)
  - Students seeking a second baccalaureate degree
  - Students seeking professional growth or professional development

## Appeals to Undergraduate Admission Decisions - Freshmen and Transfers

Cal Poly does not set aside spaces for students who appeal admission decisions. Every denied application has been reviewed for maximum consideration. Therefore, for an appeal to have merit it must bring to light new academic information as well as information pertaining to extenuating circumstances that was not present in the application information that clearly shows the student to be stronger than had been earlier evidenced. Neither grades received in the current academic year nor mistakes made by the applicant on the application are a basis for an appeal or the reversal of a decision.

Review the Cal Poly Admissions website for complete information and instructions regarding the process to submit an appeal at <http://admissions.calpoly.edu/applicants/notselected/>.

## Application Procedures

For admission consideration, Cal Poly requires applicants to submit the online application ([www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>)) with the corresponding \$55.00 application fee which is both non-refundable and non-transferable. The application and fee cannot be used to apply to another term.

Applicants should not submit additional information beyond the information submitted on the application unless requested to do so by the Admissions Office. Applicants are advised to submit complete and accurate information on the application for admission. Failure to file complete, accurate, and authentic application documentation may result in denial of admission, cancellation of academic credit, suspension, or expulsion (Section 41301 of Title V, California Code of Regulations).

View detailed online application information at <http://admissions.calpoly.edu/applicants/index.html>.

## Cal Poly Application Filing Periods

Cal Poly accepts undergraduate (freshman or transfer) applications for the Fall term only.

**Freshman Applicants** have two options under which they may apply:

- The **“Regular Decision”** option is used by the vast majority of freshman applicants and requires applicants to submit Cal Poly’s online application with the corresponding fee during the application filing period of October 1<sup>st</sup> to November 30<sup>th</sup>.  
Please note: Regular Decision applicants will receive notification of their admission status by April 1<sup>st</sup> and those selected must accept or decline Cal Poly’s offer of admission by May 1<sup>st</sup>.
- The **“Early Decision”** option is for freshman applicants for whom Cal Poly is a clear first-choice and requires applicants to submit Cal Poly’s online application with the corresponding fee and indicating Early Decision admission during the application filing period of October 1<sup>st</sup> to October 31<sup>st</sup>. For Early Decision, Cal Poly will use the ACT and/or SAT I (math and critical reading only) scores applicants have at the time of application.  
Please note: Early Decision applicants will receive notification of their admission status in mid-December and those selected must accept or decline Cal Poly’s offer of admission by January 15<sup>th</sup>. Applicants not selected for Early Decision admission will also have their application reviewed through the Regular Decision process and will receive equal consideration through that process with those who applied directly for Regular Decision. International students and all applicants wishing to apply to the majors of Art and Design or Music cannot be considered for Early Decision admission.

**Transfer Applicants** apply through the **“Regular Decision”** process which requires applicants to submit Cal Poly’s online application with the corresponding fee during the application filing period of October 1<sup>st</sup> to November 30<sup>th</sup>.

Please note: Regular Decision applicants will receive notification of their admission status by April 1<sup>st</sup> and those selected must accept or decline Cal Poly’s offer of admission by May 1<sup>st</sup>.

**Offers of admission to Cal Poly are conditional pending satisfactory compliance with the “Terms and Conditions of Admission” found online at <http://admissions.calpoly.edu/admitted/terms>.**

## Former/Returning Students

### Former Students Returning in the Same Major

Students who were previously enrolled at Cal Poly and who wish to return to the university must follow the guidelines appropriate to their category.

Former students, **who left Cal Poly in good standing (2.0 or higher GPA)** before completing their degree, may essentially resume their former program of study (major) without competing for admission with new applicants, providing the following conditions are met:

1. The student has not registered for classes at Cal Poly for three or more consecutive terms (counting summer term).
2. The student has not been on an approved leave of absence from Cal Poly.
3. A CSU paper application and corresponding fee is filed or postmarked before the application deadline date listed below for the appropriate term:

Term	Deadline
Fall Quarter	July 1st
Winter Quarter	October 1st
Spring Quarter	February 1st

Former students **who did not leave the university in good standing** (i.e., were academically disqualified), will have their application and transcripts sent to their department college for review before reinstatement can occur. Applicants in this category are advised to contact their major’s academic department or advising center to begin dialogue about satisfying any requirements **before** submitting their application.

### Former Students Returning in a New Major

Former Cal Poly students wishing to return to Cal Poly in a different major must file an online application with the corresponding fee by the same application deadline as new applicants. Applicants in this category will compete equally with new applicants for the available transfer openings in their declared major.

## Other Information

### Consistency with State Regulations

The philosophy of the Cal Poly Admissions Office is consonant with the mission of California Polytechnic State University and is in accordance with Title V, Chapter 1, Subchapter 3, of the California Code of Regulations, and specifically, the California Code of Regulations for the California State University System, Title V, Section 40600.

### Graduate Admission Requirements

View online information for graduate admission at <http://admissions.calpoly.edu/applicants/graduate/>.

### Determination of Residence for Tuition Purposes

The Cal Poly Admissions Office determines the residence status of all new and returning students for tuition purposes. View comprehensive online information at <http://admissions.calpoly.edu/applicants/mycalpoly/resinfo.html>.

## International Students

Office of Admissions, Recruitment & Financial Aid  
Administration Building (01), Room 206  
Phone: 805.756.2311; Fax: 805.756.5400  
Tour Information Line: 805.756.5734  
[admissions.calpoly.edu/](http://admissions.calpoly.edu/)  
Email: [admissions@calpoly.edu](mailto:admissions@calpoly.edu)

## International Admissions

Cal Poly, as part of the California State University (CSU) system, assesses the academic preparation of international students using factors such as academic performance, verification of English proficiency, and financial resources (to meet federal regulations). For this purpose, international students include those who hold U.S. visas as students, exchange visitors, or those in other nonimmigrant classifications. The CSU uses separate requirements and application filing dates in the admission of international students.



Reference the International Admissions section on the Cal Poly Admissions website for detailed information, at <http://admissions.calpoly.edu/applicants/international/>.

## Application Procedures

Cal Poly does not have a separate international application. International applicants submit the online application ([www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>)) appropriate to their level of entry with the corresponding \$55.00 application fee which is both non-refundable and non-transferable. The Cal Poly Admissions Office will contact each international applicant regarding additional requirements once the application has been received. View application information, deadlines and selection timelines by visiting <http://admissions.calpoly.edu/applicants/international/deadlines.html>.

For details on additional information required from international applicants, in addition to the application for admission:

**International Freshman Applicants** – visit <http://admissions.calpoly.edu/applicants/international/checklist.html>.

**International Transfer Applicants** – visit <http://admissions.calpoly.edu/applicants/international/checklist.html>. Please note: Cal Poly does not accept applications for undergraduate transfer students with less than 60 transferable semester units (90 quarter units) or applications for second undergraduate degrees.

**International Graduate Applicants** – visit <http://admissions.calpoly.edu/applicants/international/checklist.html>.

After all required documents have been received, the Admissions Office will determine eligibility for admission and will notify the applicant of the result. International applicants admitted to Cal Poly receive a Certificate of Eligibility (I-20 form) which is necessary to obtain a student visa to enter the United States or for requesting permission from the U.S. Citizenship and Immigration Services (USCIS) for transfer to Cal Poly from another U.S. institution. Other requirements may be imposed by USCIS. Applicants should note the I-20 form is valid for enrollment only at Cal Poly for the term indicated and that it includes an expiration date.

## Deadlines

Undergraduate Deadlines for International Students

Term	Application Filing Period	File Completion Deadline
Fall	Oct 1- Nov 30	March 1

Graduate Deadlines for International Students

Term	Application Filing Period	File Completion Deadline
Fall	Oct 1 - Nov 30	March 1
Winter	Oct 1 - June 30	Sept. 1

For detailed information about deadlines, visit <http://admissions.calpoly.edu/applicants/international/deadlines.html>.

International students should also visit the Cal Poly International Center website at <http://international.calpoly.edu/index.html> for additional international student information and services.

# Financial Information

## Fees and Expenses

<http://afd.calpoly.edu/fees/>

The California State University (CSU) makes every effort to keep student costs to a minimum. Fees listed in published schedules or student accounts may need to be increased when public funding is inadequate. Therefore, CSU must reserve the right, even after initial fee payments are made, to increase or modify any listed fees, without notice, until the date when instruction for a particular semester or quarter has begun. All CSU listed fees should be regarded as **estimates** that are subject to change upon approval by the Board of Trustees.

The following reflects applicable systemwide fees for both semester and quarter campuses that were authorized by the Board of Trustees at their July and November 2011 meetings and September 2012 meeting. **These rates are subject to change.**

### All Students

Application Fee (nonrefundable), payable by check or money order at time application is made: \$55

### 2013/14 Basic Tuition Fees

Units	Per Semester	Per Quarter
Undergraduate Tuition Fee		
6.1 or more	\$2,736	\$1,824
0 to 6.0	\$1,587	\$1,058
Credential Program Tuition Fee		
6.1 or more	\$3,174	\$2,116
0 to 6.0	\$1,842	\$1,228
Graduate/Post Baccalaureate Tuition Fee		
6.1 or more	\$3,369	\$2,246
0 to 6.0	\$1,953	\$1,302

### 2013/14 Doctorate Tuition Fees\*

	Units	Per Semester	Per Quarter	Per Academic Year
Education	All Students	\$5,559	\$3,706	\$11,118
Nursing Practice	All Students	\$7,170		\$14,340
Physical Therapy	All Students	\$8,074		\$16,148

\*Applicable term fees apply for campuses with special terms, as determined by the campus. Total College Year fees cannot exceed the Academic Year plus Summer Term fees. The Summer Term fee for the Education Doctorate at quarter campuses is equal to the Per Semester fee listed in the table. Total fees for the Education Doctorate over the College Year equals the Per Academic Year fee plus the Per Semester fee for the summer term at all CSU campuses.

### 2013/14 Professional Program Fee

	Semester	Quarter
Charge Per Unit	\$254	\$169

The Professional Program Fee is paid on a per unit basis in addition to basic tuition fees and campus fees for the following graduate business programs:

Master of Business Administration (M.B.A.)  
 Master of Science (M.S.) programs in Accountancy  
 Master of Science (M.S.) programs in Business Administration  
 Master of Science (M.S.) programs in Health Care Management  
 Master of Science (M.S.) programs in Business and Technology  
 Master of Science (M.S.) programs in Information Systems  
 Master of Science (M.S.) programs in Taxation

### Nonresident Students (U.S. and Foreign)

Nonresident Tuition (in addition to basic tuition fees and other systemwide fees charged all students) for all campuses:

	Semester	Quarter
Charge Per Unit	\$372	\$248

The total nonresident tuition paid per term will be determined by the number of units taken.

Mandatory systemwide fees are waived for those individuals who qualify for such exemption under the provisions of the California Education Code (see section on fee waivers).

Students are charged campus fees in addition to tuition fees and other systemwide fees. Information on campus fees can be found by contacting the individual campus(es).

### Credit Cards:

MasterCard bank credit cards may be used for payment of student fees.

### SCHEDULE OF FEES 2014/15

The CSU makes every effort to keep student costs to a minimum. Fees listed in published schedules or student accounts may need to be increased when public funding is inadequate. Therefore, CSU must reserve the right, even after initial fee payments are made, to increase or modify any listed fees, without notice, until the date when instruction for a particular semester or quarter has begun. All CSU listed fees should be regarded as **estimates** that are subject to change upon approval by the Board of Trustees.

The following reflects applicable systemwide fees for both semester and quarter campuses. **These rates are subject to change.**

### All Students

Application Fee (nonrefundable), payable by check or money order at time application is made: \$55

### 2014/15 Basic Tuition Fees

Units	Per Semester	Per Quarter
Undergraduate Tuition Fee		
6.1 or more	\$2,736	\$1,824
0 to 6.0	\$1,587	\$1,058
Credential Program Tuition Fee		
6.1 or more	\$3,174	\$2,116
0 to 6.0	\$1,842	\$1,228

Graduate/Post  
Baccalaureate Tuition  
Fee

6.1 or more	\$3,369	\$2,246
0 to 6.0	\$1,953	\$1,302

**2014/15 Doctorate Tuition Fees\***

	Units	Per Semester	Per Quarter	Per Academic Year
Education	All Students	\$5,559	\$3,706	\$11,118
Nursing Practice	All Students	\$7,170		\$14,340
Physical Therapy	All Students	\$8,074		\$16,148

\*Applicable term fees apply for campuses with special terms, as determined by the campus. Total College Year fees cannot exceed the Academic Year plus Summer Term fees. The Summer Term fee for the Education Doctorate at quarter campuses is equal to the Per Semester fee listed in the table. Total fees for the Education Doctorate over the College Year equals the Per Academic Year fee plus the Per Semester fee for the summer term at all CSU campuses.

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Master of Science (M.S.) programs in Business Administration  
Master of Science (M.S.) programs in Health Care Management  
Master of Science (M.S.) programs in Business and Technology  
Master of Science (M.S.) programs in Information Systems  
Master of Science (M.S.) programs in Taxation

**Nonresident Students (U.S. and Foreign)**

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	Semester	Quarter
Charge Per Unit	\$372	\$248

The total nonresident tuition paid per term will be determined by the number of units taken.

Mandatory systemwide fees are waived for those individuals who qualify for such exemption under the provisions of the California Education Code (see section on fee waivers).

Students are charged campus fees in addition to tuition fees and other systemwide fees. Information on campus fees can be found by contacting the individual campus(es).

**Credit Cards:**

MasterCard bank credit cards may be used for payment of student fees.

## Schedule of Fees

Please refer to <http://afd.calpoly.edu/fees/> for complete information on fees, including on-campus housing, meal costs, and parking fees.

All regularly enrolled students, both undergraduate and graduate, pay registration and tuition fees determined by the number of units per quarter. In addition to registration and basic tuition fees, nonresident and foreign students pay nonresident tuition fees. Mandatory systemwide tuition and other fees are waived for those individuals who qualify for such exemption under the provisions of the California Education Code (see Student Fee Waivers).

## Registration and Tuition Fees Per Quarter

Registration and Tuition Fees are the sum of two types of fees:

1. Campus-Wide Fees that are payable irrespective of college, and
2. Campus Academic Fees, which vary by college/academic unit. Campus-wide fees include: basic Tuition Fee, Associated Students Fee, Health Facilities Fee, Instructionally Related Activities Fee, Health Services Fee, University Union Fee, and Campus Services Card Fee. Nonresident and foreign students are also charged per unit the nonresident tuition fee.

Cal Poly registration and tuition fees are due at the time of registration, and all prior term balances must be paid in full in order to register.

Fees that are not paid by the fourth day following a student's registration become past due, and a registration hold is placed on the account that prevents adding or swapping classes. If registration and tuition fees are still past due as of the next published cancellation date, then the student may be canceled from all enrolled classes. Students who have accepted financial aid, have an approved third-party contract on file, or are receiving fee waivers are not subject to financial registration holds or class cancellation. Financial aid students whose awards are insufficient to pay fees in full are billed for the balance, and are unable to register for subsequent quarters until the balance has been paid.

## Refund of Mandatory Fees, Including Nonresident Tuition

Regulations governing the refund of mandatory fees, including nonresident tuition, for students enrolling at the California State University are included in §41802 of Title 5, California Code of Regulations. For purposes of the refund policy, mandatory fees are defined as those system-wide and campus fees that are required to be paid in order to enroll in state-supported academic programs at the California State University. Refunds of fees and tuition charges for self-support programs at the California State University (courses offered through extended education) are governed by a separate policy established by the University.

In order to receive a full refund of mandatory fees, less an administrative charge established by the campus, including nonresident tuition, a student must cancel registration or drop all courses prior to the first day of instruction for the term. Information on procedures and deadlines for canceling registration and dropping classes is available online at <http://registrar.calpoly.edu/>.

For state-supported semesters, quarters, and non-standard terms or courses of four (4) weeks or more, a student who withdraws during the term in accordance with the University's established procedures receives a refund of mandatory fees, including nonresident tuition,

based on the portion of the term during which the student was enrolled. No student withdrawing after the 60 percent point in the term is entitled to a refund of any mandatory fees or nonresident tuition.

For state-supported non-standard terms or courses of less than four (4) weeks, no refund of mandatory fees and non-resident tuition is made unless a student cancels registration or drops all classes prior to the first day in accordance with the University's established procedures and deadlines.

Students also receive a refund of mandatory fees, including nonresident tuition, under the following circumstances:

- The fees were assessed or collected in error;
- The course for which the fees were assessed or collected was canceled by the University;
- The University makes a delayed decision that the student was not eligible to enroll in the term for which mandatory fees were assessed and collected and the delayed decision was not due to incomplete or inaccurate information provided by the student; or
- The student was activated for compulsory military service.

Students who are not entitled to a refund as described above may petition the University for a refund demonstrating exceptional circumstances and the chief financial officer of the University or designee may authorize a refund if he or she determines that the fees and tuition were not earned by the University. Information concerning any aspect of the refund of fees may be obtained from the Student Accounts Office. Contact information can be found at [http://afd.calpoly.edu/student\\_accounts/](http://afd.calpoly.edu/student_accounts/).

## Fees and Debts Owed to the University

Should a student or former student fail to pay a fee or a debt owed to the institution, the institution may "withhold permission to register, to use facilities for which a fee is authorized to be charged, to receive services, materials, food or merchandise, or any combination of the above from any person owing a debt" until the debt is paid (see Title 5, California Code of Regulations, Sections 42380 and 42381).

Prospective students who register for courses offered by the University, or who are registered in courses by the University in accordance with the University policies for prospective students, are obligated for the payment of tuition and other fees associated with registration for those courses. Failure to cancel registration in any course for an academic term prior to the first day of the academic term gives rise to an obligation to pay tuition and other fees for the reservation of space in the course.

The institution may withhold permission to register or to receive official transcripts of grades or other services offered by the institution from anyone owing fees or another debt to the institution. The institution may also report the debt to a credit bureau, offset the amount due against any future state tax refunds due the student, refer the debt to an outside collection agency and/or charge the student actual and reasonable collection costs, including reasonable attorney fees if litigation is necessary, in collecting any amount not paid when due. If a person believes he or she does not owe all or part of an asserted unpaid obligation, that person may contact the campus business office. The business office, or another office on campus to which the business office may refer the person, will review all pertinent information provided by the person and available to the campus and will advise the person of its conclusions.

## Credit Cards

Master Card, Discover Card, and American Express may be used for payment of registration and tuition fees, nonresident tuition fees, housing, dining plans and certain other University fees using the web credit card system. The University also accepts electronic check payments, known as eCheck or ACH, using the web on-line payment systems. Details concerning the use of electronic checks and credit cards for fee payments may be obtained from the University website under [http://afd.calpoly.edu/Student\\_Accounts/online\\_payments.asp](http://afd.calpoly.edu/Student_Accounts/online_payments.asp). Credit cards may be used for the purchase of theatre tickets from the Cal Poly Theatre Box Office, tickets for sports events from the Athletics Ticket Office, health services from the University Health Center, Bookstore purchases, parking permits and payment of parking citations with University Police, and for Continuing Education program fees. Contact the individual service center for specific credit card information.

## Fee Waivers and Exemptions

The California Education Code includes provisions for the waiver of mandatory systemwide tuition and other fees as follows:

- § 66025.3 – Qualifying children, spouses/registered domestic partners, or unmarried surviving spouses/registered domestic partners of a war period veteran of the U.S. military who is totally service-connected disabled or who died as a result of service-related causes; children of any veteran of the U.S. military who has a service-connected disability, was killed in action, or died of a service-connected disability and meets specified income provisions; any dependents or surviving spouse/registered domestic partner who has not remarried or a member of the California National Guard who in the line of duty and in active service of the state was killed or became permanently disabled or died of a disability as a result of an event while in active service of the state; and undergraduate students who are the recipient of or the child of a recipient of a Congressional Medal of Honor and meet certain age and income restrictions;
- § 68120 – Qualifying children and surviving spouses/registered domestic partners of deceased public law enforcement or fire suppression employees who were California residents and who were killed in the course of active law enforcement or fire suppression duties (referred to as Alan Pattee Scholarships); and
- § 68121 – Qualifying students enrolled in an undergraduate program who are the surviving dependent of any individual killed in the September 11, 2001 terrorist attacks on the World Trade Center in New York City, the Pentagon building in Washington, D.C., or the crash of United Airlines Flight 93 in southwestern Pennsylvania, if the student meets the financial need requirements set forth in Section 69432.7 for the Cal Grant A Program and either the surviving dependent or the individual killed in the attacks was a resident of California on September 11, 2001.
- § 68122 – Students who are victims of trafficking, domestic violence, and other serious crimes who have been granted T or U visa status are exempt from paying nonresident tuition if they (1) attended high school in California for three or more years; (2) graduated from a California high school or attained the equivalent; and (3) registered as an entering student or are currently enrolled at a CSU campus.
- § 68130.5 – Students who are not residents of California are exempt from paying nonresident tuition if they (1) attended high school in California for three or more years; (2) graduated from a California high school or attained the equivalent; and (3) registered as an

entering student or are currently enrolled at a CSU campus. In addition, students without lawful immigration status will be required to file an affidavit stating that they have filed an application to legalize their immigration status, or will file an application as soon as they are eligible to do so. This exemption from paying nonresident tuition does not apply to students who are nonimmigrant aliens within the meaning of 8 U.S.C. 1101(a)(15), except as provided by Section 68122 above.

Students who may qualify for these benefits should contact the Admissions Office for further information and/or an eligibility determination.

## Procedure for the Establishment or Abolishment of Campus-Based Mandatory Fees

The law governing the California State University provides that specific campus fees defined as mandatory, such as a student body association fee and a student body center fee, may be established. A student body association fee must be established upon a favorable vote of two-thirds of the students voting in an election held for this purpose (Education Code, Section 89300). The campus President may adjust the student body association fee only after the fee adjustment has been approved by a majority of students voting in a referendum established for that purpose. The required fee shall be subject to referendum at any time upon the presentation of a petition to the campus President containing the signatures of 10 percent of the regularly enrolled students at the University. Student body association fees support a variety of cultural and recreational programs, childcare centers, and special student support programs. A student body center fee may be established only after a fee referendum is held which approves by a two-thirds favorable vote, the establishment of the fee (Education Code Section 89304). Once bonds are issued, authority to set and adjust student body center fees is governed by provisions of the State University Revenue Bond Act of 1947, including, but not limited to, Education Code sections 90012, 90027, and 90068.

The process to establish and adjust other campus-based mandatory fees requires consideration by the campus fee advisory committee and a student referendum as established by [Executive Order 1054](#), Section III. The campus President may use alternate consultation mechanisms if he/she determines that a referendum is not the best mechanism to achieve appropriate and meaningful consultation. Results of the referendum and the fee committee review are advisory to the campus President. The President may adjust campus-based mandatory fees but must request the Chancellor establish a new mandatory fee. The President shall provide to the fee advisory committee a report of all campus-based mandatory fees. The campus shall report annually to the Chancellor a complete inventory of all campus-based mandatory fees.

For more information or questions, please contact the Budget Office in the CSU Chancellor's Office at 562.951.4560.

## Financial Aid

Financial Aid Office  
Administration Bldg. (01), Room 212  
Phone: 805.756.2927; Fax: 805.756.7243  
<http://financialaid.calpoly.edu/>

The University has a variety of scholarships, grants, part-time employment opportunities and loans designed to assist students

financially. Additional current information may be obtained by accessing the Financial Aid Office website.

The application for Financial Aid is called the Free Application for Federal Student Aid (FAFSA). The FAFSA is available on the Web at [www.fafsa.ed.gov](http://www.fafsa.ed.gov) or may be obtained from any university or college financial aid office or most high schools. Those who file the FAFSA by March 2 receive priority in the allocation of funds. All students are encouraged to file the FAFSA and qualified students are considered for scholarships.

## Typical Student Expenses

Following are the average expenses per quarter for the 2013-14 academic year for the California resident student attending Cal Poly. Charges for room and board are payable in advance or in quarterly installments. Nonresident students should be prepared to pay additional tuition and fees. For the 2013-14 school year nonresident tuition was an extra \$248 per unit. Please see the "Fees and Expenses ([http://financialaid.calpoly.edu/\\_finaid/coa.html](http://financialaid.calpoly.edu/_finaid/coa.html))" section for more information. All State fees are subject to change upon approval by the Board of Trustees of the California State University.

## University Estimated Expenses per Quarter

Expense	Price
Registration fees	2,914
Room and board	3,721
Books and supplies	592
Personal and transportation	832
Estimated total per quarter	\$8,095

## Cancellation of Registration or Withdrawal from the Institution and Financial Aid

Students who find it necessary to cancel their registration or to withdraw from all classes after enrolling for any academic term *are required* to follow the University's official withdrawal procedures. Failure to follow formal University procedures may result in an obligation to pay fees, the assignment of failing grades in all courses and the need to apply for readmission before being permitted to enroll in another academic term. Information on canceling registration and withdrawal procedures is available from the Office of the Registrar, Administration Building, Room 222, 805.756.2531.

Students who receive financial aid funds *must consult* with the Financial Aid and Student Accounts Offices prior to withdrawing from the University regarding any refunds or repayments of grant or loan assistance received for that academic term or payment period. Students who have received financial aid and withdraw from the institution during the academic term or payment period may need to return or repay some or all of the funds received, which may result in a debt owed to the institution.

## University Scholarships

### General Information

Scholarships are awarded each year. Criteria include financial need, scholastic achievement, participation in school activities, community service, honors and organizational affiliations, and educational objectives. Some scholarships have additional requirements which



relate to a concentration or field of study, geographic origin, class level, and project or design portfolios.

There are numerous scholarships available due to the generous support of individuals and corporations. Please refer to the Financial Aid web site for detailed information.

Generally, a student must have at least a 3.0 grade point average. Both undergraduate and graduate students enrolled full time in the spring term are considered for scholarships.

**Annual Deadline Date to Apply  
(Complete the FAFSA)  
for the following academic year:  
March 2**

## How to Apply

The Financial Aid Office website offers the latest information at [financialaid.calpoly.edu/](http://financialaid.calpoly.edu/). For need-based scholarships, completing the FAFSA is required. For priority consideration for financial aid programs and Cal Poly scholarships, complete the FAFSA by **March 2**.

## Scholarship Notifications

Scholarships are normally awarded during the spring and summer for the following academic year. During that time award offer notices are sent directing the student to the self-service portal to view financial aid awards which include scholarship amount, disbursement and donor information. Awardees must accept on-line scholarship offers acknowledging program responsibilities and requirements. Recipients must be in good academic standing and maintain full-time enrollment while receiving a scholarship (continuing education and Open University units are excluded). Some scholarships require recipients to have earned at least one-half the value of the scholarship during the previous year.

Scholarships are awarded for an academic year and are typically disbursed in quarterly increments. Non-attendance results in cancellation or a prorated amount.

## Athletic Program Grants-In-Aid

Cal Poly athletic grants-in-aid are offered to selected students participating in intercollegiate athletics. Grants are renewable on a quarterly basis, the requisites for renewal being at the discretion of the University.

The grant-in-aid is subject to the financial limitations imposed by the National Collegiate Athletic Association and any conference of which the University is a member. Financial aid, scholarships, specific outside resources and employment are considered in determining compliance with these limitations. Additional information can be provided by the Athletic Department.

## Other Scholarships

In addition to University scholarships, awards from various private donors and organizations are available to assist students with University expenses. Interested students should make inquiries for such awards directly to sponsoring organizations. Currently, Cal Poly students are beneficiaries of several million dollars of outside scholarship assistance each year. Students should exercise caution in using scholarship search services; many sell information that is readily available at no cost. Other sources of scholarship funding may be available from:

- community organizations
- employers

- professional, career and trade associations

For valuable links visit the scholarship website at [http://financialaid.calpoly.edu/\\_finaid/types\\_aid/scholarships.htm](http://financialaid.calpoly.edu/_finaid/types_aid/scholarships.htm).

## Grants

**Federal Pell Grants** are designed to help undergraduates and teaching credential candidates pay for their education. The Pell Grant amount is determined by the Expected Family Contribution, the cost of education, full-time or part-time enrollment and terms of enrollment. To apply, complete the FAFSA by **March 2** for the upcoming year.

**Federal TEACH Grants** are available to students who commit to four years of teaching in a high need area (science, mathematics, special education, and, in California, agriculture) in a school serving low income families. The grant converts to a federal unsubsidized loan if the teaching commitment is not met. To apply, complete the FAFSA by **March 2** for the upcoming year and contact the financial aid office.

**Federal Supplemental Educational Opportunity Grant (SEOG)** is designed to assist undergraduate students who have substantial financial need. To apply, complete the FAFSA by **March 2** for the upcoming school year.

## Cal Grants

The California Student Aid Commission (CSAC) awards entitlement and competitive Cal Grants. To qualify, students must be California residents or eligible under AB 540. If applying for a Cal Grant for the first time, students must complete the FAFSA and a Cal Grant GPA verification form. Request the GPA Verification Form from your high school or college. To apply, complete the FAFSA and mail the GPA Verification Form to CSAC by **March 2**.

For the latest information on the Cal Grant program, visit the CSAC website at [www.csac.ca.gov](http://www.csac.ca.gov) (<http://www.csac.ca.gov>).

**Cal Grant A** is awarded to middle- and low-income undergraduates. New awards are limited to students who are freshmen, sophomores or juniors. Cal Grant A covers a portion of student registration fees and eligibility is tied to the cost of attendance. Cal Grant A may be renewed until completion of four years of college attendance. Recipients must continue to meet eligibility standards. Students may be eligible for an additional year of Cal Grant A at Cal Poly if enrolled in a designated five-year program or the teaching credential program.

**Cal Grant B** is awarded to low-income undergraduate students. First year recipients receive stipend only. Cal Grant B renewal recipients receive stipend plus a portion of registration fees. Eligibility is tied to the cost of attendance. Cal Grant B may be renewed until completion of four years of college attendance and students must meet eligibility standards. Students may be eligible for an additional year of Cal Grant B at Cal Poly if enrolled in a designated five-year program or the teaching credential program.

**State Educational Opportunity Program Grant (SEOP)** assists undergraduate students who have been admitted to the University through the Educational Opportunity Program (EOP). To apply, complete the FAFSA by **March 2** for the upcoming school year.

**State University Grant (SUG)** covers a portion of student registration fees. SUG is available to undergraduate and graduate students who are California residents or eligible under AB 540 and show financial need. To apply, complete the FAFSA by **March 2** for the upcoming year.

## Employment

**Federal Work-Study (FWS)** is a need-based program which provides part-time employment for students. Work-Study jobs assist students financially and may provide career related work experience. FWS positions are either on- or off-campus with approved departments/ organizations. Pay rates vary depending on job requirements and student skills. To receive priority consideration, complete the FAFSA by **March 2** for the upcoming school year.

## Loans

Loans are for educational purposes only, with specific provisions for repayment. There are four types: Federal Perkins Loans, Federal Direct Student Loans (FDSL), Federal Parent Loans (PLUS), and Cal Poly Long-Term Educational Loans. Also available are small, short-term emergency loans.

**Federal Perkins Loan** is a five percent interest loan available to both undergraduate and graduate students. Annual amounts are based on students' need as determined by the FAFSA data. Repayment begins nine months after the student leaves school or ceases to be enrolled at least half-time. The government pays the interest while the student is in school and during the grace period. There are cancellation and deferment provisions. To apply, complete the FAFSA by **March 2** for the upcoming school year.

**Federal Subsidized Direct Loans** are available to students through the U.S. Department of Education. Annual amounts are based on the students' need as determined by the FAFSA and federal limits. The federal government pays the interest on the loan while the student is in school and there are deferment provisions. To apply, complete the FAFSA by **March 2** for the upcoming year.

**Federal Unsubsidized Direct Loans** are available for students who are ineligible for some or all of a subsidized Federal Direct Loan. With the exception of demonstrated financial need, borrowers must meet all eligibility criteria under the Federal Direct Loan program. Interest payments begin immediately after the loan is disbursed or the borrower may elect to defer payment and add the interest to the amount owed. An additional amount of Unsubsidized Direct Loan, above the Federal Subsidized Direct limit, may be available to independent students and to dependent students whose parents are denied a PLUS Loan.

**Federal Parent Loans (PLUS)** enable borrowers to obtain low interest loans for educational costs through the U.S. Department of Education. PLUS loan repayment begins when the loan is disbursed. To apply, complete the FAFSA.

**University Long-Term Educational Loans** are available to students who demonstrate long-term financial need. Some require written application, recommendations and interviews. The interest rate is four percent on the unpaid balance during repayment. Typically, interest accrues after the specified due date, graduation or withdrawal from the University. A one percent service charge is deducted from each loan disbursement.

**University Short-Term Emergency Loans** are designed to help students cope with unanticipated, educationally-related financial emergencies. Registration fees, rent, or utility bills are expenses that students should plan and are not considered emergencies as defined under this program. Full-time enrollment and a minimum 2.0 GPA are required. Each application is reviewed on a case-by-case basis. For further information, visit the Financial Aid Office website

at [http://financialaid.calpoly.edu/\\_finaid/types\\_aid/special\\_programs/emergency.html](http://financialaid.calpoly.edu/_finaid/types_aid/special_programs/emergency.html) , or stop by the office.

## University Educational and Emergency Student Loans

There are numerous loans available due to the generous support of individuals and corporations. Please refer to the Financial Aid web site for detailed information.

## Academic Placement

English Placement Test (EPT)

Entry Level Mathematics Exam (ELM)

Cal Poly Mathematics Placement Examination (MAPE)

### Academic Placement

#### Placement Test Requirements

The California State University requires that each entering undergraduate, except those who qualify for an exemption, take the CSU English Placement Test (EPT) and the CSU Entry Level Mathematics (ELM) examination after admission and prior to enrollment. These placement tests are not a condition for admission to the CSU, but they are a condition for enrollment. These examinations are designed to identify entering students who may need additional support in acquiring college entry-level English and mathematics skills necessary to succeed in CSU baccalaureate-level courses. Undergraduate students who do not demonstrate college-level skills in English and/or mathematics should enroll in appropriate developmental courses or programs during the first term of their enrollment.

### English Placement Test (EPT)

#### Purpose of the EPT

The EPT is designed to assess the level of reading and writing skills of undergraduate students entering Cal Poly so that they can enroll in appropriate composition courses. Those undergraduate students who do not demonstrate college-level skills on the EPT are then advised to enroll in courses or programs designed to help them attain those skills. The EPT is not a condition for admission to the CSU, but it is a condition for enrollment at Cal Poly. Students may take the EPT only once. It may not be repeated.

#### Who Must Take the EPT

The CSU EPT must be completed by all non-exempt entering undergraduates prior to enrollment in any course, including remedial courses. Students who score 147 or above on the EPT are placed in college-level composition classes.

Exemptions from the EPT are granted only to those who present proof of one of the following:

- A score of "Exempt" or "Ready for college-level English courses" on the CSU Early Assessment Program (EAP) taken along with the English Language Arts California Standard Test in grade 11.
- A score of "Conditionally ready for college-level English courses" or "Conditional" on the CSU Early Assessment Program (EAP) taken on grade 11, provided successful completion of the Expository Reading and Writing Course (ERWC), AP English, 1B English or an English course approved for extra honors weight on the University of California "a-g" Doorways course list.
- A score of 500 or above on the critical reading section of the College Board SAT Reasoning Test.
- A score of 22 or above on the American College Testing (ACT) English Test.
- A score of 3 or above on either the Language and Composition or Composition and Literature examination of the College Board Scholastic Advanced Placement Program.
- Completion and transfer of the credits for a college course that satisfies the General Education A1 requirement in English

Composition, provided such a course was completed with a grade of C or better.

### Registration Holds/Disenrollment

CSU Trustee policy requires that all non-exempt students take the EPT examination after admission and before enrollment in the CSU. At Cal Poly, failure to take the EPT examination or show documented exemption before enrollment results in a hold on registration privileges and may lead to disenrollment from the University.

Information about the EPT is mailed to all students subject to the requirement. The materials also may be obtained from the Test Office website: [www.testoffice.calpoly.edu](http://www.testoffice.calpoly.edu).

### Remediation

All students who score below 147 on the EPT are required to enroll in Cal Poly's Writing and Rhetoric Stretch Program during their first year of coursework. Students who do not make adequate progress in completing the program during their first year of enrollment face disqualification from the University.

In the Writing and Rhetoric Stretch Program, students complete two quarters of coursework as a cohort with the same instructor. Coursework is taken in the following sequence:

- First, students enroll in either ENGL 102: Basic Writing or ENGL 113: Basic Writing for English as a Second Language Students
- After earning credit for either or ENGL 113, students enroll in ENGL 103: Writing Lab Tutorial *concurrently* with either ENGL 134: Writing and Rhetoric or ENGL 133: Writing and Rhetoric for English as a Second Language Students.

Note: Failure to complete successfully ENGL 102/ ENGL 113 or ENGL 103 results in a grade of F in ENGL 134/ ENGL 133.

Upon successful completion of the Writing and Rhetoric Stretch Program, students fulfill their remediation requirement and earn credit in GE Area A1.

### Entry Level Mathematics (ELM) Exam

#### Purpose of the ELM

The ELM examination is designed to assess the skill levels of entering CSU students in the areas of mathematics typically covered in three years of rigorous college preparatory courses in high school (normally Algebra I, Algebra II, and Geometry). Undergraduate students who do not demonstrate college-level skills are advised to enroll in courses or programs designed to help them attain these skills. The ELM is not a condition for admission to the CSU, but it is a condition of enrollment.

#### Who Must Take the ELM

All entering undergraduates must take the ELM examination before enrolling in a course that satisfies the college-level mathematics requirement of the General Education-Breadth program. Exemptions from the test are given only to those students who can present proof of one of the following:

- A score of "Exempt" or "Ready for college-level Mathematics courses" on the CSU Early Assessment Program (EAP), taken in grade 11 in conjunction with the CST in Summative High School Mathematics or Algebra II.
- A score of "Conditionally ready for college-level Mathematics courses" or "Conditional" on the CSU Early Assessment Program

(EAP) taken in grade 11 along with the California Standards Test in Summative High School Mathematics or Algebra II, provided successful completion of a CSU-approved 12th grade math course that require Algebra II as a prerequisite.

- A score of 550 or above on the mathematics section of the College Board SAT Reasoning Test or on a College Board SAT Subject Test in Mathematics (level 1 or level 2).
- A score of 23 or above on the ACT Mathematics Test.
- A score of 3 or above on the College Board Advanced Placement Calculus AB or Calculus BC exam or on the College Board Advanced Placement Statistics exam.
- For transfer students, completion and transfer to CSU of a college course that satisfies the requirement in Quantitative Reasoning, provided such a course was completed with a grade of C or better.

## Registration Holds/Disenrollment

CSU Trustee policy requires that all non-exempt students take the ELM examination after admission and before enrollment in the CSU. At Cal Poly, failure to take the ELM examination or show documented exemption before enrollment results in a hold on registration privileges and may lead to disenrollment from the University.

In addition, students who do not demonstrate requisite competence are required to enroll in appropriate remedial or developmental programs during the first term of enrollment and each subsequent term until such time as they demonstrate competence. Students who do not demonstrate proficiency within the first year of enrollment face disqualification from the University.

At Cal Poly, students **may not** enroll in any college level mathematics or statistics course without satisfying the ELM requirement.

Students who need to take the ELM exam are sent the information about the exam and how to register. This information is also available from the ELM/MAPE Office 805.756.2268, or online at: <http://math.calpoly.edu/elmmape.html>.

## Early Start Program

Entering resident freshmen who are not proficient in English or math will need to begin the remediation process before their first regular term by completing the Early Start Program.

The goals of the Early Start Program are as follows:

- To augment students' preparedness in English and/or math before they begin fall quarter of freshman year
- To add an important and timely assessment tool in preparing students for college
- To improve students' chances of successful completion of a college degree

Newly admitted freshmen who are required to complete Early Start will be notified of their options for completing the program.

## Cal Poly Mathematics Placement Examination (MAPE)

The Cal Poly Mathematics Placement Exams are diagnostic exams given by the Mathematics Department to place students who have satisfied the ELM requirement in the appropriate college-level math course. **The MAPE is not intended for all students, so please read the following information carefully.**

## Precalculus MAPE

Students who anticipate taking Trigonometry or Calculus (MATH 119, MATH 141, MATH 161, or MATH 221) must pass the precalculus MAPE unless they have presented proof of *one* of the following exemptions:

- a score of 600 or above on the mathematics section of the SAT I Test or on the SAT II Mathematics Tests Level I, IC (Calculator), II, or IIC (Calculator);
- a score of 26 or above on the American College Testing (ACT) Mathematics Test;
- a score of 3 or above on the College Board Advanced Placement Mathematics (Calculus AB or BC) examination;
- completion of MATH 118 at Cal Poly *or* transfer of a college course equivalent to MATH 118

**NOTE:** For **MATH 141**, students must also have credit for college or high school trigonometry, completed with grade C or better.

## Intermediate Algebra MAPE

Students who anticipate taking Precalculus Algebra (MATH 118) must pass the intermediate algebra MAPE unless they have presented proof of one of the following exemptions:

For **MATH 118:**

- a score of 550 or above on the mathematics section of the SAT I Test or on the SAT II Mathematics Tests Level I, IC (Calculator), II, or IIC (Calculator);
- a score of 23 or above on the American College Testing (ACT) Mathematics Test; *or*
- a score of 65 or above on the ELM test.

**NOTE:** Students who have satisfied the ELM requirement and are planning to take MATH 112 or MATH 116 do *not* need to take the MAPE.

Students who need to take a math placement exam must do so prior to enrollment. The MAPE is free and offered regularly throughout the year. For information, contact the ELM/MAPE Office (805-756-2268) or the Math Department Office (805-756-2206).

# Academic Standards

## Academic Obligations

All students are expected to be diligent in the pursuit of their courses of study in order that both they and the State receive maximum benefit from the educational opportunities provided. Each student is responsible for his or her enrollments and timely adds, drops and withdrawals following campus policy.

Students are expected to satisfy the academic demands required by their instructors in such ways as they may set forth, in order to satisfy the instructor that they are performing their assignments in a proper manner.

Instructors are expected to give first priority to meeting their scheduled classes and other assigned responsibilities, including keeping regular office hours for student conferences.

In classroom settings, instructors have the authority and responsibility to establish rules, maintain order, and to dismiss students from a class session for violation of the rules or misconduct. Violations or misconduct warranting more than a single dismissal from a class



session should be referred by the instructor to the Office of Student Rights and Responsibilities at 805.756.2794 for disciplinary action.

## Expected Academic Progress (EAP) Policy

Expected Academic Progress is defined as making appropriate degree progress each academic year by earning a certain percentage of degree applicable units that meet major, support, general education, concentration, and free elective (if applicable) requirements that are directly associated with the student's declared major.

Expected Academic Progress (EAP) is monitored for all students each quarter. Students who fall behind in their EAP will be designated as having an **EAP deficiency** and may be required to meet with their academic advisor. Although this designation will not be noted on their transcript, students will be expected to make up this deficiency.

Those students who are required to meet with their advisor are expected to review and discuss their academic progress, and to create a reasonable academic plan to help get the student back on track. Attending summer session, either at Cal Poly, a community college, or another regionally accredited institution, may be suggested. Should the student decide to attend another institution, he or she must confirm that the courses they decide to take at that institution will apply to their Cal Poly degree requirements upon transfer.

If the student continues to have an EAP deficiency, their department or college **may have a hold placed on their registration for the next term or place them on Administrative Academic Probation (see the section on Administrative Academic Probation).**

Those students who have a demonstrated need to attend Cal Poly on a part-time basis for at least three consecutive quarters may be considered exempt from the EAP policy. These students will be required to submit an EAP Exemption Request through their advisors in order to be evaluated for exemption.

In addition to the university's EAP policy, the College of Engineering has additional requirements. Please see the College of Engineering Advising Center for details.

### I. Native EAP Policy (Students entering Cal Poly as first-time freshmen)

Every full-time undergraduate student is required to make reasonable academic progress toward completion of the bachelor's degree. EAP is monitored for all Cal Poly students in order to help them graduate in a timely manner.

Students entering Cal Poly as first-time freshmen and who are enrolled in four-year degree programs (e.g., BA, BS, BFA) are expected to graduate in twelve quarters. Normally, this will not include summer terms, as summer is considered an opportunity to make up for any lack of progress in prior quarters or to bank progress for future quarters.

To maintain Expected Academic Progress, the following standards should be met by the end of each respective year:

**First year:** Completion of at least **20%** of the total number of units required for the degree.

**Second year:** Completion of at least of **45%** of the total number of units required for the degree.

**Third year:** Completion of at least **75%** of the total number of units required for the degree.

**Fourth year:** Completion of at least **100%** of the total number units required for the degree.

Example: A student enrolled in a four-year degree program requiring 180 total units would need to complete no fewer than 36 units by the end of the first year, no fewer than 81 units by the end of the second year, no fewer than 135 by the end of the third year, and no fewer than 180 by the end of the fourth year.

To determine the standards for programs requiring more than 180 total units, multiply the total units required by .20, .45, .75, or 1.0 for each respective year. Students enrolled in a five-year degree (e.g., BArch, BLA) or blended programs must also demonstrate Expected Academic Progress and should consult with their major department for specific requirements.

**Benchmark Courses:** In addition to monitoring the number of required units completed, some departments may identify specific benchmark courses that should be completed by the end of each respective year. Students should check with their advisor for such requirements.

**Degree Applicable Units:** Departments rely on data derived from each student's Degree Progress Report (DPR) to verify that the expected number of units completed constitute degree-applicable units (units that advance the student toward degree completion). In tallying these units for the purpose of monitoring EAP, degree-applicable credits earned from Advanced Placement (AP), International Baccalaureate (IB), and accredited baccalaureate-level transfer work will be included.

**Concentrations:** If the student's major requires a concentration, units taken for the concentration are included in assessing EAP. The concentration should be declared no later than reaching 90 units (junior standing).

**Minors:** Minors are optional at Cal Poly and are not a part of a student's EAP. Depending on the student's major, courses taken for the minor may or may not represent degree-applicable units (see "Maximum Units" below). Students who decide to pursue a minor should declare their minor no later than the end of their junior year. Minors must be completed within the EAP requirements identified (i.e., maximum number of units and quarters allowed for the degree). No minor will be awarded after the baccalaureate degree requirements have been met.

**Maximum Units:** Students graduating on time (this would be 12 quarters, excluding summers, for students enrolled in four-year degree programs) have no cap on the number of units they may complete at Cal Poly. **Students who do not graduate on time may complete no more than 24 Cal Poly units above the number required for the degree.** Exceeding the allowable 24 units may result in a hold being placed on the student's registration or the student being placed on administrative academic probation. The student will be required to submit a **Degree Completion Plan** to the major department before he or she is allowed to continue their education at Cal Poly. The Degree Completion Plan may include only degree-applicable units, as the student will not be allowed to take non-degree-applicable classes during this period. In tallying the Maximum Units, *only Cal Poly units* will be included. Credit earned from AP, IB, and transfer work will not be used in the Maximum Units calculation.

Students contemplating a change of major or the addition of a second major should be aware that the maximum unit cap applies in these circumstances. As outlined in the Change of Major section elsewhere in the catalog, major changes should be undertaken only if the new major will not result in exceeding the maximum units cap of 24 Cal



Poly units above the number required for the degree. The same holds true for a second major. In the case of a change of major, the cap would be 24 units above the number required for the new major. In the case of a second major, the cap would be 24 units above the minimum required for the primary major.

**Failure to make reasonable academic progress** as prescribed by this policy may result in a hold being placed on the student's registration or the student being placed on administrative-academic probation. Notification that a hold has been placed or being placed on administrative-academic probation will be sent to the student's Cal Poly email address. Continued failure to meet EAP standards may result in disqualification from the University.

**Exemptions:** Students who have to comply with an externally imposed set of degree progress standards (e.g., athletes following NCAA regulations) may continue to follow those guidelines. Other students for whom the Expected Academic Progress policy represents undue hardship may appeal for exemption through their advisors. Such appeals should be supported with documentation as appropriate (e.g., a physician's note).

## II. Transfer EAP Policy

Every full-time undergraduate student is required to make reasonable academic progress toward completion of their bachelor's degree. EAP is monitored for all Cal Poly students in order to help them graduate in a timely manner.

Ideally, those who enter Cal Poly as upper division transfer students and who are enrolled in four-year degree programs (BA, BS, BFA) are expected to graduate in two years (six quarters). However, EAP policy does allow students three years (nine quarters, *excluding summer quarters*) to complete their degree requirements at Cal Poly, should they still have remaining lower division requirements after they are admitted as junior transfers.

To maintain Expected Academic Progress, the following standards should be met by the end of the specified year of study at Cal Poly (note that these standards are based on the assumption that all upper division transfer students enter with at least 90 degree-applicable units and are General Education (GE) certified for lower division GE not specified by the major):

**First year:** Completion of at least **55%** of the total number of units required for the degree.

**Second year:** Completion of at least **80%** of the total number units required for the degree.

**Third year:** Completion of **100%** of the total number of units required for the degree.

Example: A transfer student enrolled in a four-year degree program requiring 180 total units would need to have completed no fewer than 99 degree-applicable units by the end of the first year, no fewer than 144 degree-applicable units by the end of the second year, and no fewer than 180 degree-applicable units by the end of the third year of study.

To determine the standards for programs requiring more than 180 total units, multiply the total units required by .55 or .80 or 1.0 for each respective year. Students enrolled in five-year degrees (e.g., BArch, BLA) or blended programs must also demonstrate Expected Academic Progress and should consult with their major department for specific requirements.

**Benchmark Courses:** In addition to monitoring the number of degree-applicable units completed, some departments may identify specific benchmark courses that should be completed by the end of each respective year. Students should check with their advisor for such requirements.

**Degree Applicable Units:** Departments rely on data derived from each student's Degree Progress Report (DPR) to verify that the minimum number of units completed constitute degree-applicable units (units that advance the student toward degree completion). In tallying these units for the purpose of monitoring satisfactory progress, degree-applicable credit earned from Advanced Placement (AP), International Baccalaureate (IB), and accredited baccalaureate level transfer work will be included.

**Concentrations:** If the student's major requires a concentration, units taken for the concentration are included in assessing the EAP. The concentration should be declared as soon as possible and no later than the end of the second quarter of study at Cal Poly.

**Minors:** Minors are optional at Cal Poly and are not a part of a student's Expected Academic Progress. Depending on the student's major, courses taken for the minor may or may not represent degree-applicable units (See "Maximum Units" below). Students electing a minor should declare the minor as soon as possible and no later than the end of the first year of study at Cal Poly. Minors must be completed within the EAP requirements identified (e.g., maximum number of units and quarters allowed for the major). No minor will be awarded after the baccalaureate degree requirements have been met

**Maximum Units:** Transfer students graduating on time (in 9 quarters, excluding summers, for transfer students enrolled in four-year degree programs) have no cap on the number of units they may complete at Cal Poly. **Transfer students who are NOT on track to graduate on time may complete no more than 24 Cal Poly units above the number required for the degree.** Exceeding the allowable 24 units may result in a hold placed on the student's registration or the student being placed on administrative-academic probation. A **Degree Completion Plan** must be submitted to the major department before they will be allowed to continue their education at Cal Poly; such transfer students may enroll *only* in degree-applicable units. In tallying the Maximum Units, *only Cal Poly units* will be included. Credit earned from AP, IB, and transfer work will not be used in the Maximum Units calculation.

Students contemplating a change of major or the addition of a second major should be aware that the maximum unit cap applies in these circumstances. As outlined in the Change of Major section elsewhere in the catalog, major changes should be undertaken only if the new major will not result in exceeding the maximum units cap of 24 Cal Poly units above the number required for the degree. The same holds true for a second major. In the case of a change of major, the cap would be 24 units above the number required for the new major. In the case of a second major, the cap would be 24 units above the minimum required for the primary major.

**Failure to make reasonable academic progress** as prescribed by this policy may result in a hold being placed on the student's registration or the student being placed on administrative-academic probation. Notification that a hold has been placed or being placed on administrative-academic probation will be sent to the student's Cal Poly email address. Continued failure to meet EAP standards may result in disqualification from the University.

**Exemptions:** Students complying with an externally imposed set of degree progress standards (e.g., athletes following NCAA regulations)

may continue to follow those guidelines. Other students for whom the Expected Academic Progress policy represents undue hardship may appeal for exemption through their advisors. Such appeals should be supported with documentation as appropriate (e.g., a physician's note).

## Academic Probation and Disqualification

The quality of academic performance is considered in the determination of a student's eligibility to remain enrolled. Uniform standards for academic probation or disqualification, and for administrative-academic probation or disqualification, are in effect at all campuses of the California State University. Undergraduate students may be placed on academic probation and later be disqualified, or be placed on administrative-academic probation and later be disqualified, when they do not meet these standards.

Students who have been placed on academic probation, administrative-academic probation, or who have been notified of their disqualification may request review of such action by the dean of the college taking the action. Students who have been disqualified for inadequate progress or performance are not readmitted until presentation of satisfactory evidence that they have improved their chances of academic success. The request for readmission is referred to the dean of the college in which the student wishes to enroll.

Students on academic probation may not participate on intercollegiate teams nor may they hold positions of leadership in student organizations or student government groups. These include, but are not limited to, such groups as: athletic teams, debate teams, drama casts, judging teams, ASI councils, boards and committees. Such students may not hold an office in a student organization, nor may they be editors, managers, or hold similar positions on student publications. However, students on academic probation may participate in such activities as club membership, intramurals, and music that do not include travel and the official representation of the University.

Certain groups may have set higher standards than the minimum for specific positions or areas of responsibility that require considerable commitments of time and energy.

An undergraduate student becomes subject to academic probation or disqualification under the conditions shown below. For minimum scholarship standards applicable to graduate and post-baccalaureate students see the Graduate Programs section.

### I. Academic Probation

An undergraduate student is automatically placed on academic probation when the grade point average drops below 2.000 (C). The grade point average applies to the current term (unadjusted for any subsequent grade forgiveness), the Cal Poly cumulative, or the higher education cumulative. The student is advised promptly, by email or other means, of being placed on probation. It is the student's responsibility to check his/her campus email account regularly.

**Note:** For first-time freshmen with Cal Poly coursework only, academic probation in their first quarter of attendance will also equate to subject to disqualification (see below).

### II. Academic Disqualification

1. An undergraduate student is subject to disqualification when any of the following is true:
  - a. The student's Cal Poly cumulative, or higher education cumulative grade point average is below 2.000.

- b. The student is on academic probation for two consecutive quarters.
- c. The student has been on academic probation for four non-consecutive quarters.

An undergraduate student who is subject to disqualification may be disqualified at the discretion of his/her college.

2. An undergraduate student will be disqualified when either of the following is true:
  - a. The student has been on academic probation three consecutive quarters.
  - b. The student has been on academic probation three or more non-consecutive quarters and has a current Cal Poly cumulative or higher education cumulative grade point average that is below 2.000.

### III. Notice of Disqualification

Students who are disqualified at the end of a quarter are notified before the beginning of the next consecutive regular quarter. Students disqualified at the beginning of a summer enrollment break are notified at least one month before the start of the fall quarter.

The Office of the Registrar will notify the student by email. It is the student's responsibility to check his/her campus email account regularly.

### IV. Administrative-Academic Probation

An undergraduate or graduate student may be placed on administrative-academic probation by action of the dean of the college in which the student is enrolled for any of the following reasons:

1. Withdrawal from all or a substantial portion of a program of studies in two successive terms or in any three terms. (Note: a student whose withdrawal is directly associated with a chronic or recurring medical condition or its treatment is not subject to administrative-academic probation for such withdrawal.)
2. Repeated failure to make Expected Academic Progress (see the section on Expected Academic Progress) toward the stated degree or program objective, including that resulting from assignment of 15 units of NC, when such failure appears to be due to circumstances within the control of the student.
3. Failure to comply, after due notice, with an academic requirement or regulation which is routine for all students or a defined group of students.

When such action is taken, the student is notified in writing and is provided with the conditions for removal from probation and the circumstances which would lead to disqualification, should probation not be removed.

### Academic Petitions

Academic petitions are handled through the academic affairs division of the University. The process of review may include the academic department, academic advising offices, administrative offices, and/or college dean's office. Typical academic petitions include, but are not limited to, transferring from one program to another, academic requirement or policy deviation requests, and admission/re-admission issues. Contact the appropriate office for specific academic petition procedures.

## Academic Petition Appeals

Following a petition decision, and under limited circumstances, students may appeal to the Associate Vice Provost for Academic Programs and Planning or his/her designee. The right to an appeal is not guaranteed and an appeal is only considered if the student can show that one or more of the following exist:

1. A requirement or policy was incorrectly applied to the petition.
2. A requirement or policy is unclear or ambiguous.
3. There is new information that should be considered in the evaluation of the petition.
4. There are special circumstances warranting the granting of the appeal.

The granting of an academic petition appeal gives students the opportunity to present the merits of their petition to the Associate Vice Provost. The Associate Vice Provost's decisions regarding appeals represent the University's final decision on academic petitions. Contact the Office of Academic Programs at 805.756.2246 for more information on the procedures for filing an academic petition appeal.

## Student Grievances

The University provides students with a variety of mechanisms to address student grievances or concerns. In all such matters, the University encourages students to attempt to resolve their grievance or concern at the source of the issue (i.e., with the professor, department chair or administrator, or college associate dean). The Dean of Students Office, at 805.756.0327, is available to any campus community member to assist with identifying and clarifying appropriate campus policies and procedures for addressing student grievances or concerns.

For general questions about grievances, contact the Dean of Students Office at 805.756.0327. The following list contains the offices or programs designated to address the more common student grievances at the University:

- **Grade Grievances** – The Fairness Board: Contact the Academic Senate Office, 805.756.1258 (See University Policies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/universitypolicies>) page for more detail on the functions of this Board)
- **Individual Student Misconduct** – Office of Student Rights and Responsibilities, 805.756.2794 (See Student Affairs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/studentaffairs>) page for more detail on the functions of this office)
- **Student Club Misconduct** – Student Life and Leadership, 805.756.2476 (See Student Affairs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/studentaffairs>) page for more detail on the functions of this office)

## Eligibility for Intercollegiate Athletics

Eligibility for competition in intercollegiate athletics is regulated in general by the rules of the National Collegiate Athletic Association (NCAA), and specifically by current Conference and university regulations. The Director of Athletics is responsible for maintaining up-to-date intercollegiate athletics eligibility rules applicable to the University. The Faculty Athletic Representative has the responsibility for the interpretation of the NCAA, Conference, and university rules

for determining student eligibility to represent the University in intercollegiate athletic events.

## Eligibility for Student Activities

Students on either academic or disciplinary probation may not participate on intercollegiate teams nor may they hold positions of leadership in chartered student organizations or coded student government groups. Students on probation may participate in such student organizations and groups as members but they may not hold an office or represent the University or the Associated Students, Incorporated, in any official capacity.

## Student Conduct and Discipline

It is expected that all Cal Poly students are enrolled for serious educational pursuits and that they conduct themselves so as to preserve an appropriate atmosphere of learning. It is also expected that all students who enroll at Cal Poly are willing to assume the responsibilities of citizenship in the campus community. Association in such a community is voluntary, and students may withdraw from it at any time that they consider the obligations of membership disproportionate to the benefits. While enrolled, students are subject to campus authority that includes the prerogative of dismissing those whose conduct is inimical to the aims of an institution of higher education.

While enrolled, students are subject to the regulations governing discipline stated in *Education Code* Section 66017 and in Title 5 of the *California Code of Regulations*, Sections 41301–41302, and to such rules and regulations as have been approved and promulgated by authority of the President. Copies of Title 5 *California Code of Regulations* 41301 and 41302, which deal specifically with student disciplinary regulations, are available to all students in the "Appendix" of this catalog. Other applicable regulations are contained in this Catalog, in the *Campus Administrative Policies*, the Standards for Student Conduct, Rights and Responsibilities, and in other official university publications, including the Cal Poly website.

## Evaluation of Transfer Credit

### Transfer Credit

The Evaluations Unit in the Office of the Registrar will evaluate previous college work in relation to Cal Poly degree requirements. Admitted transfer students will receive an email from Evaluations that their evaluation has been completed and will then be able to access their [Degree Progress Report](#) via the Student Center on the Cal Poly Portal; they cannot access the Degree Progress Report prior to that time, nor can Evaluations provide specific information about credit prior to that time.

Every effort is made to provide a complete Degree Progress Report (DPR), with all transfer credit reflected, prior to the date of transfer student registration in August. The DPR serves as the basis for determining remaining requirements for the student's specific objectives. The Degree Progress Report is available throughout a student's Cal Poly career and should be used to track progress toward the degree. More information about the Degree Progress Report can be found here:

[http://registrar.calpoly.edu/content/Degree\\_Progress/degree\\_progress](http://registrar.calpoly.edu/content/Degree_Progress/degree_progress) .

While every effort is made to complete the evaluation according to the timelines outlined above, it is important that new transfer students review their previous college work in terms of the degree requirements outlined in the catalog in order to make a tentative selection of courses for their first quarter of enrollment. Students should consult a faculty advisor in their major department or the appropriate Advising Center for assistance in the selection of courses. They should also use the "By Major" agreements on [www.assist.org](http://www.assist.org) (<http://www.assist.org>) for assistance with work from California community colleges.

Some major/support courses may need to be petitioned through the student's major department if articulation agreements are not in place in ASSIST, or if classes were taken at a private institution, a UC, or an out-of-state school.

Note: Transfer students with Advanced Placement credit must have their scores sent to Cal Poly directly from the College Board; notation of AP exams on a college transcript is not sufficient for Cal Poly to award credit. It is recommended that students do this as soon as possible, in order for the transfer evaluation to be complete and accurate, and in order to satisfy registration prerequisites.

Semester units transferred to Cal Poly are converted to quarter units by multiplying the semester units by one and one-half; a three-unit semester class will equate to 4.5 Cal Poly units. If the Cal Poly requirement is 4 units, the excess 0.5 unit will count toward free electives.

The evaluation remains valid provided that the student matriculates for the term specified, pursues the objective declared, and remains in continuous attendance.

While students may follow the specific academic program requirements for the catalog year on which their initial evaluation of transfer credit is based, they are responsible for complying with any and all changes in other regulations, policies, and procedures, which may appear in subsequent catalogs, or which are communicated to them via email from the Office of the Registrar. These include CSU-mandated changes and changes approved by Cal Poly's Academic Senate and/or administration.

## Credit for Community College Courses

Course credit earned at regionally accredited community colleges is evaluated by the Evaluations Unit in accordance with the following provisions:

- Community college credit is allowed up to a maximum of 105 quarter units (70 semester units) toward overall units for the degree. Credits earned above this allowable maximum may still be used to satisfy subject and grade point requirements, but may not be applied toward the total units required for graduation (Example: a student in a 180-unit program, who has 110 quarter units of community college credit satisfying subject requirements, must still complete **75** units of non-community college work [not 70 units]).
- Upper division credit is never granted for community college work.
- The 105-unit limit does not apply to work from four-year institutions; however, specific course requirements, as well as Cal Poly residency requirements, must still be met, regardless of the number of units transferred from four-year institutions (see "Academic Residence Requirements" under "Minimum Requirements for Graduation."

Cal Poly maintains articulation agreements at [www.assist.org](http://www.assist.org) (<http://www.assist.org>) with all California Community Colleges (CCC), the California State University (CSU) and University of California (UC) campuses. The CCC campuses publish the CSU General Education (GE), the Intersegmental General Education Transfer Core (IGETC) course lists, and the lists of CSU transferable courses on the ASSIST website.

Transfer credit for GE courses is accepted from California institutions, as approved by the CSU Chancellor's office. The GE Area letters and numbers at Cal Poly (e.g., GE A1, D4) may be different from other colleges; see the flyer located on the Office of the Registrar's website for help in understanding these differences.

[http://content-calpoly-edu.s3.amazonaws.com/registrar/1/Degree\\_Progress/Assist\\_help.pdf](http://content-calpoly-edu.s3.amazonaws.com/registrar/1/Degree_Progress/Assist_help.pdf)

Note: GE certification, whereby transfer students can complete all lower-division GE at a CCC or CSU, does not exempt students from meeting the CSU requirement of 72 overall units of GE. Many Cal Poly programs require specific GE courses in the Major and/or Support; these courses must be met with articulated equivalencies. See the General Education (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) page for General Education requirements.

## Other Academic Credit

### Advanced Placement (AP) Credit

Cal Poly grants credit for AP exams successfully completed through the College Board AP program. AP scores may be requested from Educational Testing Service (ETS)/AP Programs and should be sent to Cal Poly electronically. *To request scores:* ETS/AP Program, PO Box 6671, Princeton, NJ 08541-6671 or 609.771.7300. Cal Poly cannot accept paper score reports which have been opened by the student. Notation of Advanced Placement on high school transcripts is not sufficient; official scores must be requested from ETS.

Exams passed with a score of 3 or higher result in nine (9) quarter units of credit, except where otherwise noted on the credit matrix. All credit is given on a credit/no credit basis; units do not calculate into the GPA. Credit may vary from year to year, as Cal Poly requirements and AP Exams change. AP credit matrices are available on the Office of the Registrar web-site:

[http://registrar.calpoly.edu/content/Degree\\_Progress/other\\_ac\\_credit](http://registrar.calpoly.edu/content/Degree_Progress/other_ac_credit)

Please refer to the matrix for the **specific** year the exam was taken; credit is always extended based on the year of the exam. To determine credit for combined exams, use the matrix for the year of the last exam taken.

### International Baccalaureate (IB) Exam Credit

The International Baccalaureate Diploma shall be considered in lieu of a high school diploma for admission to the University.

The International Baccalaureate **transcript** is required to receive University credit. IB transcripts may be requested from IB North America by email: [transcripts.ibna@ibo.org](mailto:transcripts.ibna@ibo.org), or by phone: (212) 696-4464.

Credit is awarded for classes at the **Higher** level. No credit is extended for Standard level exams.



All credit is given on a credit/no credit basis; units do not calculate into the GPA.

For each Higher Level exam score of 5 or higher, a maximum of 8 units of credit is awarded.

IB credit matrices are available on the Office of the Registrar website: [http://registrar.calpoly.edu/content/Degree\\_Progress/other\\_ac\\_credit](http://registrar.calpoly.edu/content/Degree_Progress/other_ac_credit). Please refer to the matrix for the **specific** year the exam was taken; credit is always extended based on the year of the exam.

## Credit for Non-collegiate Instruction

Cal Poly grants undergraduate degree credit for successful completion of non-collegiate instruction, either military or civilian, appropriate to the baccalaureate, which has been recommended by the Commission on Educational Credit and Credentials of the American Council on Education. The number of units allowed are those recommended in the Guide to the Evaluation of Educational Experience in the Armed Services and the National Guide to Educational Credit for Training Programs.

## Credit for Military Service

Nine quarter units of elective credit are allowed toward graduation to any student submitting evidence of satisfactory completion of basic training in the military service of the United States. Cal Poly requires the DD-214 form to extend credit. 4 units satisfy GE Area D4, and 5 units are elective credit. Credit is allowed in accordance with the recommendations by the Commission on Educational Credit and Credentials of the American Council on Education. The numbers of units allowed are those recommended in the *Guide to the Evaluation of Educational Experience in the Armed Services*. Credit is not given for college level General Educational Development Tests. No grade points are assigned in connection with units of credit allowed for military service. The units allowed are not included in scholarship computations.

## Credit by Examination

Cal Poly grants credit to those students who pass examinations that have been approved for credit systemwide. These include some College Level Examination Program (CLEP) examinations.

CLEP tests acceptable for credit are:

- College Algebra-Trigonometry with a passing score of 50;
- Pre-Calculus with a passing score of 50;
- General Chemistry with a passing score of 50;
- Calculus with Elementary Functions with a passing score of 51.

4.5 quarter units of credit may be earned with an assigned grade of credit (CR), which is not included in the GPA calculation.

Credit for CLEP and other externally developed examinations is *not* awarded if any of the following apply:

- examination previously taken within the past year;
- equivalent degree credit or duplicate credit has already been granted;
- credit has been granted for previous coursework or for a previously completed more advanced or higher level examination.

## Challenging Cal Poly Courses

A student may challenge a course in which he or she is qualified through previous education by taking an examination developed at the campus. Credit shall be awarded to those who pass them successfully. A student may not petition for credit by examination if the student

has ever been enrolled in the course. Credit shall not be awarded when credit has been granted at a level more advanced than that represented by the course.

The credit by examination option is only available to regular Cal Poly students during a term in which they are officially enrolled. The graded credit by examination petition must be received by the Office of the Registrar prior to the beginning of the term after which credit is to be granted. A fee is charged for such an exam.

The examination may include written, oral, or skills tests, or a combination of all three types, and is sufficiently comprehensive to determine that the student has essentially the same knowledge and skills as those students who successfully complete the course. The grade received is entered on the student's permanent record. The grade may not be Credit/No Credit (CR/NC), except for courses which have CR/NC grading only. The length of the examination is consistent with the unit value of the course.

Arrangements to obtain course credit by exam may be made with the head of the department in which the course is taught. Units of credit received through this procedure do not apply toward the residence requirements or the Cal Poly GPA for any of the degrees or credentials offered by the University. Detailed instruction for applying for credit by examination may be obtained from the Office of the Registrar.

# General Requirements – Bachelor's Degree

## General Graduation Requirements

There are eight general requirements which all students must meet in order to earn the bachelor's degree from Cal Poly and participate in commencement. The more students understand their progress toward meeting these requirements and relate them to the many programs available, the better the chance of creating an exciting educational experience and avoiding errors which may delay graduation.

*Students must be formally admitted to the major in which they wish to graduate, and must matriculate, in order to earn a degree.*

The specific requirements for each degree program are shown under the academic department offering the major and include a curriculum display with courses listed by Major, Support, General Education, and Electives. Each major has a degree flow chart, which shows the recommended sequence of courses leading to the degree; see the "Degree Flowcharts" link at the top of this page.

Students are responsible for meeting all requirements. Advice is available from faculty advisors, college advising centers, the Office of the Registrar, and students' online Degree Progress Reports. Students should plan their degree programs carefully and review them frequently with their advisors. Students are strongly encouraged to access their Degree Progress Report after registering each quarter, to verify that courses in which they enrolled are fulfilling requirements as expected. They are also encouraged to address any unanticipated deficiencies in the information shown on their Degree Progress Report, while realizing that recently received substitutions, transfer credit, etc., may not yet be reflected in the Degree Progress Report.

## Minimum Requirements for Graduation

### 1. Minimum Number of Units

Baccalaureate degree programs ..... Minimum 180 units



Individual baccalaureate degree programs may require more than 180 units. (Title 5, Sections 40500, 40501, 40505, 40507) A minimum of 60 units overall must be upper division (defined as any course completed by the student at the 300- or 400-level; this could include transfer work completed at the upper-division level at the transfer institution).

Degree	Minimum # of major units at 300-400 level
Bachelor of Arts (BA)	18
Bachelor of Science (BS)	27
Bachelor of Fine Arts (BFA)	27
Bachelor of Architecture (BArch)	41
Bachelor of Landscape Architecture (BLA)	41

## 2. Grade Point Average (GPA)

Students must earn at least a 2.0 GPA in: 1) all Higher Education units earned (all college-level work), 2) Cal Poly cumulative units earned, and 3) the major (the courses listed as major courses in the curriculum display). For a definition of GPA and quality points and hours, please refer to the Grading section of this catalog.

## 3. U. S. Cultural Pluralism (USCP) Requirement

Students must complete the USCP requirement. See the separate section on USCP.

## 4. General Education (GE) Courses

Students must complete the GE requirements as indicated in the degree program and shown in the GE section of this catalog. A CSU-mandated minimum of 72 units of GE overall must be completed.

## 5. Graduation Writing Requirement (GWR)

Students must demonstrate competency in writing skills as described below.

## 6. Senior Project

A senior project is required for all Cal Poly students as described below.

## 7. Academic Residence Requirements

The minimum requirements for units taken in residence at Cal Poly are:

- 50 quarter units
- 36 of the 50 units in residence must be upper division
- 18 of the 36 upper division units in residence must be in the major
- 12 units of General Education
- 30 units in residence of the last 40 units counted toward the degree

Extension credit or credit by examination may not be used to fulfill the residence requirements. However, a maximum of 36 quarter units of extension credit may be counted toward the bachelor's degree.

## 8. Evaluation for Graduation

Students should ideally request a graduation evaluation from the Office of the Registrar **four** quarters prior to their anticipated graduation date. The request serves three functions: it allows students to participate in the corresponding commencement ceremony (see Commencement section below); it alerts Evaluations to review the student's record for degree conferral after the final term of enrollment; and, if submitted four quarters prior, it affords the student an opportunity for a graduation

evaluation. This evaluation, which in most cases is completed using the Degree Progress Report, confirms remaining requirements for graduation and is a formal statement on the expected quarter of graduation. If a student does not receive a graduation evaluation, s/he can use the DPR to track progress-to-degree, in consultation with an advisor.

Students are encouraged to submit any and all paperwork (substitutions, transcripts for requirements completed elsewhere, etc.) in a timely fashion in order to expedite conferral of degrees.

If a student breaks enrollment prior to completion of degree requirements, she or he may be required to re-enroll and may be held to catalog requirements in effect at that time.

# Commencement and Final Degree Conferral

For a student to participate in graduation ceremonies, the student must satisfy *at least one* of the following:

- shall have completed all degree requirements and not have participated in a graduation ceremony previously;
- shall currently be enrolled in classes that would complete all of that student's degree requirements;
- shall be registered for classes for the following term that would allow the student to complete all of her/his degree requirements.

Commencement ceremonies are coordinated by the Office of the Vice President for Student Affairs, in collaboration with the University's Commencement Committee, and are held twice annually in June and December. The Commencement Office is located in the Student Services Building (124), Room 210. See [www.commencement.calpoly.edu](http://www.commencement.calpoly.edu).

Students completing all degree requirements in the Winter, Spring or Summer term, who have indicated as such by filing a graduation evaluation request for one of these terms, are automatically eligible to participate in the Spring (June) Commencement. Students completing all degree requirements in the Fall term are eligible for Fall (December) Commencement.

The actual date of graduation is the end of the quarter in which all requirements have been met; this date may differ from the student's last quarter of enrollment (an example is a student who completes the Graduation Requirement (GWR) after the last term of enrollment).

Graduating students receive one complimentary diploma. Additional diplomas may be ordered through El Corral Bookstore. The diploma is not ordered until all degree requirements have been completed. The diploma is mailed to the student's mailing address approximately five to six weeks after the degree has been conferred by the Evaluations Unit in the Office of the Registrar. It is the student's responsibility to update her/his mailing address on her/his [my.calpoly.edu](http://my.calpoly.edu) portal.

Concentrations and minors are not noted on the diploma; they are, however, noted on the transcript.

Once a degree has been awarded, subsequent revision and alteration of any transcript entry is permitted only for correction of proven error as certified by the appropriate academic dean and the Registrar. No changes are made to the academic record after 60 days following the awarding of the degree.

## Graduation Writing Requirement (GWR)

All students must demonstrate competency in writing skills as a requirement for graduation. Information on currently available ways to meet this graduation requirement may be obtained from the Writing & Rhetoric Center Office, Agriculture Building (10) Room 130 (805-756-2067), or on the Writing & Rhetoric Center webpage, [www.writingcenter.calpoly.edu](http://www.writingcenter.calpoly.edu).

The Board of Trustees of the California State University has mandated that all students earning undergraduate or graduate degrees in the CSU must be certified as proficient in writing at the upper-division level.

Students must earn proficiency after reaching 90 units and are strongly encouraged to attempt the GWR before their final quarter of enrollment. Students should review their program requirements to determine which option is appropriate. The GWR, if taken at another CSU campus, may be approved if the student is pursuing a Cal Poly degree.

At Cal Poly, students may meet the Graduation Writing Requirement (GWR) through one of the following options:

1. Pass the Writing Proficiency Exam.
2. Pass an approved upper-division course with a grade of C or better (**C- or below does not qualify**) AND receive certification of proficiency in writing based on a 500-word in-class essay. The course may be taken on a credit/no credit basis, but the student must earn a minimum grade of C in order to satisfy the GWR component of the class.

The following courses are approved for GWR credit:

### Non-GE writing courses:

ENGL 301	Advanced Composition - ESL
ENGL 302	Writing: Advanced Composition
ENGL 310	Corporate Communication
ENGL 317	Technical Editing
ENGL 326	Literary Criticism

### GE C4 literature courses:

ENGL 330	British Literature in the Age of Belief: to 1485
ENGL 331	British Literature in the Age of Discovery: 1485-1660
ENGL 332	British Literature in the Age of Enlightenment: 1660-1798
ENGL 333	British Literature in the Age of Romanticism: 1798-1832
ENGL 334	British Literature in the Age of Industrialism: 1832-1914
ENGL 335	British Literature in the Age of Modernism: 1914-Present
ENGL 339	Introduction to Shakespeare
ENGL 340	The Literary Sources of the American Character: 1600-1865
ENGL 341	The Literary Sources of the American Character: 1865-1914
ENGL 342	The Literary Sources of the American Character: 1914-1956
ENGL 343	Multiple Voices of Contemporary American Literature
ENGL 345	Women Writers of the Twentieth Century

ENGL 346	Ethnic American Literature
ENGL 347	African American Literature
ENGL 349	Gender in Twentieth Century Literature
ENGL 350	The Modern Novel
ENGL 351	Modern Poetry
ENGL 352	Modern Drama
ENGL 354	The Bible as Literature and in Literature and the Arts
ENGL 370	World Cinema
ENGL 371	Film Styles and Genres
ENGL 372	Film Directors
ENGL 380	Literary Themes
ENGL 381	Diversity in Twentieth-Century American Literature
ENGL 382	LGBT Literature and Media

## Senior Project

**Definition:** The senior project is a capstone experience required for all Cal Poly students receiving a baccalaureate degree. It integrates theory and application from across the student's undergraduate educational experiences. The senior project consists of one or more of the following:

1. a design or construction experience,
2. an experiment,
3. a self-guided study or research project,
4. a presentation,
5. a report based on internship, co-op, or service learning experience,
6. a public portfolio display or performance.

Where the senior project does not consist primarily of a written document, departments may, where they deem appropriate, require some written documentation (length to be determined by the department) to accompany the senior project. The precise nature or form of a senior project is to be determined by the department or program of the student's major. The senior project is normally related to the student's field of study, future employment, and/or scholastic goals, and is carried out under direct faculty supervision.

## Expected Outcomes

At the discretion of the major department, students are expected to demonstrate some or all of the following abilities:

- Reduce a topic to specific points of analysis.
- Organize the points of analysis into a logical sequence.
- Apply acquired competencies to the successful completion of a project.
- Obtain, evaluate, synthesize, and apply project-related information.
- Develop and follow a project plan.
- Estimate hours of labor and/or cost of materials necessary to complete a project.
- Organize, illustrate, and write clear and concise project documentation.
- Accept supervision when needed.

## Requirements

1. The total number of senior project units must be 1 to 6 quarter units.
2. Normally 30 hours of student work is required for each unit of credit granted.
3. Projects requiring an excessive amount of time are discouraged.
4. The number of students participating in a group senior project should not be so large as to unduly limit individual experience or responsibility and initiative.
5. The student is responsible for identifying costs and potential funding sources for his or her senior project prior to initiation of the project. Costly projects are discouraged.
6. It is the student's responsibility to become informed about the university's intellectual properties policy and human subject policy (where applicable).

## Library Copy

Senior projects created by Cal Poly students are submitted to Kennedy Library and become part of the library's collection. For more information and details on the process, please see the Library page on depositing senior projects. (<http://lib.calpoly.edu/seniorprojects>)

## General Education Mission Statement

### *Strengthening intellectual, creative and professional lives*

The General Education Program is one of the primary sites for realizing Cal Poly's vision of a comprehensive polytechnic education. The program promotes an understanding and appreciation of the foundational disciplines that ground all intellectual inquiry. It enriches the specialized knowledge acquired in a major program with an understanding of its scientific, humanistic, artistic, and technological contexts. The program imparts knowledge and transferable skills, fosters critical thinking and ethical decision making, supports integrative learning, and prepares students for civic engagement and leadership.

## California State University (CSU) General Education Breadth Requirements

Consistent with CSU Executive Order 1065, Cal Poly's General Education Program has been designed to complement the major program and electives completed by each baccalaureate candidate, to assure that graduates have made noteworthy progress toward being truly educated persons. These requirements are designed to provide the knowledge, skills, experiences, and perspectives that will enable CSU students to expand their capacities to take part in a wide range of human interests and activities; to confront personal, cultural, moral, and social problems that are an inevitable part of human life; and to cultivate both the requisite skills and enthusiasm for lifelong learning. Faculty are encouraged to assist students in making connections among disciplines to achieve coherence in the undergraduate educational experience

Courses approved for GE Breadth should be responsive to the need for students to have developed knowledge of, or skills related to, quantitative reasoning, information literacy, intellectual inquiry, global awareness and understanding, human diversity, civic engagement, communication competence, ethical decision-making, environmental systems, technology, lifelong learning and self-development, and

physical and emotional health throughout a lifetime. Each CSU campus is required to define its GE student learning outcomes to fit within the framework of the four Essential Learning Outcomes drawn from the Liberal Education and America's Promise (LEAP (<http://www.aacu.org/leap>) ) campaign, an initiative of the Association of American Colleges and Universities:

## LEAP Essential Learning Outcomes Framework

1. Knowledge of Human Cultures and the Physical and Natural World
2. Intellectual and Practical Skills
3. Personal and Social Responsibility
4. Integrative Learning

Within the LEAP framework, Cal Poly has expanded its focused learning objectives that students should achieve through the General Education Program:

1. Aesthetic Appreciation/Creative Thinking
2. Critical Thinking
3. Integrative Learning
4. Physical-Psychological Health
5. Scientific, Mathematical Understanding, Problem Solving
6. Disciplinary Knowledge
7. Writing Proficiency
8. Cultural Diversity/Global Understanding
9. Oral Communication
10. Ethical Reasoning

## GE Course Substitutions

Students are expected to complete the GE courses published for their degree program. Cal Poly GE courses **must** be selected from the approved GE list. Substitutions are not permitted except in extraordinary circumstances. Students requesting exceptions must follow petition procedures, outlined on the GE web site (<http://www.ge.calpoly.edu>) . This process may take several weeks.

## GE Study Abroad

Students are strongly encouraged to submit a GE Study Abroad petition before going abroad in order to determine which courses will be granted GE credit. For assistance with GE Study Abroad petitions, contact the Cal Poly International Center office. (<http://international.calpoly.edu>)

## Transfer Credit

Transfer credit for GE courses is accepted from California institutions, as approved by the Chancellor's office. The GE Area letters and numbers at Cal Poly (e.g., GE A1, D4) may be different at other colleges. For more information, use the Need help figuring out assist flyer (PDF) ([http://records.calpoly.edu/Degree\\_Progress/Assist\\_help.pdf](http://records.calpoly.edu/Degree_Progress/Assist_help.pdf)) located on the Office of the Registrar's website. Some Cal Poly programs specify particular GE courses for Major or Support; these courses must be met with articulated equivalencies. Refer to [www.Assist.org](http://www.Assist.org) (<http://www.assist.org>) for California Community College both CSU GE lists and specific articulation agreements.

## General Education (GE) Requirements

- All Cal Poly students are required to take 72 quarter units of General Education.
- A minimum of 12 units is required in residence.
- A minimum of 12 units is required at the upper-division level (8 units upper-division for Engineering Programs).
- Double Counting Lower-Division: Some majors indicate specific GE courses to fulfill both GE and major & support requirements (These are listed in the major's curriculum display). Students should consult their academic advisors during freshman year for clarification.
- Double Counting Upper-Division: Courses from a student's Major department **may not** be used to fulfill upper-division Arts & Humanities (C4) or upper-division Society and the Individual (D5).
- All GE courses are 4 units unless otherwise indicated.
- X** = non-unit requirement

## Abbreviations in Table Below

- CAED** = College of Architecture & Environmental Design (except ARCE majors)
- CAFES** = College of Agriculture, Food, & Environmental Sciences (except BRAE majors)
- CLA** = College of Liberal Arts
- CSM** = College of Science & Mathematics (except LS majors)
- ENGR** = Majors in: College of Engineering (CENG), BioResource Engineering (BRAE) and Architectural Engineering (ARCE)
- LS** = Liberal Studies Majors
- LAES** = Liberal Arts & Engineering Studies Majors
- OCOB** = Orfalea College of Business

## GE FOUNDATIONAL LEARNING (Lower-Division Requirements)

### *Intellectual and Practical Skills, Knowledge of Human Cultures, and Personal and Social Responsibility*

Students are encouraged to complete GE Communication (Area A) classes during their freshman year. The three-course Communication sequence provides instruction and practice in the kinds of skills in writing, speaking, and critical thinking that students will need in their later courses. Completion of this sequence is a prerequisite for many other GE classes. Students are also encouraged to complete their lower-division foundational GE classes in Science and Mathematics (Area B), Arts and Humanities (Area C), and Society and the Individual (Area D) by the end of their sophomore year to give them the skills and knowledge to succeed in all their upper-division classes

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
COMMUNICATION (AREA A)				
Expository Writing (A1-Writing Intensive)	4		4	4
Oral Communication (A2)	4		4	4
Reasoning, Argumentation, Writing (A3-Writing Intensive)	4		4	4

Communication Unit Sub-total 12 12 12

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
SCIENCE AND MATHEMATICS (AREA B)				
Mathematics/Statistics (B1)	8		8	8
Life Science (B2)	4		4	4
Physical Science (B3)	4		4	4
Lab taken with either Life Science or Physical Science (B4)	X		X	X
Science and Mathematics Elective (B1-B5)	4			
Upper-Division Science and Mathematics (B6)				4
Designated Science and Mathematics Courses				8
Science and Mathematics Unit Sub-total	20		16	28

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
ARTS AND HUMANITIES (AREA C)				
Literature (C1-Writing Intensive)	4		4	4
Philosophy (C2-Writing Intensive)	4		4	4
Fine and Performing Arts (C3)	4		4	4
Upper-Division Elective (C4)	4		4	4
Arts and Humanities Elective (C1-C5)			4	
Arts and Humanities Unit Sub-total	16		20	16

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
SOCIETY AND THE INDIVIDUAL (AREA D)				
The American Experience (D1-40404)	4		4	4
Political Economy (D2)	4		4	4
Comparative Social Institutions (D3)	4		4	4
Self Development (D4; CSU Area E)	4		4	4
Society and the Individual Unit Sub-total	16		16	16

## GE INTEGRATED AND APPLIED LEARNING (Upper-Division Requirements)

### *Synthesis and advanced inquiry across disciplines*

Most majors are required to take an one upper-division Arts and Humanities (C4) course, one upper-division Society and the Individual (D5) course and and one upper-division Technology (F) course. (Note: ENGR follows a slightly different pattern in upper-division.) These GE courses are integrative in nature and require students to apply knowledge and understanding acquired in lower-division courses. Courses in these areas achieve depth in an advanced study of a subject to new but related areas of inquiry.

	CLA LS	LAES	CAED CAFES CSM OCOB	ENGR
UPPER-DIVISION				
Arts and Humanities (C4-Writing Intensive)	4		4	4
Society and the Individual (D5-Writing Intensive)	4		4	
Technology (Area F)	4		4	
Upper-division courses unit sub-total	12		12	4
GE TOTAL	72 units		72 units	72 units

## General Education Courses

### COMMUNICATION (AREA A)

	CLA LS	LAES	CAED CAFES CSM OCOB	ENGR
COMMUNICATION (AREA A)				
Expository Writing (A1)	4		4	4
ENGL 133	Writing & Rhetoric for English as a Second Language Students			
ENGL 134	Writing and Rhetoric			

	CLA LS	LAES	CAED CAFES CSM OCOB	ENGR
Oral Communication (A2)	4		4	4

COMS 101 Public Speaking

COMS 102 Principles of Oral Communication

HNRS 101 Public Speaking

	CLA LS	LAES	CAED CAFES CSM OCOB	ENGR
Reasoning, Argumentation, and Writing (A3)	4		4	4
COMS 126	Argument and Advocacy			
COMS 145	Reasoning, Argumentation, and Writing			

ENGL 145	Reasoning, Argumentation, and Writing
ENGL 148	Reasoning, Argumentation and Professional Writing
ENGL 149	Technical Writing for Engineers
HNRS 145	Reasoning, Argumentation, and Writing
HNRS 148	Reasoning, Argumentation and Professional Writing
HNRS 149	Technical Writing for Engineers
PHIL 126	Logic and Argumentative Writing

### SCIENCE AND MATHEMATICS (AREA B)

	CLA LS	LAES	CAED CAFES CSM OCOB	ENGR
SCIENCE & MATHEMATICS (AREA B)	20		16	28
Mathematics / Statistics (B1)	8		8	8

HNRS 141	Calculus I
HNRS 142	Calculus II
HNRS 143	Calculus III
MATH 112	Nature of Modern Math
MATH 117	Precalculus Algebra II
MATH 118	Precalculus Algebra
MATH 119	Precalculus Trigonometry
MATH 141	Calculus I
MATH 142	Calculus II
MATH 143	Calculus III
MATH 161	Calculus for the Life Sciences I
MATH 162	Calculus for the Life Sciences II
MATH 182	Calculus for Architecture and Construction Management
MATH 221	Calculus for Business and Economics
MATH 227	Mathematics for Elementary Teaching I
STAT 130	Statistical Reasoning
STAT 217	Introduction to Statistical Concepts and Methods
STAT 218	Applied Statistics for the Life Sciences
STAT 251	Statistical Inference for Management I
STAT 252	Statistical Inference for Management II (5)
STAT 313	Applied Experimental Design and Regression Models

	CLA LS	LAES	CAED CAFES CSM OCOB	ENGR
Life Science (B2) (B2&4=lab course)	4		4	4
ANT 250	Biological Anthropology			
ASCI 112	Principles of Animal Science			
BIO 111	General Biology (B2 & B4)			
BIO 114	Plant Diversity and Ecology (B2 & B4)			
BIO 123	Biology of Sex			



BIO 161	Introduction to Cell and Molecular Biology (B2 & B4)
BIO 227	Wildlife Conservation Biology
BOT 121	General Botany (B2 & B4)
MCRO 221	Microbiology (B2 & B4)
MCRO 224	General Microbiology I (B2 & B4) (5)
PPSC 110	People, Pests and Plagues (B2 & B4)
For Engineering students only; concurrent enrollment required:	
BIO 213	Life Science for Engineers
BRAE/ENGR 213	Bioengineering Fundamentals

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
Physical Science (B3) (B3&4=lab course)	4		4	4

ASTR 101	Introduction to the Solar System
ASTR 102	Introduction to the Stars and Galaxies
ASTR 112	Introduction to the Stars and Galaxies (B3 & B4)
CHEM 110	World of Chemistry (B3 & B4)
CHEM 111	Survey of Chemistry (B3 & B4)
CHEM 124	General Chemistry for the Engineering Disciplines I (B3 & B4)
CHEM 125	General Chemistry for the Engineering Disciplines II (B3 & B4)
CHEM 127	General Chemistry for Agriculture and Life Science I (B3 & B4)
GEOL 102	Introduction to Geology
GEOL 205	Earthquakes
HNRS 131	General Physics I (B3 & B4)
HNRS 132	General Physics II (B3 & B4)
HNRS 134	General Physics IA
PHYS 104	Introductory Physics
PHYS 107	Introduction to Meteorology
PHYS 111	Contemporary Physics for Nonscientists
PHYS 115	Physics of Sound and Music
PHYS 121	College Physics I
PHYS 122	College Physics II (B3 & B4)
PHYS 131	General Physics I (B3 & B4)
PHYS 132	General Physics II (B3 & B4)
PHYS 133	General Physics III (B3 & B4)
PHYS 141	General Physics IA
PSC 101	Matter and Energy (B3 & B4)

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
One lab B4 taken with B2 or B3 courses (B4)	X		X	X

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
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CLA, LS : LAES students 4 0 0  
select 1 course from B1-B4  
or B5

#### Area B5

CLA and LS students: Select one course from B1-B5.

BIO 112	Environmental Biology and Conservation
BIO 302	Human Genetics
BIO 305	Biology of Cancer
BOT 311	Plants, People and Civilization
FSN 210	Nutrition
GEOL 203	Fossils and the History of Life
HNRS 319	Natural Resource Ecology, Theories and Applications
LA 220	Landscape Ecology: Concepts, Issues and Interrelationships
MATH 326	Mathematics and Visual Arts
NR 319	Natural Resource Ecology, Theories and Applications
PSC 201	Physical Oceanography
PSY 340	Biopsychology
SS 121	Introductory Soil Science

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
Science and Mathematics Upper-Division Elective for ENGR only (B6)	0		0	4

CSC 341	Numerical Engineering Analysis
GEOL 305	Fundamentals of Seismology
MATH 304	Vector Analysis
MATH 344	Linear Analysis II
MATH 408	Complex Analysis I
PHYS 412 & PHYS 452	Solid State Physics and Solid State Physics Laboratory
PHYS 417	Nonlinear Dynamical Systems
STAT 312	Statistical Methods for Engineers
STAT 321	Probability and Statistics for Engineers and Scientists
STAT 350	Probability and Random Processes for Engineers

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
Additional Science and Mathematics for ENGR only	0		0	8

#### ARTS AND HUMANITIES (AREA C)

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
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ARTS AND HUMANITIES (AREA C)	16	20	16
Literature (C1)	4	4	4

ENGL 230	Masterworks of British Literature through the Eighteenth Century
ENGL 231	Masterworks of British Literature from the Late 18th Century to the Present
ENGL 240	The American Tradition in Literature
ENGL 251	Great Books I: Introduction to Classical Literature
ENGL 252	Great Books II: Medieval to Enlightenment Literature
ENGL 253	Great Books III: Romanticism to Modernism Literature
FR 233	Critical Reading in French Literature
GER 233	Critical Reading in German Literature
HNRS 232	Masterworks of British Literature from the Late 18th Century to the Present
HNRS 251	Great Books I: Introduction to Classical Literature
SPAN 233	Introduction to Hispanic Readings

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
Philosophy (C2)	4		4	4

HNRS 230	Philosophical Classics: Knowledge and Reality
HNRS 231	Philosophical Classics: Ethics and Political Philosophy
PHIL 230	Philosophical Classics: Knowledge and Reality
PHIL 231	Philosophical Classics: Ethics and Political Philosophy

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
Fine and Performing Arts (C3)	4		4	4

ARCE 260	History of Structures
ARCH 217	History of World Architecture: Prehistory - Middle Ages
ARCH 218	History of World Architecture: Middle Ages - 18th Century
ARCH 219	History of World Architecture: 18th Century - Present
ART 101	The Fundamentals of Drawing
ART 111	Introduction to Art
ART 112	Survey of Western Art
ART 122	Basic Digital Photography
ART 148	Beginning Sculpture
COMS 208	Performance of Literature
DANC 221	Dance Appreciation
LA 211	History of Landscape Architecture: Ancient Civilizations through Colonial America

LA 212	History of Modern and Contemporary Landscape Architecture
MU 101	Introduction to Music Theory
MU 120	Music Appreciation
MU 221	Jazz Styles (USCP)
MU 227	Popular Music of the USA (USCP)
MU 229	Music of the 60's: War and Peace (USCP)
TH 210	Introduction to Theatre
TH 227	Theatre History I
TH 228	Theatre History II

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
Arts and Humanities Upper- Division Elective (C4)	4		4	4

Courses from student's Major Dept do not receive C4 credit

ARCH 320	Topics in Architectural History
ARCH 326	Native American Architecture and Place (USCP)
ART 311	Art History - Nineteenth Century Art
ART 314	History of Photography
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements
ART 370	Michelangelo
ART 371	Topics in Renaissance Art
COMS 308	Group Performance of Literature
DANC 311	Dance in American Musical Theatre
DANC 321	Cultural Influence on Dance in America (USCP)
ENGL 330	British Literature in the Age of Belief: to 1485
ENGL 331	British Literature in the Age of Discovery: 1485-1660
ENGL 332	British Literature in the Age of Enlightenment: 1660-1798
ENGL 333	British Literature in the Age of Romanticism: 1798-1832
ENGL 334	British Literature in the Age of Industrialism: 1832-1914
ENGL 335	British Literature in the Age of Modernism: 1914-Present
ENGL 338	Introduction to Shakespeare-London Study
ENGL 339	Introduction to Shakespeare
ENGL 340	The Literary Sources of the American Character: 1600-1865
ENGL 341	The Literary Sources of the American Character: 1865-1914
ENGL 342	The Literary Sources of the American Character: 1914-1956
ENGL 343	Multiple Voices of Contemporary American Literature
ENGL 345	Women Writers of the Twentieth Century (USCP)
ENGL 346	Ethnic American Literature (USCP)
ENGL 347	African American Literature (USCP)
ENGL 349	Gender in Twentieth Century Literature (USCP)
ENGL 350	The Modern Novel

ENGL 351	Modern Poetry	PHIL 332	History of Ethics
ENGL 352	Modern Drama	PHIL 333	Political Philosophy
ENGL 353	Drama in London	PHIL 334	Philosophy of Law
ENGL 354	The Bible as Literature and in Literature and the Arts	PHIL 335	Social Ethics (USCP)
ENGL 370	World Cinema	PHIL 336	Feminist Ethics, Gender and Society (USCP)
ENGL 371	Film Styles and Genres	PHIL 337	Business Ethics
ENGL 372	Film Directors	PHIL 339	Biomedical Ethics
ENGL 380	Literary Themes	PHIL 340	Environmental Ethics
ENGL 381	Diversity in Twentieth-Century American Literature (USCP)	PHIL 341	Professional Ethics
ENGL 382	LGBT Literature and Media (USCP)	PHIL 342	Philosophy of Religion
ENGL 386	Creative Nonfiction	PHIL 350	Aesthetics
ENGL 387	Fiction Writing	RELS 301	Religions of Asia
ENGL 388	Poetry Writing	RELS 302	Monotheisms: Judaism, Christianity, and Islam
ES 300	Chicano/a Non-Fiction Literature (USCP)	RELS 304	Judaism
ES 326	Native American Architecture and Place (USCP)	RELS 306	Hinduism
ES 340	Cultural Production and Ethnicity	RELS 307	Buddhism
ES 360	Ethnicity and the Land (USCP)	RELS 310	Christianity
FR 305	Significant Works in French	RELS 311	Islam
FR 350	French Literature in English Translation	RELS 370	Religion, Gender, and Society (USCP)
GER 305	Significant Works in German	RELS 372	Spiritual Extremism: Asceticism, Mysticism, and Madness
GER 350	German Literature in English Translation	RELS 374	Religion and Violence
HNRS 304	Values and Technology	RELS 378	Religion and Contemporary Values
HNRS 320	Values, Media, and Culture	SPAN 305	Significant Works in Spanish
HNRS 332	British Literature in the Age of Enlightenment: 1660-1798	SPAN 307	Spanish and Latin American Film
HNRS 333	British Literature in the Age of Romanticism: 1798-1832	SPAN 340	Chicano/a Authors (USCP)
HNRS 342	The Literary Sources of the American Character: 1914-1956	SPAN 350	Hispanic Literature in English Translation
HNRS 343	Multiple Voices of Contemporary American Literature	SPAN 351	Chicano/Latino Writers in the United States (USCP)
HNRS 380	Literary Themes	TH 310	Women's Theatre (USCP)
HUM 303	Values and Technology	TH 320	Black Theatre (USCP)
HUM 310	Humanities in World Cultures	TH 360	Theatre in the United States
HUM 312	Humanities in Chicano/a Culture (USCP)	TH 390	Global Theatre and Performance
HUM 320	Values, Media, and Culture	UNIV 361	Modernism
HUM 361	Modernism	WGS 370	Religion, Gender, and Society (USCP)
MU 324	Music and Society (USCP)		
MU 328	Women in Music		
NR 360	Ethnicity and the Land (USCP)		
PHIL 311	Greek Philosophy		
PHIL 312	Medieval Philosophy		
PHIL 313	Early Modern Rationalism		
PHIL 314	Early Modern Empiricism		
PHIL 315	Kant and 19th Century European Philosophy		
PHIL 316	20th Century European Philosophy		
PHIL 317	History of Analytic Philosophy		
PHIL 320	Asian Philosophy		
PHIL 321	Philosophy of Science		
PHIL 322	Philosophy of Technology		
PHIL 331	Ethics		

**CAED, CAFES, CSM and OCOB students: Select any course from C1 - C5**

	CLA LAES LS	CAED CAFES CSM OCOB	ENGR
Arts and Humanities Elective (C5)	0	4	0

**Area C5 Courses**

CHIN 201	Intermediate Mandarin Chinese I
CHIN 202	Intermediate Mandarin Chinese II
CHIN 203	Intermediate Mandarin Chinese III
FR 201	Intermediate French I
FR 202	Intermediate French II
FR 203	Intermediate French III
GER 201	Intermediate German I
GER 202	Intermediate German II
GER 203	Intermediate German III

ITAL 201	Intermediate Italian I
JPNS 201	Intermediate Japanese I
SPAN 201	Intermediate Spanish I
SPAN 202	Intermediate Spanish II
SPAN 203	Intermediate Spanish III

**SOCIETY & THE INDIVIDUAL (AREA D/E)**

	CLA LS	LAES LS	CAED CAFES OCOB	ENGR CSM
SOCIETY AND THE INDIVIDUAL	20		20	16
The American Experience (40404) (D1)	4		4	4

ES 112	Race, Culture and Politics in the United States (USCP)
HIST 201	United States History to 1865 (USCP)
HIST 202	United States History Since 1865 (USCP)
HIST 206	American Cultures (USCP)
HIST 207	Freedom and Equality in American History (USCP)
HNRS 112	Race, Culture and Politics in the United States (USCP)
HNRS 207	Freedom and Equality in American History (USCP)
POLS 112	American and California Government
WGS 201	Introduction to Women's and Gender Studies in the United States (USCP)

	CLA LS	LAES LS	CAED CAFES OCOB	ENGR CSM
Political Economy (D2)	4		4	4

ECON 201	Survey of Economics
ECON 222	Macroeconomics
HIST 213	Modern Political Economy
HIST 214	Political Economy of Latin America and the Middle East
HNRS 201	Survey of Economics
HNRS 213	Modern Political Economy
SOC 218	International Political Economy

	CLA LS	LAES LS	CAED CAFES OCOB	ENGR CSM
Comparative Social Institutions (D3)	4		4	4

ANT 201	Cultural Anthropology
ANT 202	World Prehistory
ES 212	Global Origins of United States Cultures (USCP)
ES 241	Survey of Indigenous Studies (USCP)
ES 242	Survey of Africana Studies (USCP)
ES 243	Survey of Latino/a Studies (USCP)

ES 244	Survey of Asian American Studies (USCP)
GEOG 150	Introduction to Cultural Geography
HIST 210	World History I
HIST 216	Comparative Social Movements
HIST 221	World History, Beginnings to 1000
HIST 222	World History, 1000 - 1800
HNRS 212	Global Origins of United States Cultures (USCP)
HIST 223	World History, 1800 - Present
HNRS 216	Comparative Social Movements
HNRS 223	World History, 1800 - Present
RELS 201	Religion, Dialogue, and Society
SOC 110	Comparative Societies

	CLA LS	LAES LS	CAED CAFES OCOB	ENGR CSM
Self Development (D4, CSU Area E)	4		4	4

FSN 250	Food and Nutrition: Customs and Culture (USCP)
KINE 250	Healthy Living
KINE 255	Personal Health: A Multicultural Approach (USCP)
KINE 260	Women's Health Issues (USCP)
PSY 201	General Psychology
PSY 202	General Psychology

	CLA LS	LAES LS	CAED CAFES OCOB	ENGR CSM
Society and the Individual Upper-Division Elective (D5)	4		4	0

Courses from student's major do not receive D5 credit.

ANT 325	Pre-Columbian Mesoamerica
ANT 330	Indigenous South Americans
ANT 344	Sex, Death, and Human Nature
ANT 345	Human Behavioral Ecology
ANT 360	Human Cultural Adaptations
BUS 311	Managing Technology in the International Legal Environment
CRP 334	Cities in a Global World
ECON 303	Economics of Poverty, Discrimination and Immigration (USCP)
ECON 304	Comparative Economic Systems
ECON 322	Economic History of the Advanced World
ES 308	Fire and Society
ES 310	Hip-Hop, Poetics and Politics (USCP)
ES 320	African American Cultural Images (USCP)
ES 321	Native American Cultural Images (USCP)
ES 322	Asian American Cultural Images (USCP)
ES 323	Mexican American Cultural Images (USCP)
ES 330	The Chinese American Experience (USCP)

ES 335	The Filipina/o American Experience (USCP)
ES 351	Global Engineering: Gender, Race, Class, Nation
ES 380	Critical Race Theory (USCP)
ES 381	The Social Construction of Whiteness (USCP)
GEOG 300	Geography of United States
GEOG 301	Geography of Resource Utilization
GEOG 308	Global Geography
GEOG 370	Geography of Latin America
HIST 306	The Witch-Hunt in Europe, 1400-1800
HIST 307	European Thought 1800-2000
HIST 308	The Trans-Atlantic Slave Trade
HIST 309	Cultures of West Africa and the African Diaspora
HIST 310	East Asian Culture and Civilization
HIST 316	Modern East Asia
HIST 317	The Lure of the Sea
HIST 318	The City in the Modern World
HIST 319	Modern South and Southeast Asia
HIST 320	Colonial and Revolutionary America
HIST 321	Civil War America
HIST 322	Modern America
HIST 323	Versions of the Past: Novels, Comics and Movies
HIST 324	The Historical Novel in the United States, 1960s to the Present
HIST 334	Modern Europe, 1789-1914
HIST 335	Modern Europe, 1914-Present
HIST 336	Britain at War: The British, the Americans and the Struggle for Freedom, 1939-1945
HNRS 303	Economics of Poverty, Discrimination and Immigration
HIST 350	The Scientific Revolution, c. 1500-1800
HNRS 303	Economics of Poverty, Discrimination and Immigration (USCP)
HNRS 312	East Asian Culture and Civilization
HNRS 323	Modern America
HNRS 324	The Historical Novel in the United States, 1960s to the Present
HNRS 334	Modern Europe, 1789-1914
HNRS 340	Sexuality Studies
HNRS 391	Appropriate Technology for the World's People: Development
HUM 315	Critical Issues in Latin American Studies
HUM 316	London: From Roman Colony to World Capital
KINE 323	Sport and Gender (USCP)
KINE 324	Sports, Media and American Popular Culture (USCP)
NR 308	Fire and Society
NR 323	Human Dimensions in Natural Resources Management
POLS 325	Global Political Issues
POLS 338	Critical Issues in American Politics
POLS 339	Authoritarian and Democratic Rule
POLS 348	Early American Political Thought
POLS 349	Contemporary American Political Thought

PSY 311	Environmental Psychology
PSY 318	Psychology of Aging
PSY 352	Conflict Resolution: Violent and Nonviolent
RELS 344	Approaches to Religion and Spirituality
SOC 315	Global Race and Ethnic Relations
SOC 326	Sociology of the Life Cycle
SOC 377	Sociology of Religion
UNIV 391	Appropriate Technology for the World's People: Development
WGS 301	Contemporary Issues in Women's and Gender Studies (USCP)
WGS 320	Women in Global Perspective
WGS 340	Sexuality Studies
WGS 351	Global Engineering: Gender, Race, Class, Nation

**TECHNOLOGY UPPER-DIVISION ELECTIVE (AREA F)**

	CLA LS	LAES	CAED CAFES OCOB	ENGR CSM
TECHNOLOGY UPPER-DIVISION ELECTIVE (F)	4		4	0

AERO 310	Air and Space
AG 315	Organic Agriculture
AG 330	Cal Poly Land: Nature, Technology, and Society
AG 350	The Global Environment
AG 360	Holistic Management
ASTR 324	Longitude, Navigation, and Timekeeping
BIO 307	World Aquaculture: Applications, Methodologies and Trends
BOT 329	Plants, Food, and Biotechnology
BRAE 340	Irrigation Water Management
BRAE 348	Energy for a Sustainable Society
CHEM 349	Chemical and Biological Warfare
CM 317	Sustainability and the Built Environment
CRP 338	Digital Cities
CRP 339	Disaster-Resistant Sustainable Communities
CSC 302	Computers and Society
CSC 310	Computers for Poets
EDES 350	The Global Environment
ENGR 302	Transportation and Manufacturing in the Twenty-First Century
ENGR 350	The Global Environment
ENVE 324	Introduction to Air Pollution
ES 350	Gender, Race, Science and Technology (USCP)
FSN 319	Food Technology for the Consumer
GEOG 317	The World of Spatial Data and Geographic Information Technology
GRC 377	Web and Print Publishing
HCS 329	Plants, Food, and Biotechnology
HIST 354	History of Network Technology
HIST 359	Living in a Material World
HNRS 310	Air and Space
HNRS 311	Computers for Poets



HNRS 392	Appropriate Technology for the World's People: Design
HUM 302	Human Values in Agriculture
HUM 330	Cal Poly Land: Nature, Technology, and Society
HUM 350	The Global Environment
IME 320	Human Factors and Technology
IT 330	Packaging Fundamentals
IT 341	Packaging Polymers and Processing
LA 317	The World of Spatial Data and Geographic Information Technology
MATE 359	Living in a Material World
ME 320	Consumer Energy Guide
NR 312	Technology of Wildland Fire Management
NR 317	The World of Spatial Data and Geographic Information Technology
NR 321	Water Systems Technology, Issues and Impacts
POLS 333	World Food Systems
PSC 307	Nuclear Weapons in the Post-9/11 World
PSC 320	Energy, Society and the Environment
SCM 320	Technology in London
SCM 325	Genetic Engineering Technology
SCM 330	Ocean Discovery through Technology
SCM 335	Nuclear Science and Society
SCM 350	The Global Environment
UNIV 330	Cal Poly Land: Nature, Technology, and Society
UNIV 333	World Food Systems
UNIV 350	The Global Environment
UNIV 392	Appropriate Technology for the World's People: Design
WGS 350	Gender, Race, Science and Technology (USCP)

## United States Cultural Pluralism (USCP)

**United States Cultural Pluralism (USCP)** courses must focus on all of the following:

- One or more diverse groups (defined as specifically inclusive of, but not limited to, an individual's race/ ethnicity, sex/gender, socioeconomic status, cultural heritage, disability, and sexual orientation), whose contributions to contemporary American society have been impeded by cultural conflict or restricted opportunities, as stated in the Diversity Learning Objectives
- Contemporary social issues resulting from cultural conflict or restricted opportunities, including , but not limited to, problems associated with discrimination based on age, ethnicity, gender, nationality, abilities, religion, sexual orientation, socioeconomic status, or race
- Critical thinking skills used by students to approach these contemporary social issues in a sensitive, responsible manner; examine their own attitudes; and consider the diverse perspectives of others
- The contributions of people from diverse groups to contemporary American society

Students are required to complete *one* USCP course. This course also fulfills a requirement for Major, Support, General Education, or Free Elective category.

The following courses fulfill the United States Cultural Pluralism requirement. Consult the Schedule of Classes (PASS) or your academic advisor for an up-to-date list.

AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	4
ANT 415	Native American Cultures	4
ARCH 326	Native American Architecture and Place (C4) <sup>1</sup>	4
COMS 416	Intercultural Communication	4
CRP 215	Planning for and with Multiple Publics	4
DANC 321	Cultural Influence on Dance in America (C4) <sup>1</sup>	4
ECON 303	Economics of Poverty, Discrimination and Immigration (D5) <sup>1</sup>	4
ENGL 345	Women Writers of the Twentieth Century (C4) <sup>1</sup>	4
ENGL 346	Ethnic American Literature (C4) <sup>1</sup>	4
ENGL 347	African American Literature (C4) <sup>1</sup>	4
ENGL 349	Gender in Twentieth Century Literature (C4) <sup>1</sup>	4
ENGL 381	Diversity in Twentieth-Century American Literature (C4) <sup>1</sup>	4
ENGL 382	LGBT Literature and Media (C4) <sup>1</sup>	4
ES 112	Race, Culture and Politics in the United States (D1) <sup>1</sup>	4
ES 114	Race in American Culture	4
ES 212	Global Origins of United States Cultures (D3) <sup>1</sup>	4
ES 215	Planning for and with Multiple Publics	4
ES 241	Survey of Indigenous Studies (D3) <sup>1</sup>	4
ES 242	Survey of Africana Studies (D3) <sup>1</sup>	4
ES 243	Survey of Latino/a Studies (D3) <sup>1</sup>	4
ES 244	Survey of Asian American Studies (D3) <sup>1</sup>	4
ES 300	Chicano/a Non-Fiction Literature (C4) <sup>1</sup>	4
ES 310	Hip-Hop, Poetics and Politics (D5) <sup>1</sup>	4
ES 320	African American Cultural Images (D5) <sup>1</sup>	4
ES 321	Native American Cultural Images (D5) <sup>1</sup>	4
ES 322	Asian American Cultural Images (D5) <sup>1</sup>	4
ES 323	Mexican American Cultural Images (D5) <sup>1</sup>	4
ES 325	Sex and Gender in African American Communities	4
ES 326	Native American Architecture and Place (C4) <sup>1</sup>	4
ES 330	The Chinese American Experience (D5) <sup>1</sup>	4
ES 335	The Filipina/o American Experience (D5) <sup>1</sup>	4
ES 350	Gender, Race, Science and Technology (Area F) <sup>1</sup>	4
ES 360	Ethnicity and the Land (C4) <sup>1</sup>	4
ES 380	Critical Race Theory (D5)	4
ES 381	The Social Construction of Whiteness (D5) <sup>1</sup>	4
FSN 250	Food and Nutrition: Customs and Culture (D4) <sup>1</sup>	4
HIST 201	United States History to 1865 (D1) <sup>1</sup>	4
HIST 202	United States History Since 1865 (D1) <sup>1</sup>	4

HIST 206	American Cultures (D1) <sup>1</sup>	4	WGS 370	Religion, Gender, and Society (C4) <sup>1</sup>	4
HIST 207	Freedom and Equality in American History (D1) <sup>1</sup>	4	WGS 435	American Women's History from 1870	4
HIST 208	Survey of California History	4	WGS 450	Feminist Theory	4
HIST 406	African-American History from 1865	4	<sup>1</sup> Course also satisfies GE requirement		
HIST 435	American Women's History from 1870	4			
HNRS 112	Race, Culture and Politics in the United States (D1) <sup>1</sup>	4			
HNRS 207	Freedom and Equality in American History (D1) <sup>1</sup>	4			
HNRS 212	Global Origins of United States Cultures (D3) <sup>1</sup>	4			
HNRS 303	Economics of Poverty, Discrimination and Immigration (D3) <sup>1</sup>	4			
HUM 312	Humanities in Chicano/a Culture (C4) <sup>1</sup>	4			
JOUR 219	Multicultural Society and the Mass Media	4			
KINE 255	Personal Health: A Multicultural Approach (D4) <sup>1</sup>	4			
KINE 260	Women's Health Issues (D4) <sup>1</sup>	4			
KINE 323	Sport and Gender (D5) <sup>1</sup>	4			
KINE 324	Sports, Media and American Popular Culture (D5) <sup>1</sup>	4			
MU 221	Jazz Styles (C3) <sup>1</sup>	4			
MU 227	Popular Music of the USA (C3) <sup>1</sup>	4			
MU 229	Music of the 60's: War and Peace (C3) <sup>1</sup>	4			
MU 325	America's Music	4			
MU 328	Women in Music (C4) <sup>1</sup>	4			
NR 360	Ethnicity and the Land (C4) <sup>1</sup>	4			
PHIL 335	Social Ethics (C4) <sup>1</sup>	4			
PHIL 336	Feminist Ethics, Gender and Society (C4) <sup>1</sup>	4			
POLS 310	Politics of Ethnicity and Gender	4			
POLS 343	Civil Rights in America	4			
PSY 260	African American Psychology	4			
PSY 372	Multicultural Psychology	4			
PSY 475	The Social Psychology of Prejudice	4			
RELS 370	Religion, Gender, and Society (C4) <sup>1</sup>	4			
SOC 316	American Ethnic Minorities	4			
SPAN 111	Elementary Hispanic Language and Culture	4			
SPAN 206	Spanish for Heritage Speakers	4			
SPAN 340	Chicano/a Authors (C4) <sup>1</sup>	4			
SPAN 351	Chicano/Latino Writers in the United States (C4) <sup>1</sup>	4			
TH 300	Topics in Diversity on the American Stage	4			
TH 310	Women's Theatre (C4) <sup>1</sup>	4			
TH 320	Black Theatre (C4) <sup>1</sup>	4			
WGS 201	Introduction to Women's and Gender Studies in the United States (D1) <sup>1</sup>	4			
WGS 301	Contemporary Issues in Women's and Gender Studies (D5) <sup>1</sup>	4			
WGS 350	Gender, Race, Science and Technology (Area F) <sup>1</sup>	4			

## Choice of Catalog/Catalog Rights

Cal Poly issues a new catalog every one or two years, and the requirements for degree programs may change from one catalog to the next. Students have the right to choose the catalog they will use, as described in Section 40401 of Title 5 of the *California Code of Regulations*.

An undergraduate student remaining in attendance in regular sessions at any California State University campus, at any California community college, or any combination of California community colleges and campuses of the California State University, may for purposes of meeting graduation requirements, elect to meet the catalog requirements in effect at the campus from which the student will graduate either:

1. at the time the student began such attendance, or
2. at the time of entrance to the campus granting the degree, or
3. at the time of graduation, or
4. as allowed by campus policy: Cal Poly also allows students to elect the requirements of any catalog in effect during their regular attendance.

Campus authorities may authorize or require substitutions for discontinued courses. A campus may require a student changing his or her major or any minor field of study to complete the major or minor requirements in effect at the time of the change.

For purposes of this section, "attendance" means attendance in at least one semester or two quarters each university year. Absence due to an approved educational leave or for attendance at another accredited institution of higher learning shall not be considered an interruption in attendance, if the absence does not exceed two years.

## Choice of Catalog Older than 10 years for Returning Students

Returning students may request to complete their degrees on a catalog older than 10 years only if all remaining degree requirements at the time they left Cal Poly do not exceed 16 units. The decision to approve or disapprove a student's request is based on: (1) her/his willingness to commit to completing outstanding degree requirements within a specified timeframe, and (2) her/his ability to demonstrate, with written documentation, reasonable currency of knowledge and skills in her/his degree field to the satisfaction of the faculty in the applicable major, as certified by the department chair. Both the college dean and the Associate Vice Provost for Academic Programs must give approval.

Currency in the degree field may be demonstrated by additional coursework, in addition to the remaining degree requirements on the student's original catalog, and/or by relevant work experience, to be determined by the department chair. Because Cal Poly degrees are always granted for the term in which requirements are completed, additional requirements may vary, depending on the amount of time elapsed and on the major field, in order to reconcile the curriculum of an older catalog with current trends in the academic discipline.

The expiration of a catalog is determined by adding 10 years to the last term in which that catalog was in effect (e.g., the 2011-13 catalog will be "older than 10 years" after Spring Quarter 2023).

Students are not allowed to complete a degree that is no longer offered by the University.

Note: In addition to remaining degree requirements on the student's catalog, s/he may also be required to complete the GWR. Check with the Evaluations Unit in the Office of the Registrar.

## Grading

A grade may be changed for the purpose of correcting clerical or administrative error, or to correct an error in the calculation or recording of a grade. A change of grade shall not occur as a result of additional work performed or reexamination beyond the established course requirements.

**Earned Hours** are all hours for which credit was earned (excludes grades of F, WU, and NC).

**Quality Hours** carry grade point value (excludes CR and NC).

**Quality Points** are awarded for each course unit and are determined by multiplying course unit by the quality point value of the grade.

**Grade Point Average (GPA)** is determined by dividing Quality Points by Quality Hours.

**Higher Education GPA** is the grade point average of all college level work.

**Transcripts** are the official record of academic history. Once a degree has been awarded, subsequent revision and alteration of any transcript entry is permitted only for correction of proven error as certified by the appropriate academic dean and the Registrar. No changes are made to the academic record after 60 days following the awarding of the degree.

## Grading Symbols

### Academic Grading Symbols Earned

Symbol	Definition	Quality Points Earned
A	Superior Attainment of Course Objectives	4.0
A-	Superior Attainment of Course Objectives	3.7
B+	Good Attainment of Course Objectives	3.3
B	Good Attainment of Course Objectives	3.0
B-	Good Attainment of Course Objectives	2.7
C+	Acceptable Attainment of Course Objectives	2.3
C	Acceptable Attainment of Course Objectives	2.0
C*	Acceptable Attainment of Course Objectives	1.7
D+**	Poor Attainment of Course Objectives	1.3
D	Poor Attainment of Course Objectives	1.0
D-	Poor Attainment of Course Objectives	0.7
F	Non-Attainment of Course Objectives	0.0
CR	Credit	-
NC	No Credit	-

\* Certain sequenced courses may have a C– prerequisite for advancement.

\*\* If a grade of D+ or less is received in a course that is a prerequisite for another course, the student is encouraged to repeat the prerequisite course before attempting the next course in sequence.

## Credit/No Credit Grading

Some courses, as indicated in their catalog descriptions, are offered on a Credit/No Credit grading basis only. The following conditions apply when a student elects to take for Credit/No Credit grading those courses that are not designated by the University as being graded on an exclusive Credit/No Credit basis.

- Students desiring to elect a course on a Credit/No Credit grading basis must be currently enrolled in the course and must elect the Credit/No Credit grading option through the registration system. This request can be made through the 8<sup>th</sup> day of the quarter. Students may **not** change from one grading system to the other after the end of the 8<sup>th</sup> day of the term.
- Undergraduate students are given a grade of CR for accomplishment equivalent to a grade of C– or better. No credit (NC) is given for D+ or lower grades. Graduate students receive a grade of CR that is based on an evaluated grade of B– or higher and NC for assigned grades of C+ or lower. Instructors submit conventional letter grades to the Registrar's Office where they are converted to Credit/No Credit grades. **NOTE: Some post-baccalaureate programs penalize students for a grade of CR.**
- The applicant for a Credit/No Credit grade must have at least a 2.0 grade point average in cumulative Cal Poly work. This requirement is waived for first-time students.
- No more than two courses may be selected for Credit/ No Credit grading in any term.
- Units earned in courses for which the grade was CR count toward satisfaction of all degree requirements.
- Undergraduate students may elect a maximum of 16 units of Credit/No Credit grading. Up to 4 units of Credit/No Credit grading is allowed in major or support courses, if allowed by the student's major department (see the Degree Requirements and Curriculum for each major to determine if Credit/No Credit grading is allowed). Up to 4 units (or one course, if the course is a five-unit course, e.g., CHEM 111) of Credit/No Credit grading is allowed in General Education courses (those GE courses which are required for the bachelor's degree). The remainder can be taken as free electives. These unit maximums refer to the **selection** of credit/no credit grading, regardless whether a student earns a grade of CR or NC.
- Credit/No Credit grading is removed for courses not meeting the above guidelines; the grade is reversed to the letter grade assigned by the instructor. Students are strongly encouraged to verify, before enrolling, whether they are allowed to select Credit/ No Credit grading for a particular course or requirement.
- Non-matriculated students, including those in the Extension Program, Summer Session, and Workshops must meet the same requirements as matriculated students to elect courses on a Credit/No Credit grading basis. (The 2.0 GPA requirement is waived in the case of non-matriculated students having no previous coursework recorded at Cal Poly.)

## Administrative Grading Symbols

Symbol	Definition	Quality Points Earned
AU	Audit	-
I	Incomplete (authorized)	-
RD	Report Delayed	-
RP	Report in Progress	-
W	Withdrawn	-
WU	Withdrawal Unauthorized	0

### Audit

An auditor is a student who attends a course and receives no credit for the course. Enrollment as an auditor is subject to permission of the instructor. Enrollment in a course as an auditor shall be permitted only after students otherwise eligible to enroll on a credit basis have had an opportunity to do so.

Auditors are subject to the same fee structure as credit students, and regular class attendance is expected. Once enrolled as an auditor, a student may not change to credit status unless such a change is requested prior to the last day to add classes. Courses enrolled in with audit grades are not considered when determining enrollment status (for financial aid and other purposes).

An instructor is authorized to submit a change-of-grade form to change an AU to NC for students who audit a class but do not attend or do not meet agreed-upon criteria.

The student services fee and nonresident tuition fee are determined on the basis of the total units for which the student is enrolled including courses audited.

### Incomplete (Authorized)

An incomplete signifies that a portion of required coursework has not been completed and evaluated in the prescribed time period due to unforeseen but fully justified reasons and that there is still a possibility of earning credit. It is the student's responsibility to bring pertinent information to the instructor who determines the means by which the remaining course requirements are satisfied. A final grade is assigned when the work agreed upon has been completed and evaluated. The student is not permitted to re-enroll in the course to complete course requirements. If the student does re-enroll, the original grade of I is counted as an F (or NC) and the re-enrollment is processed as a repeated course.

The instructor designates terms of the contract and length of time allowed to complete work, not to exceed one year. Failure to complete the assigned work results in the I being counted as equivalent to an F (or NC) for grade point average computation. All remaining grades of I are changed to F (or NC) at the time the student's degree is awarded.

### Withdrawal Unauthorized

The symbol "WU" indicates that an enrolled student did not withdraw from the course and also failed to complete course requirements. It is used when, in the opinion of the instructor, completed assignments or course activities or both were insufficient to make normal evaluation of academic performance possible. For purposes of grade point average and progress point computation, this symbol is equivalent to an "F".

## Report In Progress

The "RP" symbol is used in connection with courses that extend beyond one academic term. It indicates that work is in progress but that assignment of a final grade must await completion of additional work. Work is to be completed within one year except for graduate degree theses, which have a three-year time limit.

Cumulative enrollment in units attempted may not exceed the total number applicable to the student's educational objective. Re-enrollment is permitted prior to the assignment of the final grade provided that the total permissible number of units for the course or courses is not exceeded. Work is to be completed within a stipulated time period.

The RP symbol shall be replaced with the appropriate final grade within one year or the grade is converted to an F, except that grades of RP for graduate degree theses convert to a grade of No Credit (NC) if a final grade has not been assigned within three years. All remaining RP grade symbols are changed to F or NC at the time the student's degree is awarded.

## Repeating a Course

Undergraduate students cannot repeat courses in which they have earned a C or better grade. If a course that was originally taken for a letter grade is re-taken with *credit/no credit grading*, the original grade is not excluded from the GPA. With the exception of the reasons listed below, the repeat adjustment is made automatically at the end of the term in which the course is repeated. A repeat petition is required for the following reasons only:

- the course was originally taken at Cal Poly before Fall 1987
- the course was originally taken at another institution
- the course has changed prefix or number
- the course was taken through Cal Poly Continuing Education

Repeat petitions for the situations listed above must be turned in to the Office of the Registrar by the end of the seventh week of the quarter in which the course is repeated.

## Course Repeats with Grade Forgiveness

Undergraduate students may repeat a maximum of 16 units at Cal Poly for purposes of improving their GPA. Courses subsequently repeated at another institution and transferred back to Cal Poly are not eligible for forgiveness. If the second Cal Poly grade is equal to or higher than the first, then it replaces the first grade. The original grade is "forgiven" from the GPA computation, but both grades appear on the student's transcript. **Grade forgiveness does not apply if the second grade is lower than the first grade. In this case, both grades are averaged into the student's GPA.** Effective Summer 2007, any course is eligible for grade forgiveness one time only. Consecutive attempts beyond the second attempt are averaged into the GPA along with the second attempt while the grade from the first attempt remains forgiven. **Clarification added, effective Summer 2011.**

## Course Repeats with Grades Averaged

Students may repeat an additional 18 units in addition to the 16 units for which grade forgiveness is permitted. Once the 16 unit forgiveness limit is reached, the grade from the repeat attempt shall not replace the original grade; instead both grades shall be calculated into the overall GPA.



Once students accumulate 34 units (16 units with forgiveness + 18 units with averaging) of repeated courses, they will no longer be allowed to repeat any future courses.

## Withdrawals / Renewal

The W grading symbol indicates that the student was permitted to withdraw from the course after the regular add/drop period with the approval of the appropriate campus officials. It carries no adverse connotation of quality of student performance and is not used in calculating grade point averages.

Between the end of the regular add/drop period and the end of the seventh week of instruction a student must request permission to withdraw from a course by processing a petition that is available at the Office of the Registrar. The petition is approved and withdrawal authorized only if there are serious and compelling reasons for withdrawal in the judgment of the department head.

The withdrawal petition also requires the signature of the course instructor and the student's academic advisor.

Between the end of the 7th week of instruction and the last day of instruction, withdrawals are permitted only if the withdrawal is based on an emergency situation clearly beyond the control of the student. In such cases a final or incomplete grade may be assigned for courses in which sufficient work has been completed to permit an evaluation to be made. The student must request permission to withdraw as specified above, or request grade assignment, both of which are subject to approval by designated campus officials. Any student who fails to provide notification or who fails to obtain formal approval to withdraw is subject to failing grades (WU, F, or NC).

Undergraduate students may withdraw from no more than 28 quarter units.

### Cancellation of Registration or Withdrawal from the Term

Students who find it necessary to cancel their registration or to withdraw from all classes after enrolling for any academic term are required to follow the University's official withdrawal procedures. Failure to follow formal University procedures may result in an obligation to pay fees as well as the assignment of failing grades in all courses and the need to apply for readmission before being permitted to enroll in another academic term.

Students may drop their classes on CPreReg all the way through the add/drop period, until the end of the 8<sup>th</sup> day of the term. Grades are not assigned for courses dropped during this period.

With the approval of campus officials, a student is permitted to withdraw from all classes for the quarter for serious and compelling reasons until the end of the 7th week of instruction. After the 7th week and through the last day of instruction, withdrawals for the term must be based on an emergency situation clearly beyond the control of the student, and approved by campus officials.

The student is required to initiate a request for a term withdrawal with the Registrar and to complete required exit procedures. If the student is unable to appear in person, he/she may write or call the Office of the Registrar, 805.756.2531, to request withdrawal. The request must specify reasons for leaving the institution and include the student's signature. The date of the withdrawal is established according to the guidelines contained in the institutional policies governing term withdrawals or as determined by the Registrar.

The student may be eligible for a full or partial refund of registration fees depending upon the time and circumstances of withdrawal. If eligible for a refund, the refund remains in the student's account on campus, unless the student files a written application for the refund to be sent to the student. Fee refund policy information is available at [fees.calpoly.edu](http://fees.calpoly.edu).

Students who receive financial aid funds must consult with the Financial Aid and Student Account Offices prior to withdrawing from the University regarding any refunds or repayments of grant or loan assistance received for that academic term. If a Title IV financial aid recipient withdraws from the University during a payment period, the grant or loan assistance received is subject to federal refund and repayment provisions.

### Withdrawal from Previous Terms

A student may petition to have all grades retroactively changed to the administrative grade of "W" if he/she can demonstrate and document that there were serious and compelling reasons or circumstances that resulted in the unofficial withdrawal for the quarter in question. A student may not retroactively withdraw from selected courses during a particular quarter, but must petition to withdraw from the entire quarter. **The petition must be submitted within one year following the end of the term.** Refunds of registration fees are not available for withdrawals following the last day of instruction. For more information, contact the Office of the Registrar.

### Academic Renewal

The Trustees of the California State University have established a program of Academic Renewal whereby students who are having difficulty meeting graduation requirements due to a grade point deficiency may petition to have up to two semesters or three quarters of previous undergraduate coursework discounted from all considerations associated with meeting requirements for the baccalaureate degree. None of the courses taken in such terms can be applied toward the degree.

Academic Renewal, as defined by campus policy, is processed only at the point of graduation. Academic Renewal is intended only to enable graduation from Cal Poly and is not available for individuals who already possess a baccalaureate degree or who meet graduation requirements without the approval of a petition for Academic Renewal.

**Conditions:** In order to qualify for Academic Renewal all of the following conditions established by the Trustees must be met:

1. Five years must have elapsed since the term or terms to be disregarded were completed. The terms to be disregarded may have been taken at any institution.
2. Since completion of the term(s) to be disregarded, the student must have completed coursework at Cal Poly of at least one of the following:
  - 22 units with a minimum GPA of 3.00,
  - 45 units with a minimum GPA of 2.50,
  - 67 units with a minimum GPA of 2.00
3. The student must present evidence that the coursework to be disregarded was substandard and not representative of the student's present scholastic ability and level of performance.

Final determination, that one or more terms shall be disregarded, shall be based on careful review of evidence by a committee appointed by the President, which shall include the designee of the chief academic officer and consist of at least three members (E.O. 1037).



For additional information about Academic Renewal, contact the Evaluations Unit of the Office of the Registrar.

## Other Academic Policies

### Academic Honors

The **Dean's Honors List** is compiled at the end of each quarter to honor undergraduate students who have completed 12 or more letter-graded units during the quarter with a 3.5 grade point average or better for that term. Units with a grade of CR do not count toward the 12-unit minimum. The **President's Honors List** is compiled at the end of each university year to honor those undergraduate students who have demonstrated consistent achievement, as represented by being named to the Dean's Honors List for any three of the four quarters of the university year. The university year begins with summer quarter.

Candidates for bachelor's degrees with the following **Cal Poly grade point averages** are awarded honors at graduation. **Only courses taken at Cal Poly calculate into the Cal Poly grade point averages.** The GPA is officially calculated at the time the student has *completed* graduation requirements:

- Summa cum laude – 3.85
- Magna cum laude – 3.70
- Cum laude – 3.50

These honors are noted on both the diploma and the transcript.

### Blended BS+MS Programs

Blended programs provide an accelerated route to a graduate professional degree, with simultaneous awarding of both bachelor's and master's degrees. See individual programs for additional information.

### Change of Major

**This policy goes into effect beginning with students admitted for Fall 2010.** Students admitted before Fall 2010 may use either this policy or the previous change of major policy in their respective catalog.

This policy applies to matriculated undergraduate students at Cal Poly wishing to change their major. The "target" major is the major into which a student wishes to transfer.

### Policy Statement

Cal Poly students are required to declare a major at the time of application. Some students find that their interests and abilities lead them in a different direction. The University must offer a transparent and timely process for all students who seek to change majors.

### Process

#### 1. General Guidelines

##### a. Minimum Time at Cal Poly

Students must complete at least one quarter at Cal Poly before requesting a change of major.

##### b. Basic Criteria that may be used in advising for determining Target Major Options

All academic departments should give careful consideration when determining target major options. The following criteria may be considered:

- i The majors for which the student was eligible at time of admission,
- ii College academic record (e.g., GPA, coursework, etc.), and
- iii Remaining coursework and the student's ability to complete degree requirements in the new major within the published unit maximums for that major.

#### c. One Chance to be Accepted

Students who enter into an individualized change of major agreement (ICMA) and do not complete the ICMA requirements will *not* be eligible to request that major again later in their career at Cal Poly.

#### d. Completion of Change of Major

The change of major will be approved once the student has successfully met all of the requirements of the ICMA.

#### e. Timeframe

The ICMA must be feasible to complete and be completed in no more than two quarters.

#### f. Publication of Change of Major Criteria

As applicable, departments' web sites should post the minimum criteria required of all students to change major into their program, including timelines.

#### g. Impact Constraints

Per the Office of the Chancellor's *The California State University Enrollment Management Policy and Practices*, other admissions requirements for all transfer students (internal and external) entering the target majors on impacted campuses must be the same (e.g., portfolios, auditions, etc.).

#### h. Academic Standing

A change of major agreement will be void if a student is academically disqualified prior to the completion of the agreement.

### 2. Requesting a Change of Major

- a. Meet with current advisor to review major options and talk about career paths. Consider, also, consulting with Career Services, other advisors, and faculty and/or department heads/chairs in both current and target majors.
- b. Meet with the department head/chair or designee in the target major to determine the likelihood of success in the new major.
- c. Review the curriculum requirements for the target major.
- d. If the target major is not a good fit for the student, the student will be advised to look at other options.
- e. If the student receives a positive assessment based on consideration of I.B., and it is clear that he/she can complete degree requirements in the new major within the unit maximum (unit maximum is 24 units above program requirements), then an ICMA will be developed (see below).

### 3. III. Individualized Change of Major Agreement (ICMA)

The change of major will be approved once the student has successfully met all of the requirements of the ICMA.

The ICMA will cover no more than two quarters. The ICMA may include the following components:

- a. Maximum of three specified courses or 12 units in the target major.

- b. Additional courses and/or units to allow the student to meet minimum progress standards and complete degree applicable units in both majors, whenever possible (e.g., GE courses or electives a student could use to meet degree requirements in both current and target majors).
- c. GPA requirements, as determined by the department (e.g., overall/term GPA, GPA in major-specified courses, GPA in past two quarters).
- d. If applicable, specific steps to be met to resume good academic standing status.

## General Information

As much as possible, entering students are encouraged to make careful and informed decisions about the initial application to their declared majors. All majors at Cal Poly are impacted and it will be difficult to change into some majors despite a student's best efforts. Nevertheless, sometimes students will find that their interests, abilities, or talents will take them in a different direction than they had identified when they originally applied to Cal Poly and they may seek to change to a different major. Depending on the degree of impact of the target major (i.e., the relationship between the number of applicants to the major and the number of places available), there might only be a few spaces available for change of majors, or no spaces at all. Students who are unable to change into their desired majors might also need to consider applying to another university in the major of their choice.

If a student makes the decision to change major, doing so early in the academic career will better allow a student to make degree progress in a timely manner and stay within the University's minimum progress to degree standards (see the Expected Academic Progress policy in the "Academic Standards" section of the catalog); major changes late in the academic career will be restricted by the University's minimum progress standards, including the unit maximum.

All students, whether lower division (those with fewer than 90 Cal Poly units) or upper division (those with more than 90 Cal Poly units or 90 transfer units), intending to change majors must demonstrate that they can complete the new major within the minimum progress standards and the unit maximum set forth by the University. This is likely to be a greater challenge for upper division students, who will have fewer remaining degree requirements. Further, students need to be aware that not all departments can accommodate upper division change of majors.

## Course Substitution

Although a curriculum is specified for each major, under certain conditions a student may be permitted some deviation from the established curriculum. See the major department for substitutions involving major or support courses.

All Cal Poly students are expected to complete the GE courses specified in their degree program. Cal Poly GE courses must be selected from the GE requirement list. Substitutions are not permitted except in extraordinary circumstances. Students requesting exceptions must follow petition procedures, outlined on the GE web site. This process may take several weeks.

## Double Majors or Degrees

If a student has completed the requirements for two or more majors leading to the same baccalaureate degree (e.g., two BS degrees),

those majors are acknowledged on a single diploma. The major which the student requests as her/his **primary** major will appear first on the diploma. If a student has completed the requirements for two or more majors leading to different baccalaureate degrees (e.g., a BS and a BA), those degrees and the completed major or majors leading to each degree are acknowledged on two separate diplomas. If a student has completed concurrently the requirements for two or more degrees, at least one of which is a graduate degree, Cal Poly issues a separate diploma for each degree earned.

A student who adds a second major to her/his degree objective is expected to fulfill all requirements for both majors. However, a student may be allowed to use one senior project to fulfill the requirements for two majors. The program in which the student seeks to replace the senior project must grant permission before the student begins the project. Permission must be obtained using a major/support substitution.

Students who have declared two majors will be awarded both degrees for the term in which all requirements are completed for both.

## Final Examinations

If a student has more than two final exams on the same day, faculty should make a reasonable effort to schedule an alternative final exam for that student during the finals week. It is the student's responsibility to notify an instructor of the final exam conflict and to request to reschedule the final exam by the end of the seventh week of instruction.

## Graduate Courses Taken by Undergraduates for Graduate Credit

Cal Poly undergraduates who have achieved senior standing may take courses in the 400 or 500 series for possible graduate credit while still undergraduates. If they subsequently enter a Cal Poly master's or credential program, they may petition to have such course credit applied toward their master's degree or credential program, **if** the units were not used in any way for the baccalaureate degree. A Graduate Petition for Special Consideration is the means of petitioning for this allowance.

## Student Classification/Standing

Undergraduate students are assigned a classification level according to the number of quarter units earned:

### Lower Division

Freshman ..... fewer than 45 units  
Sophomore..... 45 to 89 units

### Upper Division

Junior ..... 90 to 134 units  
Senior..... 135 or more units

For the purposes of this calculation, earned units include transfer and Advanced Placement credit, in addition to Cal Poly units.

## Academic Minors

A minor is an integrated, coherent group of courses (24 to 30 quarter units), which gives the student knowledge in an area that lies outside of the major field of study. Please see Programs A-Z (<http://>

catalog.calpoly.edu/previouscatalogs/2013-15/programsaz) for the list of minors.

Requirements for the minor:

- At least half of the units must be from upper-division courses (300- or 400-level)
- At least half of the units must be taken at Cal Poly
- Not more than one-third of the courses in a minor can be graded Credit/No Credit (CR/NC), except for courses that have mandatory CR/NC grading
- A minimum 2.0 GPA is required in all units counted for completion of the minor (foreign language minors must have a 2.75 GPA)

The minor must be completed prior to, or at the same time as, the requirements for the bachelor's degree. A major and a minor may not be taken in the same degree program, and a minor is not required for a degree.

Students who wish to complete a minor are to contact the department offering the academic minor as early as possible in the program and fill out the appropriate agreement form. Students may select a minor which has requirements from a catalog that is different from that of their major. The minor form can then be submitted to the Office of the Registrar. The completion of the minor is noted on the student's transcript, but is not shown on the diploma. In no case is a diploma awarded for the minor.

## Registration

Students are required to enroll in courses by using the web registration system (CPRReg). The courses selected should meet the requirements specified for each student's major course of study.

Credit for coursework completed is given only when the student is properly registered. A student is not properly registered until fee requirements have been met and enrollment in classes through the CPRReg system has been confirmed. **Students are strongly advised to print copies of their schedule for their records.** Individuals are not permitted to attend courses unless they are officially registered as regular students, as approved extension students, or as enrolled auditors (see Audit).

Information concerning registration for classes is available at <http://registrar.calpoly.edu/content/registration/index>. Information concerning payment of fees is available at <http://fees.calpoly.edu/>.

## Enrollment Policy

State funding is allocated to the University based on student enrollment each term. Any attendance/participation in classes where the student is not officially enrolled during the term of participation (and where appropriate registration fees have not been paid) is against campus policy. This includes enrollment in Internship courses and acceptance of a position through the Cooperative Education program. All registration should be completed by the end of the Add Period, the 8<sup>th</sup> day of the term.

Official term enrollment requires the awarding of grades for classes attempted.

## Class Attendance

Students are expected to attend class regularly to keep the quality and quantity of their work high. Absence from classes is regarded as serious. An excused absence can be allowed only by the instructor in charge of the class upon consideration of the evidence justifying the absence presented by the student. An excused absence merely gives the individual who missed the class an opportunity to make up the work and in no way excuses the student from the work required.

### "Excusable" Reasons for Missing Class

It is strongly urged that instructors accept the following "excusable" reasons for allowing students to make up missed work:

- Illness with a doctor's statement
- Serious illness or death of close relatives
- Active participation in university events (an instructor may require a statement from the adviser involved certifying that the student was actively participating in a recognized university event)
- Field trips
- Religious holidays
- Selective service and military reasons
- NCAA athletic competitions
- Instructionally Related Activities (IRA)/competitions
- Jury duty or any other legally required court appearances
- Job or internship interviews

Any student seeking to make up missed work pursuant to the above listed "excusable" reasons must inform the instructor of their intent in a timely manner.

## Holding of Records

Student records may be placed on a "Hold" status because of financial or other obligations to the University. The Hold authorizes the University to deny registration, prevent the release of transcripts, and to withhold other services normally provided to the student. A student's records are held until the obligation is cleared to the satisfaction of the office or department placing the Hold.

## Enrollment Status

*Full-time undergraduate students* are those enrolled in 12 or more units of coursework in any regular quarter. *Half-time undergraduate students* are those enrolled in 6 to 11 units, and part-time undergraduate students are those enrolled for 5 or less units. Verification of enrolled units is based on enrollment status at the time of the verification request. Full-time status for graduate students is defined in the "Graduate Studies" section of this catalog.

## Maximum Unit Load

### Add/Drop

**responsibility of the student.** The add/drop period continues through CPRReg initial registration cycles until the end of the 8<sup>th</sup> day of instruction of each term. During this period, the student has the opportunity to add or drop classes. See specific dates for completing these transactions at <http://registrar.calpoly.edu/content/>

Calendars\_Deadlines/index . Students are responsible for knowing and adhering to these published timelines and for their enrollments.

## Adding

*Closed classes:* If a class is full, students may use a permission number, issued by the instructor, during the first 8 days of instruction. See [http://registrar.calpoly.edu/content/Calendars\\_Deadlines/index](http://registrar.calpoly.edu/content/Calendars_Deadlines/index) for details.

*Time conflict:* Students may not enroll in two classes that meet at the same time.

*Eligibility:* Students must meet prerequisite and Schedule of Classes footnote requirements and be in attendance at the first class meeting to remain enrolled in the class.

*Late registration:* Students registering late have until the end of the add/drop period to pay late registration fees and to register for classes through CPreReg with a permission number issued by the instructor of the class.

## Dropping

<sup>th</sup> day of instruction to drop a class through CPreReg. No entry is made on their academic records. At the end of the regular add/drop period the instructor must assume that any student who has not dropped voluntarily remains officially enrolled in the class. For information on withdrawing after the end of the regular add/drop period see Withdrawals from Courses.

*First class meeting:* An instructor **may** drop a student from a class for failure to attend the first class meeting.

*Footnote requirement:* An instructor **may** drop a student from a class if the footnote requirements, as stated in the online Schedule of Classes on PASS, are not met.

*Prerequisite missing:* An instructor **may** drop a student from a class if the prerequisite requirements, as stated in the catalog course description, have not been completed.

*Canceled classes:* If a class is canceled, students are automatically dropped and have no reporting responsibilities.

## Leaves of Absence

### Eligibility for All Leaves

1. A student on Educational or Medical Leave is considered to be in continuous attendance with the purpose of returning to the same curriculum that was in effect when the leave began.
2. A student on Educational or Medical Leave is not required to apply for readmission or pay an application fee provided that the student returns to the same major and within the time period agreed upon when the application was approved.
3. No more than two leaves are available to each student (totaling a maximum of 8 terms).
4. A student on leave may return and enroll for any term prior to the term when the leave is scheduled to end. NO leave is extended beyond the two-year limitation for any reason.
5. Any student on leave who fails to return and enroll within the time limits specified by the leave agreement is required to reapply for admission, pay the reapplication fee, and may be held to any new curriculum requirements which may be in effect.

### Educational Leaves:

1. A Planned Educational Leave must be for a purpose that contributes to the student's educational objective and is approved by the student's major department head or chair.

2. To be considered for an Educational Leave, the student must be eligible to enroll for the term in which the leave begins and not be on academic probation.
3. The application for Educational Leave must be initiated and approved before the leave begins and is not granted retroactively.
4. Application forms and information concerning Leaves of Absence may be obtained from the Office of the Registrar.

### Medical Leaves:

1. A Medical Leave provides time for the student to receive treatment or to recover from a disabling injury or other medical condition and is approved by a medical doctor.
2. The Medical Leave begins the term following the student's last term in attendance and may be granted retroactively based on the student's personal situation.
3. A written letter together with medical documentation is required. Information concerning Leaves of Absence may be obtained from the Office of the Registrar.

## Returning Students

### Intrasystem and Intersystem Enrollment Programs

**CSU Concurrent Enrollment** – matriculated students in good standing may enroll on a space available basis at both their home CSU campus and a host CSU campus during the same term. Credit earned at the host campus is reported to the home campus to be included on the student's transcript at the home campus. This counts as residential credit towards the degree but is shown as transfer credit.

**CSU Visitor Enrollment** – matriculated students in good standing enrolled at one CSU campus may enroll on a space available basis at another CSU campus for one term. Credit earned at the host campus is reported to the home campus to be included on the student's transcript at the home campus as transfer credit.

**Intersystem Cross Enrollment** – matriculated CSU, UC, or community college students may enroll on a space available basis for one course per term at another CSU, UC, or community college and request that a transcript of record be sent to the home campus and recorded as transfer credit.

### Health Screening

Students graduating from a California public high school only need to complete the Cal Poly Health History Form, available on the Health Center Portal. They should access the Health Center Portal by logging into their Cal Poly Portal and by selecting the Health Center red cross icon. **No immunization records need to be sent in.**

All **other** entering CSU students are required to present proof of the following immunizations to the CSU campus they are attending before the beginning of their first term of enrollment. If proof cannot be presented at that time, then the following conditions must be met:

- **Measles and Rubella:** Students must submit proof of immunity to measles and rubella within one year of the time of first enrollment. Students will not be allowed to register for a second year until they have fulfilled this requirement.
- **Hepatitis B:** Students who are 18 years of age or younger at the start of their first term at a CSU campus must provide proof of full

immunity against Hepatitis B prior to their second quarter. Full immunization against Hepatitis B consists of three timed doses of vaccine over a minimum 4- to 6-month period. **Students will not be allowed to register for a second quarter** until they have presented proof to Health Services that they have received at least one shot, and must complete the series prior to the second year of enrollment.

**Meningococcal Disease.** Each incoming freshman who will be residing in on-campus housing will be required to complete an online form indicating that they have received information about meningococcal disease and the availability of the vaccine to prevent contracting the disease and indicating whether or not the student has chosen to receive the vaccination. This form is part of the Health History Form, available on the Health Center Portal. They can access the Health Center Portal by logging into their Cal Poly Portal and by selecting the Health Center red cross icon.

The above are **not** admission requirements, but are required of students as conditions of enrollment in the CSU.

**Compliance with the requirements can be met in the following ways:**

**1. Submit Documentation**

A copy of any one of the following will satisfy immunization requirements:

- School Immunization Record
- County Health Department Immunization Record (well baby booklet)
- International Health & Immunization Record (used by military & foreign travelers)
- Family physician's record
- Verified record of blood test showing immunity

**-or-**

**Download the Hepatitis B and Measles/Rubella Immunization Form** (<http://hcs.calpoly.edu/sites/hcs/files/documents/faq.pdf>) **and mail to:**

Health Services  
California Polytechnic State University  
1 Grand Avenue  
San Luis Obispo, CA 93407-0210  
or send via FAX: (805) 756-5298

**2. Be immunized**

For those who do not have documentation, immunizations can be obtained at:

- A private health care provider
- A local clinic or County Public Health Department
- The Cal Poly Health Center once an individual is an enrolled student

**3. Have a blood test**

A rubella/rubeola titer and/or Hepatitis B surface antibody test will determine if an individual is immune either by past immunization or by having had the diseases.

**4. Request a waiver or exemption**

- Medical: If medical circumstances contraindicate immunization, an individual may be granted an exemption.

- Religious: State law permits exemption from immunization for those who object to immunization on religious or personal grounds.
- Waivers for exemption are available at Health Services.

In the event of an outbreak of these diseases, students who signed a waiver may be temporarily excluded from class, residence halls or campus.

[http://hcs.calpoly.edu/content/health/req\\_immunizations](http://hcs.calpoly.edu/content/health/req_immunizations) or call Health Services at 805.756.1211.



# College of Agriculture, Food & Environmental Sciences

Agricultural Sciences Bldg. (11), Room 211

Phone: 805.756.2161

<http://cafes.calpoly.edu/>

Dean: Andy Thulin

Associate Dean: Richard A. Cavaletto

Associate Dean: Mark D. Shelton

Assistant Dean: Russ Kabaker

## Academic Programs

Program name	Program type
Agribusiness	MS, Minor
Agribusiness Specialization	MBA
Agricultural and Environmental Plant Sciences	BS
Agricultural Business	BS
Agricultural Communication	BS, Minor
Agricultural Education	MAgEd
Agricultural Science	BS
Agricultural Systems Management	BS
Agriculture	MS, Credential
Animal Science	BS
BioResource and Agricultural Engineering	BS
Crop Science	Minor
Dairy Products Technology	MPS
Dairy Science	BS, Minor
Disaster Management/Homeland Security	Minor
Environmental Earth Sciences	BS
Environmental Soil Science	BS, Minor
Environmental Management and Protection	BS
Equine Science	Minor
Food Science	BS, Minor
Forestry and Natural Resources	BS
Forestry Sciences	MS
Fruit Science	Minor
Geographic Information Systems for Agriculture	Minor
Indigenous Studies in Natural Resources and the Environment	Minor
Land Rehabilitation	Minor
Meat Science and Processing	Minor
Military Science	Minor
Nutrition	BS, Minor
Plant Protection	Minor
Poultry Management	Minor
Rangeland Resources	Minor
Recreation, Parks and Tourism Administration	BS
Sustainable Agriculture	Minor
Water Engineering Specialization	MS

Water Science

Minor

Wine and Viticulture

BS, Minor

The College of Agriculture, Food and Environmental Sciences (CAFES) offers programs reflecting the growing diversity of choices available and skills required in modern agriculture, life sciences, and related professions.

### Mission Statement

The College of Agriculture, Food and Environmental Sciences uses a "learn by doing" approach to prepare leaders in agriculture, food systems, natural resources, and life sciences who are equipped to address the diverse needs of society.

### Learning Outcomes

All students who complete a program in CAFES should be able to:

- Demonstrate expertise and the use of technology in their respective discipline.
- Demonstrate effective oral and written communication skills.
- Make choices based on an understanding of personal and professional ethics and respect for diversity of people and ideas.
- Recognize leadership principles and skills.
- Evaluate and solve problems using critical thinking.
- Demonstrate an appreciation for sustainability and global perspectives.

Students take courses in their major field beginning with their first quarter of enrollment. This early exposure to their major provides them with knowledge to supplement that gained in other coursework in basic sciences, mathematics and the liberal arts. Moreover, it allows students to evaluate whether or not the curriculum selected is appropriate to their interests and abilities. Taking courses in the major throughout the academic program fosters personal contact with faculty and other students having common interests but varied backgrounds.

The students' early involvement in their major field, combined with the faculty's close contacts with schools, private industry, governmental agencies, and nonprofit organizations provide excellent opportunities for student internships during their junior or senior years. Other opportunities which enhance education, provide financial assistance, and help prepare students for the job market include enterprise projects, scholarships, and work-study jobs.

CAFES faculty are experts in their disciplines, and are dedicated to teaching. They are eager to help students learn, are readily available for consultation and are proud of their close relationship with students.

Academic advising is provided to all students through Academic Advising Centers and their major department in the college. Each student is assigned a faculty advisor. Students are encouraged to meet with their advisors quarterly to plan their schedule, review curriculum information, discuss career opportunities, and receive information on internships, enterprise projects and co-ops. Academic advising centers and resources provide guidance on university and college policies and procedures including course transfers, substitutions and other general information.

Student clubs are active in every department. The 43 clubs, most of which are affiliated with national professional organizations, provide an excellent forum for student and faculty interactions. Active club members may practice leadership skills, and attend national, state

and local professional meetings, as well as participate in a variety of professional and social events.

### **Agricultural Lands and Outdoor Laboratories**

Nearly 5,000 acres of agricultural production, processing and research land and facilities are available for student use at Cal Poly. These facilities provide students with unique opportunities for hands-on experiences which augment classroom instruction.

The campus farm includes a dairy, beef center, horse, sheep, swine and poultry units, horse training and show arenas, an animal nutrition center, meat processing center, veterinary clinic and rodeo facilities. Also available are irrigated and dryland fields for annual crops, orchards and vineyards, an irrigation demonstration field, erosion research facility, large-scale composting operation, hoop houses, arboretum, wholesale and retail nurseries, putting greens and turf research plots, a wine lab, and greenhouses. Eleven acres of certified organic farmland support our organic farming program.

### **Other Labs and Special Facilities**

Special facilities include several microcomputer laboratories, laboratories with modern equipment for soil- plant-water testing, engineering testing and manufacturing shops, complete food processing units for dairy products, meats, fruit and vegetables, and four biotechnology and embryology laboratories.

### **Santa Cruz County Properties**

The 3,200 acre Swanton Pacific Ranch and 600 acre Valencia Creek forest in Santa Cruz County were generously donated by Al Smith, alumnus of Cal Poly's former Crop Science Department. These properties provide students with an opportunity to live and work on a commercial farm with forestry, watershed management, cattle and organic crop production activities. The lands also support a wide range of research topics for undergraduate and graduate students.

### **Experiential Learning**

Students have many opportunities to participate in experiential learning activities which exemplify Cal Poly's "learn by doing" philosophy. For example, more than 80% of CAFES classes include laboratories or activity sessions. Enterprise projects offer students practical experience in animal, plant, and food production, processing, and research. Some of these are financially backed by the Cal Poly Corporation and offer students entrepreneurial experiences similar to those found in private industry.

## **Courses**

The courses offered in each agricultural curriculum may be grouped into four areas:

### **Major**

The major courses include a required cluster of courses in which the student expects to graduate. These courses constitute the core of specific preparation for the student's major field in agriculture.

### **Support**

The support courses draw from courses in agriculture, life sciences, and closely allied fields which support and supplement the block of courses constituting the student's major.

### **General Education**

Courses are selected from the physical and life sciences, mathematics, communications, arts and humanities, and social, political, and economic institutions. These courses furnish the student with

background and support for agricultural courses as well as providing cultural background for the students' intelligent participation in a complex world society.

### **Free Electives**

Course selection from electives is designed to provide freedom for students to pursue interests of their choosing in any university department.

## **Recommended Preparation**

In addition to pursuing the CSU mandated entrance requirements, high school and community college students are encouraged to participate in co-curricular activities as part of their preparation for admission to majors in Cal Poly's College of Agriculture, Food and Environmental Sciences. These activities could include, but are not limited to, FFA, 4-H, leadership roles in school clubs, meaningful work experience and community organizations.

### **Laboratory Safety**

Students are required to meet sanitation and safety regulations in laboratories. These regulations are explained by the instructor at the first meeting of the class.

Agricultural Sciences Bldg., Room 211

Phone: 805.756.2161

[http://cafes.calpoly.edu/about\\_cafes/grad\\_programs.html](http://cafes.calpoly.edu/about_cafes/grad_programs.html)

Associate Dean: Mark D. Shelton

[mshelton@calpoly.edu](mailto:mshelton@calpoly.edu)

## **General Characteristics**

Graduate studies in the College of Agriculture, Food and Environmental Sciences (CAFES) allow the student to pursue either a professional program designed to enhance the competencies of agricultural educators, or an academic program of graduate-level scholarly activities and research in one of several specializations. Graduates are prepared for:

- professional-level positions with business and industry, government, and foreign service in agriculture and related fields;
- continued graduate work at other institutions.

## **Admission/Acceptance Requirements – MS Only**

- File an application for Graduate Admission via [www.csumentor.edu/](http://www.csumentor.edu/) (<http://www.csumentor.edu/>) by the deadlines specified at <http://admissions.calpoly.edu/applicants/>
- Submit Graduate Record Exam (GRE) General Test scores electronically to Institution Code: R4038
- Three Letters of Recommendation

## **Prerequisites**

For consideration as a graduate student, an applicant will have completed a bachelor's degree from an accredited college/university with a minimum grade point average of 2.75 in the last 90-quarter units. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing.

All applicants who do not speak and write English as their primary language are required to complete the Test of English as a Foreign

Language (TOEFL), taken within the last 2 years with a minimum score of 550 (paper version), 213 (computerized version), or 80 (internet based). Submit scores electronically to Institution Code: 4038. This requirement does not apply if your country of citizenship is listed on Cal Poly Admissions website: <http://admissions.calpoly.edu/applicants/international/checklist.html>

Each program may list additional requirements for admission to the specific program.

## Degree Requirements

**Formal Study Plan.** Graduate students must file the formal study plan for the degree with the CAFES Graduate Coordinator no later than the end of the quarter in which the 12<sup>th</sup> unit of approved courses is completed. The formal program of study must include at least 45 units of committee-approved graduate coursework; at least half of the units required by the committee as reflected on the formal study plan must be at the 500 level. Students should refer to the course descriptions in this catalog for credit limitations of individual courses; for example, total credit for AG 500, Individual Study, is limited to six units.

All candidates must meet the current Graduation Writing Requirement (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>). All Students are required to pass an oral comprehensive examination which is normally given during the final quarter of the program of study. A written comprehensive exam may also be required by the master's degree committee, but his is optional. For students in a thesis program the final oral comprehensive examination includes, but is not necessarily limited to, a defense of the thesis.

## Thesis

The thesis is based on independent, supervised research. Students should contact individual departments to determine the availability of funding support for their research. The final copy of the thesis must meet the standards explained in the "Manual of Instructions for the Preparation and Submission of the Master's Thesis or Master's Project" available from the Cal Poly Research and Graduate Programs Office. At least one course in statistical methods and/or experimental design is required of students in a thesis based curriculum.

A copy of the thesis or project report must be received and reviewed by the Thesis Editor in the Graduate Programs Office. Upon completion of any required corrections, the student submits the electronic thesis/project report to the DigitalCommons@CalPoly, a digital archive for the University. These steps must be completed before the degree is awarded.

## Graduate Student Continuous Enrollment Policy

Effective Fall Quarter 2009, graduate students are required to maintain continuous enrollment from the time of first enrollment in a graduate program until completion of the degree. Continuous enrollment is defined as being enrolled during Fall, Winter, and Spring quarters each year. All graduate students must be enrolled the quarter they graduate. Therefore, a student graduating Summer quarter must be enrolled during the summer. Students can maintain continuous enrollment either by being enrolled as a regular student; obtaining approval for an education or medical leave prior to the quarter when such a leave would begin; or by registering in a special course designated for this purpose, during quarters in which they are not regularly enrolled. The special course GS 597 is taken through Cal Poly Extended Education.

Credits in GS 597 do not count toward meeting degree requirements. Students who fail to fulfill this continuous enrollment requirement will not be permitted to graduate even if all degree requirements have been completed until payment has been made for all quarters of non-enrollment. This requirement is not retroactive to terms prior to Fall 2009. For further information and a registration form, visiting the Extended Education (<http://www.extended.calpoly.edu>) website.

## MS Agriculture, Specialization in Agricultural Engineering Technology

Students have the opportunity to focus their program on the application of engineering technologies and management to solve agriculturally related problems.

## MS Agriculture, Specialization in Animal Science

The program provides students with an interdisciplinary, science-based program, where students develop basic scientific knowledge, apply that knowledge to a research project, then write and defend a thesis. An individual's coursework and research project is focused based upon his or her interests and goals in Animal Science, and under the guidance of the advisor and thesis committee.

Additional prerequisites: Prospective students are required to:

- submit a cover letter identifying interests, goals and experience relevant to the MS program, and
- submit a résumé

## MS Agriculture, Specialization in Crop Science

For students with undergraduate preparation in plant agriculture. Research currently is focused primarily in postharvest technology, viticulture, and integrated pest management, with additional work being done in other areas, including agronomy, horticulture, and precision farming.

## MS Agriculture, Specialization in Dairy Products Technology

An applied program for students who desire to use their academic preparation in food science and nutrition, dairy science, microbiology, chemistry, engineering, biochemistry and related fields to address applied research questions of impact to the field of dairy science and technology. The program requires the demonstration of strong analytical thinking, effective oral and written communication, and project management. Coursework and thesis experience are designed with flexibility to enhance and increase proficiency in scientific methods while enriching students' overall preparation to enter the workforce. Graduates enter research and development positions with major food companies, leadership positions in dairy food processing and other allied areas, or further graduate study for the Ph.D. Students have opportunity to work on funded research projects of the Dairy Products Technology Center and interact with multidisciplinary teams of scientists from throughout the world. International students are encouraged to apply.

Additional prerequisites: Prospective students are required to:

- submit a cover letter identifying interests, goals and experience relevant to the MS program, and
- submit a résumé

## MS Agriculture, Specialization in Environmental Horticulture Science

For students interested in careers in teaching, applied research positions in industry, or to students planning on continuing on for a Ph.D. It would also appeal to foreign students interested in an American graduate degree, particularly since California is internationally famous for its horticulture industry.

## MS Agriculture, Specialization in Food Science and Nutrition

For students with undergraduate preparation in food science, nutrition, or other science-based curricula. A thesis is required. Research areas vary with faculty expertise and interest; refer to Food Science and Nutrition Department and College of Agriculture, Food and Environmental Sciences web pages for more information on faculty research. Graduates are prepared for further study in doctoral programs or for responsible positions in nutrition and food industries.

## MS Agriculture, Specialization in Irrigation

The program requires the demonstration of strong analytical thinking, effective oral and written communication, and project management.

Additional prerequisites:

- B.S. or B.A. with proficiency in basic chemistry and math.
- Students must have successfully completed at least one undergraduate class in general irrigation, soil science, crop science, calculus, and hydraulics, plus be familiar with spreadsheets.

Students may complete prerequisite courses at Cal Poly if necessary.

## MS Agriculture, Specialization in Plant Protection Science

Provides research experience at the graduate level; provides the opportunity to conduct field and/or laboratory research programs with corporate stakeholders for career enhancement; allows students to develop more diverse or specialized skill sets for post-graduation employment; provides opportunity to obtain required coursework for state licensing.

## MS Agriculture, Specialization in Recreation, Parks, and Tourism Management

The Recreation, Parks, and Tourism Management specialization provides students with advanced study for management positions in the leisure industry or to pursue a career in higher education. The program currently focuses on applied social science research related to tourism, event management, and outdoor recreation management.

Prerequisite: In order to develop an academic background in this discipline, students who have not completed a B.S./B.A. degree in Recreation, Parks and Tourism Administration may be required to take the following courses: RPTA 360 and STAT 512.

## MS Agriculture, Specialization in Soil Science

Provides graduate level knowledge and skills for soils interpretation and management, for teaching, or for continuation into a PhD program.

Department facilities include modern instrumentation, laboratories, and a glasshouse. Students have access to several thousand acres of agricultural, forest, and range lands. Graduates meet educational requirements for professional certification by the American Registry of Certified Professionals in Agronomy, Crops, and Soils, and as Certified Professional Erosion and Sediment Control Specialists.

## MBA, Specialization in Agribusiness

The Orfalea College of Business and the Agribusiness Department jointly offer an Agribusiness Specialization in the Master of Business Administration program. The program is part of the MBA curriculum and requires the completion of six graduate classes taught by the Agribusiness Department (see Orfalea College of Business (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness>) section of this catalog for more information). Information and application materials may be obtained by writing to the MBA Coordinator, Orfalea College of Business.

## MS Agribusiness

The Master of Science in Agribusiness is designed to enhance the agribusiness management, commodity marketing, and technical skills of graduate students with interests in international and domestic agribusiness. Please see the Agribusiness (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agribusiness>) section of this catalog for more information.

## MS Engineering, Specialization in Water Engineering

The College of Engineering and the BioResource and Agricultural Engineering Department jointly offer the Water Engineering Specialization under the M.S. Engineering. Please see College of Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering>) section of this catalog for more information.

## Agricultural Communication Minor

Brock Center for Agricultural Communication  
Agriculture Bldg. 10, Room 235  
Phone: 805.756.6138

Coordinator: Scott Vernon

This interdisciplinary minor enhances the students' ability to seek careers in dynamic professions associated with the agricultural industry, including print journalism, broadcast journalism, and public relations.

The minor is a cooperative effort between CAFES and the College of Liberal Arts and students are advised by faculty members assigned to the Brock Center for Agricultural Communication. Students have the opportunity to participate in the Cal Poly chapter of the national Agricultural Communicators of Tomorrow Association.

## Environmental Studies Minor

Please see the College of Science and Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics>) for more information on this interdisciplinary minor.



## Geographic Information Systems for Agriculture Minor

BioResource and Agricultural Engineering  
Bldg. 08, Room 101  
Phone: 805.756.2378

Coordinator: Tom Mastin

An interdisciplinary program sponsored by three departments in CAFES: BioResource and Agricultural Engineering, Natural Resources Management and Environmental Sciences, and Horticulture and Crop Science. New technologies of geographic information systems (GIS), global positioning systems (GPS), and orthophotography (uniform scale aerial photographs) are revolutionizing the management of resources. There are great employment opportunities for those who understand these technologies. Students interested in this minor may come from the following majors: forestry and natural resources, crop science, soil science, landscape architecture, agricultural systems management, bioresource and agricultural engineering, animal science or earth sciences. Students from any major are welcome to take this minor.

## Indigenous Studies in Natural Resources and the Environment Minor

An interdisciplinary minor sponsored by the departments of Natural Resources Management and Environmental Sciences and Ethnic Studies. For more information, see the Natural Resources Management and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences>) section.

## Land Rehabilitation Minor

Natural Resources Management & Environmental Resources Department  
Bldg. 11, Room 217  
Phone: 805.756.2702

Coordinator: Doug Piirto

Students completing the minor gain skills in recognizing, assessing, and treating disturbed lands for numerous purposes, including erosion and sediment control, water quality improvement, habitat restoration, and aesthetic enhancement. They develop proficiency in plant identification and selection, soil properties and processes, and ecological principles, and also learn to set criteria and judge the feasibility, prudence, efficiency, and effectiveness of rehabilitation efforts.

Each student is required to complete a hands-on rehabilitation or restoration field project that provides practical experience in recognizing, assessing, and treating a landscape disturbance. Before beginning the treatment phase, the student must prepare a written plan that includes a problem assessment, treatment design, anticipated outcome, and budget. This plan must be approved by the faculty advisor and the minor coordinator before land treatment begins. Project may be carried out individually or in small groups. Contact the minor coordinator for more details.

## Rangeland Resources Minor

Animal Science  
Bldg. 10, Room 141

Phone: 805.756.2419

Coordinator: Marc R. Horney

This interdisciplinary minor prepares students for careers in the science and management of semi-arid grasslands, shrublands, and savannas. This is an entry point into a wide range of careers in extensive agriculture (range and pasture-based livestock production), and environmental conservation - including wildlife and natural resource management. Students will learn purposes and methods of assessing the health and productivity of rangeland ecosystems, and how to manage the herbivorous animals that depend on them. Coursework in the minor will give students an understanding of the interactions of plants, animals, water, soil and landscape features in these ecosystems. This minor will partially prepare students for careers including specialist positions with the federal government (BLM, NPS, NRCS, USFS), state government and non-governmental conservation organizations as scientists, resource specialists, and managers, and for opportunities in the private sector as agricultural or environmental consultants, ecologists, wildlife biologists, wildland managers, ranch managers, and other natural resource management specialists. This minor offers sufficient courses to meet the basic educational requirements for California Certified Rangeland Manager (CRM) licensing program.

Students must have successfully completed the following courses: BOT 121 or BIO 162, GE Area B1 MATH course, and SS 121 in order to be admitted to the minor program. Once admitted, students will have opportunities to travel to professional conferences and meetings, assist in projects being done on public and private lands in the area, and participate in a variety of other activities.

## Sustainable Agriculture Minor

Horticulture and Crop Science  
Bldg. 11, Room 230  
Phone: 805.756.1237

Coordinator: John Peterson

Students approach modern agricultural problems from a holistic perspective, emphasizing agricultural planning integrated with ecological principles. Through experience in sustainable agricultural practices, students learn about a farm in the context of an agro-ecosystem: a system whose processes and relationships can be manipulated to allow production with fewer adverse environmental impacts and external inputs. Students develop knowledge and skills involving holistic management, crop production, and adaptive decision-making in a hands-on environment. The minor is available to all Cal Poly students.

## Water Science Minor

BioResource and Agricultural Engineering  
Bldg. 08, Room 101  
Phone: 805.756.2378

Irrigation Emphasis Coordinator: Stuart W. Styles

Natural Resources Management and Environmental Sciences  
Bldg. 180, Room 209  
Phone: 805.756.2702

Water Policy/Watershed Management Emphasis Coordinator:  
Christopher G. Surfleet

The minor emphasizes one of three areas of study: irrigation, water policy, or watershed management. In California, 85% of the developed



water is used for irrigation. Irrigation water use and management have tremendous impacts upon ground water quality, power usage, crop yields, surface water supplies and quality, drainage problems, and water availability for transfer to urban uses. For students interested in the environment and water, the Water Science minor provides marketable skills.

## MS Agriculture, Specialization in Agricultural Engineering Technology

### Required Courses

BRAE 599	Thesis in BioResource and Agricultural Engineering	6
AG 581 or BRAE 581	Graduate Seminar Graduate Seminar in BioResource and Agricultural Engineering	1
SS 501	Research Planning	4
STAT 512	Statistical Methods	4
STAT 513	Applied Experimental Design and Regression Models	4
BRAE 521	Systems Analysis of Agricultural Systems	4

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses approved by the student's graduate committee

Total units 45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Animal Science

### Required Courses

ASCI 581	Graduate Seminar in Animal Science	3
AG 581	Graduate Seminar	1
STAT 512	Statistical Methods	4
STAT 513	Applied Experimental Design and Regression Models	4
AG 599	Thesis	6
Select from the following:		16
AG 500	Individual Study	
ASCI 403	Applied Biotechnology in Animal Science	
ASCI 405	Domestic Livestock Endocrinology	
ASCI 406	Applied Animal Embryology and Assisted Reproduction	
ASCI 415	HACCP for Meat and Poultry Operations	
ASCI 420	Animal Metabolism and Nutrition	
ASCI 438	Systemic Animal Physiology	
ASCI 440 or ASCI 540	Immunology and Diseases of Animals Advanced Immunology and Diseases of Animals	
ASCI 450	Computer Applications in Animal Science: Spreadsheet Analysis	
ASCI 500	Individual Study in Animal Science	

ASCI 503	Advanced Molecular Techniques in Animal Science
ASCI 593	Stem Cell Research Internship
ASCI 594	Applications in Stem Cell Research
AGED 438	Instructional Processes in Agricultural Education
BIO 501	Molecular & Cellular Biology
BIO 524	Developmental Biology Seminar
CHEM 528	Nutritional Biochemistry
NR 532	Applications in Biometrics and Econometrics

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses approved by the student's graduate committee

Total units 45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Crop Science

### Required Courses

CRSC 445	Cropping Systems	4
CRSC 581	Graduate Seminar in Crop/Fruit Production	3
CRSC 599	Thesis in Crop Science	6
HCS 511 or STAT 513	Ecological Biometrics Applied Experimental Design and Regression Models	4
HCS 570	Selected Topics in Horticulture and Crop Science	3
HCS 571	Selected Topics Laboratory in Horticulture and Crop Science	1
SS 501	Research Planning	4

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses, approved by the student's graduate committee

Total units 45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Dairy Products Technology

### Required Courses

DSCI 401	Physical and Chemical Properties of Dairy Products	4
DSCI 444	Dairy Microbiology	4
DSCI 570	Selected Topics in Dairy Science	3
DSCI 571	Selected Advanced Laboratory in Dairy Science	3
DSCI 581	Graduate Seminar in Dairy Science	3
DSCI 599	Thesis in Dairy Science	6
STAT 523	Design and Analysis of Experiments I	4

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses, approved by the student's graduate committee	18
Total units	45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Environmental Horticultural Science

### Required Courses

CRSC 581	Graduate Seminar in Crop/Fruit Production	3
or EHS 581	Graduate Seminar in Ornamental Horticulture	
HCS 500	Individual Study in Horticulture and Crop Science	4
HCS 511	Ecological Biometrics	4
or STAT 513	Applied Experimental Design and Regression Models	
HCS 570 & HCS 571	Selected Topics in Horticulture and Crop Science and Selected Topics Laboratory in Horticulture and Crop Science	4
SS 501	Research Planning	4
EHS 599	Thesis in Environmental Horticulture Science	6

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses approved by the student's graduate committee	20
Total units	45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Food Science and Nutrition

### Required Courses

FSN 581	Graduate Seminar in Food Science and Nutrition	3
FSN 599	Thesis	6
Select one of the following:		2-4
SS 501	Research Planning	
Other 400-500 level research methods course		
STAT 512	Statistical Methods	4

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses, approved by the student's graduate committee	28-30
Total units	45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Irrigation

### Required Courses

BRAE 405	Chemigation	1
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BRAE 414	Irrigation Engineering	4
BRAE 435	Drainage	4
BRAE 440	Agricultural Irrigation Systems	4
BRAE 438	Drip/Micro Irrigation	4
or BRAE 439	Vineyard Water Management	
BRAE 500	Individual Study	3
BRAE 532	Water Wells and Pumps	4
BRAE 533	Irrigation Project Design	4
BRAE 599	Thesis in BioResource and Agricultural Engineering	6
400-500 level research methods or statistics course		3

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses approved by the student's graduate committee	8
Total units	45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Plant Protection Science

### Required Courses

CRSC 581	Graduate Seminar in Crop/Fruit Production	3
or EHS 581	Graduate Seminar in Ornamental Horticulture	
HCS 511	Ecological Biometrics	4
or STAT 513	Applied Experimental Design and Regression Models	
HCS 570 & HCS 571	Selected Topics in Horticulture and Crop Science and Selected Topics Laboratory in Horticulture and Crop Science	4
PPSC 521	Plant-Pest Interactions	4
PPSC 599	Thesis	6
SS 501	Research Planning	4
Select from the following:		8
PPSC 405	Advanced Weed Management	
PPSC 414	Grape Pest Management	
PPSC 427	Disease and Pest Control Systems for Ornamental Plants	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses approved by the graduate committee	12
Total units	45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Recreation, Parks and Tourism Management

### Required Courses

POLS 510	Research Design	4
RPTA 450	Resource and Grant Development	4
RPTA 527	Leisure Behavior and Theory	4
RPTA 581	Graduate Seminar in Recreation, Parks and Tourism (1) (1)	2
RPTA 599	Thesis in Recreation, Parks and Tourism	9
STAT 513	Applied Experimental Design and Regression Models	4

### Approved Electives <sup>1</sup>

Any 400 and 500 level courses approved by the graduate committee	18
Total units	45

<sup>1</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## MS Agriculture, Specialization in Soil Science

### Required Courses <sup>1</sup>

SS 422	Soil Microbiology and Biochemistry	4
SS 423	Soil and Water Chemistry	5
SS 431	Soil Resource Inventory	4
SS 432	Soil Physics	5
SS 501	Research Planning	4
SS 508	Environmental Assessment for Erosion Control	3
SS 522	Advanced Soil Fertility	3
SS 581	Graduate Seminar in Forestry and Environmental Sciences	3
SS 582	GIS in Advanced Land Management	3
SS 599	Thesis	6

### Approved Electives <sup>2</sup>

Any 400 and 500 level courses approved by the graduate committee	5
Total units	45

<sup>1</sup> Soil Science students with credit in SS 422, SS 423, SS 431, or SS 432 from the undergraduate degree may substitute other courses in the Required Courses list.

<sup>2</sup> At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

## Agricultural Communication Minor

### Required Courses

JOUR 203	News Reporting and Writing	4
JOUR 205	Agricultural Communications	4
COMS 301	Business and Professional Communication	4
AGED 404	Agricultural Leadership	3
Approved Electives		15

For Majors in the College of Agriculture, Food and Environmental Sciences:

A minimum of 10 units must be at 300-400 level; two courses must be selected from JOUR, COMS, ENGL

For Majors in Journalism, Communication Studies, and other Non-agriculture Majors:

A minimum of 10 units must be at 300-400 level

Total units 30

## Geographic Information Systems for Agriculture Minor

### Required Courses

Select from the following: 2-4

BRAE 133 & BRAE 151	Introduction to Engineering Design Graphics and CAD for Agricultural Engineering	
CE 112 & CE 113	Design Principles in Civil Engineering and Computer Aided Drafting in Civil Engineering	
BRAE 239	Engineering Surveying	4
BRAE 345	Aerial Photogrammetry and Remote Sensing	3
NR/LA 218	Applications in GIS	3

Select from the following: 3

NR 418	Applied GIS	
BRAE 470 or LA 470 or HCS 470	Selected Advanced Topics	

### Emphasis areas

Select one of the following emphasis areas: 12

#### Environmental Information Emphasis

BRAE 447	Advanced Surveying with GIS Applications	
NR 306	Natural Resource Ecology and Habitat Management	
or BIO 325	General Ecology	
NR 416	Environmental Impact Analysis and Management	

#### Precision Agriculture Emphasis

CRSC 244	Precision Farming	
Select two of the following:		
BRAE 447	Advanced Surveying with GIS Applications	
CRSC 445	Cropping Systems	
HCS 410	Crop Physiology	
PPSC 405	Advanced Weed Management	
PPSC 431	Insect Pest Management	
SS 433	Land Use Planning	

VGSC 423 Advanced Vegetable Science

Total units

27-29

## Land Rehabilitation Minor

Before being admitted to the minor, students must have successfully completed the following courses: BOT 121 or BIO 114, SS 121, MATH 118.

At least one-half of the units must be at the 300-400 level. Generally, courses required for the student's major degree cannot be counted toward the minor, except that courses selected in the required core may count in both the major and minor programs. This and other course exceptions must be approved by the minor coordinator. As a guideline, students should take at least 20 units from outside their major degree program.

### Required Courses

Select from the following: 14

#### Plant area (select one course):

BOT 238	Central Coast Flora and Vegetation
BOT 433	Field Botany
EHS 381	Native Plants for California Landscapes

#### Soils area (select one course):

SS 321	Soil Morphology
SS 440	Forest and Range Soils

#### Ecological Principles (select one course):

AG 360	Holistic Management
BOT 326	Plant Ecology
NR 306	Natural Resource Ecology and Habitat Management

#### Project (select one course from):

Special Problems
Selected Advanced Topics
Senior Project
other course approved by the minor coordinator

### Approved Electives

Select from the following: 12

ASCI 329	Principles of Range Management
BOT 313	Taxonomy of Vascular Plants
BRAE 340	Irrigation Water Management
EHS 382	Restoration Horticulture
ERSC 202	Soil Erosion and Water Conservation
GEOG 318	Applications in GIS
HCS 124	Plant Propagation
MCRO 436	Environmental Microbiology
NR/LA 218	Applications in GIS
NR 307	Fire Ecology
NR 320	Watershed Management and Restoration
NR 408	Water Resource Law and Policy
PPSC 321	Weed Biology and Management
PPSC 327	Vertebrate Pest Management
SS 221	Fertilizers and Plant Nutrition

Total units

26

## Rangeland Resources Minor

Before being admitted to the program, students must have successfully completed the following courses: BIO 162, GE Area B1 MATH course, SS 121.

### Required Courses <sup>1</sup>

#### Range Resource Area

Select from the following: 7-8

ASCI 329	Principles of Range Management	
ASCI 370	Rangeland Improvements	
AG 360	Holistic Management	

#### Rangeland Animal Management Area

Select from the following: 4

ASCI 223	Systems of Sheep Management	
ASCI 311	Advanced Beef Cattle System Management	
ASCI 339	Internship in Animal Science	
BIO 427	Wildlife Management	

#### Rangeland Plant Physiology Area

BIO 435 Plant Physiology 4

#### Rangeland Ecology Area

Select from the following: 4

BOT 326	Plant Ecology	
NR 306	Natural Resource Ecology and Habitat Management	
PPSC 321	Weed Biology and Management	

#### Rangeland Measurements Area

Select from the following: 4

BIO 419	Ecological Methodology	
CRSC 411	Experimental Techniques and Analysis	
ERSC 202	Soil Erosion and Water Conservation	
SS 321	Soil Morphology	
SS 440	Forest and Range Soils	

#### Rangeland Policy/Planning Area

Select from the following: 3

ASCI 460	Rangeland Assessment and Planning	
CRP 342	Environmental Planning Methods	
NR/CRP 404	Environmental Law	
NR/CRP 408	Water Resource Law and Policy	
SS 433	Land Use Planning	

Total units 26-27

<sup>1</sup> At least one-half of the units must be 300-400 level. Select courses with advisor approval.

## Sustainable Agriculture Minor

### Required Courses

AG 315	Organic Agriculture	4
AG 339	Internship in Agriculture	4
AG 360	Holistic Management	4
CRSC 203	Organic Farming Enterprise Project	2

### Area Studies <sup>1</sup>

Select minimum of one course from each of the following areas: 15

Last updated: 04/22/15

### Agriculture and Society Area

AG 350	The Global Environment	
AGB 312	Agricultural Policy	
GEOG 301	Geography of Resource Utilization	
GEOG 333	Human Impact on the Earth	
NR 142	Environmental Management	
UNIV/POLS 333	World Food Systems	

### Production Agriculture Area

AGB 212	Agricultural Economics	
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
ASCI 221	Introduction to Beef Production	
ASCI 223	Systems of Sheep Management	
ASCI 311	Advanced Beef Cattle System Management	
BOT 323	Plant Pathology	
BRAE 340	Irrigation Water Management	
BUS 212	Financial Accounting for Nonbusiness Majors	
CRSC 445	Cropping Systems	
PPSC 321	Weed Biology and Management	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	
SS 221	Fertilizers and Plant Nutrition	

### Agroecology Area

NR 306	Natural Resource Ecology and Habitat Management	
NR 319	Natural Resource Ecology, Theories and Applications	
NR 323	Human Dimensions in Natural Resources Management	
PPSC 421	Plant-Pest Interactions	
ERSC 202	Soil Erosion and Water Conservation	
SS 321	Soil Morphology	

### Environmental Design Area

EDES 406	Sustainable Environments	
EHS 381	Native Plants for California Landscapes	
LA 202	Design Fundamentals I	
LA 221	California Plants and Plant Communities	

Total units 29

<sup>1</sup> Minimum 4 units at 300-400 level.

## Indigenous Studies in Natural Resources and the Environment Minor

### Required Courses

ES 241	Survey of Indigenous Studies (D3) (USCP)	4
ES/NR 360	Ethnicity and the Land (C4) (USCP)	4
NR 141	Introduction to Forest Ecosystem Management	3
or NR 142	Environmental Management	

### Emphasis

Select from the following: 8



ERSC/GEOG 325	Climate and Humanity
ES/NR 406	Indigenous Peoples and International Law and Policy
ES 450	Fieldwork in Comparative Ethnic Studies
NR/ES 308	Fire and Society (D5)
NR 323	Human Dimensions in Natural Resources Management (D5)
NR 335	Conflict Management in Natural Resources
PHIL 340	Environmental Ethics (C4)
<b>Approved Electives<sup>1</sup></b>	
At least 4 units must be upper division (300-400).	
Select from the following:	8
<b>Ethnic Studies</b>	
ES/CRP 215	Planning for and with Multiple Publics (USCP)
ES 243	Survey of Latino/a Studies (D3) (USCP)
ES 321	Native American Cultural Images (D5) (USCP)
ES/ARCH 326	Native American Architecture and Place (C4) (USCP)
ES 380	Critical Race Theory (D5) (USCP)
ES 381	The Social Construction of Whiteness (D5) (USCP)
ES 390	Research Methodology in Comparative Ethnic Studies
ES/NR 406	Indigenous Peoples and International Law and Policy
ES 450	Fieldwork in Comparative Ethnic Studies
<b>Natural Resource Management and Environmental Sciences</b>	
ERSC 202	Soil Erosion and Water Conservation
ERSC/GEOG 250	Physical Geography
ERSC/GEOG 325	Climate and Humanity
ERSC/GEOG 333	Human Impact on the Earth
ERSC/GEOL 402	Geologic Mapping
NR 215	Land and Resource Measurements
NR/LA 218	Applications in GIS
NR 260	Forest Practices and Environmental Protection
NR 306	Natural Resource Ecology and Habitat Management
NR 307	Fire Ecology
NR/ES 308	Fire and Society (D5)
NR 311	Environmental Measurements and Interpretation
NR 312	Technology of Wildland Fire Management
NR 320	Watershed Management and Restoration
NR 321	Water Systems Technology, Issues and Impacts (F)
NR 323	Human Dimensions in Natural Resources Management (D5)
NR 326	Natural Resources Economics and Valuation
NR 335	Conflict Management in Natural Resources

NR 340	Wildland Fire Management
NR/CRP 404	Environmental Law
NR 408	Water Resource Law and Policy
NR/BIO/SS 421	Wetlands
SS 121	Introductory Soil Science (B5)
SS 321	Soil Morphology
<b>Additional Electives</b>	
AG 350	The Global Environment (F)
AG 360	Holistic Management
ANT 201	Cultural Anthropology (D3)
ANT 312	Introduction to Cultural Resources Management
ANT 320	California's Native Past
ANT 330	Indigenous South Americans (D5)
ANT 415	Native American Cultures (USCP)
BIO 114	Plant Diversity and Ecology (B2 & B4)
BIO 227	Wildlife Conservation Biology (B2)
BIO 307	World Aquaculture: Applications, Methodologies and Trends
BIO 325	General Ecology
BIO 327	Wildlife Ecology
BIO 401	Conservation Biology
BIO 428	Marine Conservation and Policy
BOT 311	Plants, People and Civilization (B5)
ENGL 346	Ethnic American Literature (C4) (USCP)
ENGL 380	Literary Themes
FSN 250	Food and Nutrition: Customs and Culture (C4) (USCP)
GEOG 301	Geography of Resource Utilization (D5)
HIST 208	Survey of California History (USCP)
HUM/AG 330	Cal Poly Land: Nature, Technology, and Society (F)
LA 220	Landscape Ecology: Concepts, Issues and Interrelationships
LA 330	Cultural Landscapes: People, Places and Ethical Decisions
PHIL 340	Environmental Ethics (C4)
POLS 325	Global Political Issues (D5)
RPTA 302	Environmental and Wilderness Education
RPTA 413	Tourism and Protected Area Management
SPAN 351	Chicano/Latino Writers in the United States (C4) (USCP)
SOC 315	Global Race and Ethnic Relations (D5)
SOC 316	American Ethnic Minorities (USCP)

Total units

27

<sup>1</sup> Consultation with the minor advisor is desirable and recommended in selecting classes. If any of these courses is taken to meet a major, support, or general education requirement in the degree, it cannot be double-counted as an approved elective.

## Water Science Minor

### Required Courses

BRAE 340	Irrigation Water Management	4
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SS 121	Introductory Soil Science	4
NR 408	Water Resource Law and Policy	3

**Emphasis Area**

Select one emphasis area: 13-18

**Irrigation Emphasis**

Select 13 units from the following:

BRAE 237 Introduction to Engineering Surveying

or BRAE 239 Engineering Surveying

BRAE 331 Irrigation Theory

BRAE 405 Chemigation

BRAE 435 Drainage

BRAE 438 Drip/Micro Irrigation

BRAE 439 Vineyard Water Management

BRAE 440 Agricultural Irrigation Systems

BRAE 532 Water Wells and Pumps

**Water Policy Emphasis**

Select 17-18 units from the following:

AGB 315 Land Economics

AGB 409 California Agricultural Law

or NR 404 Environmental Law

NR 320 Watershed Management and Restoration

NR 435 Natural Resource Policy Analysis

SS 433 Land Use Planning

**Watershed Management Emphasis**

Select 16 units from the following:

NR 306 Natural Resource Ecology and Habitat  
Management

NR 320 Watershed Management and Restoration

NR 420 Advanced Watershed Hydrology

SS 440 Forest and Range Soils

Total units 24-29

## Agribusiness

Agriculture Bldg. (10), Room 210  
Phone: 805.756.5000; Fax: 805.756.5040  
<http://www.agb.calpoly.edu/>

Department Chair: Jay E. Noel

### Academic Programs

Program name	Program type
Agricultural Business	BS
Agribusiness	Minor, MS

The Agribusiness Management program prepares students for rewarding and satisfying careers in the dynamic and increasingly global agrifood and fiber system. The program provides a course of study that develops the requisite interpersonal and communication skills, critical thinking skills, and applied business skills that are required to have successful careers in an ever changing economic, technological, political, and social environment. Graduates are highly sought after by firms that produce and market food and fiber products, provide logistics and transportation services, market research services, banking and finance services, state and federal government agencies, agricultural organizations that provide commodity promotion, lobbying, and information services, and non-food and fiber businesses. Many graduates have gone on to earn law, masters of science, and masters of business administration degrees.

The Agribusiness Department curriculum provides a solid foundation in communication and leadership skills, economics, accounting, finance, marketing, and food and fiber policy. Students are encouraged to get involved with academic clubs, student teams, and internship programs. In addition, the curriculum allows for students to gain knowledge of the technical and scientific issues associated with production agriculture. The upper division curriculum structure provides students coursework that develops quantitative skills while having the flexibility to choose courses that allow them to pursue a generalist agribusiness perspective or focus on a specific agribusiness interest area, such as food marketing or finance. The course of study concludes with capstone courses that provide for the application of the interpersonal and communication skills, critical thinking skills, and applied business skills developed earlier in the curriculum.

### Undergraduate Programs

#### BS Agricultural Business

The Agribusiness Management program prepares students for exciting and satisfying careers in the dynamic and increasingly global agrifood and fiber system. The program provides a course of study that develops the requisite interpersonal and communication skills, knowledge base, critical thinking skills, and applied business skills that are required to have a successful career in an ever-changing economic, technological, political, and social environment. Our graduates are highly sought after by firms and organizations that span and support the agrifood system. Career opportunities for Cal Poly Agribusiness Management graduates range from companies that produce and market food and fiber products, provide logistics and transportation services, market research services, banking and finance services, to agricultural organizations that provide commodity promotion, lobbying, and information services, state and federal government agencies, and non-food and fiber businesses.

### Agribusiness Minor

In today's ever more complex, technology-driven world, it is a necessity for any graduate in agriculture to have some exposure to marketing, personnel management, financial management, budgeting, and economics if they are to succeed. The minor is designed to give students in the College of Agriculture, Food and Environmental Sciences this opportunity. Interested students must apply for acceptance into the minor through the Agribusiness Department.

### Graduate Program

#### MS Agribusiness

The Master of Science in Agribusiness is designed to enhance the agribusiness management, commodity marketing, and technical skills of graduate students with interests in international and domestic agribusiness:

#### Additional Prerequisites

A bachelor's degree and one course in each of the following areas: Intermediate microeconomics, macroeconomics, statistics, calculus or business calculus. Submit Graduate Record Exam (GRE) General Test scores (50 percentile required) electronically to Institution Code: R4038.

#### Program of Study

Graduate students must file a formal study plan with their major professor, graduate committee, college and university graduate studies office no later than the end of the quarter in which the 12<sup>th</sup> unit of approved courses is completed.

## BS Agricultural Business

### Program Learning Objectives

1. AGB students will exhibit critical thinking and complex problem-solving skills leading to engaging in lifelong learning.
2. AGB students will possess strong interpersonal and teamwork skills, as well as the ability to work independently.
3. AGB students will develop technical competency in their discipline but will also learn to think in a broader global context.
4. AGB students' actions will reflect professionalism, high ethical standards, and respect for diversity and sustainability.
5. AGB students will possess oral and written communication skills that are effective with diverse audiences (employers, employees, industry, and government).
6. AGB graduates are industry-ready with skills and knowledge employers' value.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA

- U.S. Cultural Pluralism (USCP)

Note: Up to 4 units of major or support courses may be selected as credit/no credit.

### MAJOR COURSES

AGB 101	Introduction to Agribusiness	4
AGB 202	Sales, Communication and Leadership in Agribusiness	4
AGB 212	Agricultural Economics	4
AGB 214	Agribusiness Financial Accounting	4
AGB 260	Agribusiness Information Technology	4
AGB 301	Food and Fiber Marketing	4
AGB 310	Agribusiness Credit and Finance	4
AGB 312	Agricultural Policy	4
AGB 313	Agriculture Economic Analysis	4
AGB 323	Agribusiness Managerial Accounting	4
AGB 327	Agribusiness Data Analysis	4
AGB 328	Decision Tools for Agribusiness	4
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)	4
AGB 460 & AGB 461	Research Methodology in Agribusiness and Senior Project	4
or AGB 462	Senior Project - Applied Agribusiness Problems	
or AGB 463	Senior Project - Agribusiness Consulting	
or AGB 464	Senior Project - Advanced Internship Experience in Agribusiness	

### Agribusiness general electives <sup>2</sup>

Select AGB courses at the 300-500 level	12
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### Agribusiness advanced applied elective

Select from the following:	4
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AGB 406	Agribusiness Marketing Planning	
AGB 410	Agricultural Lending	
AGB 427	Advanced Agribusiness Data Analysis	
AGB 450	Agribusiness Strategy Formulation	

### SUPPORT COURSES

BUS 207	Legal Responsibilities of Business	4
CHEM 110	World of Chemistry (B3 & B4) <sup>1</sup>	4
	Life science elective with lab (B2 & B4) or without lab (B2) <sup>1</sup>	4
ECON 222	Macroeconomics (D2) <sup>1</sup>	4
MATH 221	Calculus for Business and Economics (B1) <sup>1,3</sup>	4
STAT 251	Statistical Inference for Management I (B1) <sup>1</sup>	4

### Agricultural science and technology electives

Select from the following:	12
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#### Animals Area (select one):

ASCI 112	Principles of Animal Science	
ASCI 211	Meat Science	
ASCI 225	Introduction to Poultry Management	
ASCI 229	Anatomy and Physiology of Farm Animals	
ASCI 321	Zoonoses and Veterinary Public Health Concerns	
DSCI 201	Introduction to Dairy Nutrition and Feed Ingredients	

DSCI 230	General Dairy Husbandry	
DSCI 231	General Dairy Manufacturing	

#### Agronomic Area (select one):

CRSC 123	Forage Crops	
EHS 230	Environmental Horticulture	
FRSC 132	Pomology I	
FRSC 230	California Fruit Growing	
FRSC 311	Survey of Viticulture	
HCS 120	Principles of Horticulture and Crop Science	
SS 121	Introductory Soil Science	
SS 131	Soils in Environmental and Agricultural Systems	
SS 221	Fertilizers and Plant Nutrition	
VGSC 230	Introduction to Vegetable Science	

#### Other Science Area (select one):

BRAE 439	Vineyard Water Management	
FSN 125	Introduction to Food Science	
FSN 210	Nutrition	
FSN 230	Elements of Food Processing	
FSN 250	Food and Nutrition: Customs and Culture	
FSN 341	Wines and Fermented Foods	
FSN 370	Food Plant Sanitation and Prerequisite Programs	
WVIT 365	Wine Analysis and Amelioration	

### GENERAL EDUCATION (GE)

(See GE program requirements below.)	52
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### FREE ELECTIVES

Free Electives	20
Total units	180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> 500-level courses used for a baccalaureate degree may not be applied toward a master's degree or credential program. Consultation with advisor is recommended.

<sup>3</sup> Prerequisite: Passing score on appropriate Mathematics Placement Examination, or MATH 118 or equivalent.

## General Education (GE) Requirements

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics (no additional units required)	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course <sup>1</sup>	
Area C	Arts and Humanities	
C1	Literature	4

C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		52

<sup>1</sup> Required in Support; also satisfies GE.

## Agribusiness Minor

Note: One course in the minor may be graded credit/no credit.

### Required Courses

AGB 212	Agricultural Economics	4
AGB 214	Agribusiness Financial Accounting	4
or BUS 212	Financial Accounting for Nonbusiness Majors	
AGB 301	Food and Fiber Marketing	4
AGB 310	Agribusiness Credit and Finance	4
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)	4

### Approved Electives <sup>1</sup>

Select from the following: 8

AGB 202	Sales, Communication and Leadership in Agribusiness	
AGB 260	Agribusiness Information Technology	
AGB 312	Agricultural Policy	
AGB 318	Global Agricultural Marketing and Trade	
AGB 322	Principles of Agribusiness Management	
AGB 323	Agribusiness Managerial Accounting	
AGB 324	Agricultural Property Management and Sales	
AGB 326	Rural Property Appraisal	
AGB 331	Farm Accounting	
AGB 404	Food Retail Management	

Total units 28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## MS Agribusiness

### Required Courses

AGB 427	Advanced Agribusiness Data Analysis	4
AGB 450	Agribusiness Strategy Formulation	4
AGB 460	Research Methodology in Agribusiness	2-4
or SS 501	Research Planning	

Last updated: 04/22/15

AGB 514	Agribusiness Managerial Leadership and Communication	4
NR 532	Applications in Biometrics and Econometrics <sup>1</sup>	4
AGB 543	Agribusiness Policy and Program Analysis	4
AGB 554	Food System Marketing	4
AGB 555	Technological and Economic Change in Agribusiness	4
AGB 563	International Agribusiness Trade and Development	4
AGB 599	Thesis in Agribusiness	6
<b>Committee Approved Electives (400-500 level) <sup>2</sup></b>		7-8

At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level

Total units 47-50

<sup>1</sup> This course has particular statistical applications for economics and business forecasting that are appropriate to this program.

<sup>2</sup> Similar courses or course equivalents already completed at the undergraduate level require that the student complete additional "committee approved" elective units, but not reduce the degree unit requirement. Those electives are to be selected from the College of Agriculture, Food and Environmental Sciences or the Orfalea College of Business at the 400 or 500 level.



## Agricultural Education & Communication

Agriculture Bldg. (10), Room 244

Phone: 805.756.2803

<https://aged.calpoly.edu/>

Department Head: William C. Kellogg

### Academic Programs

Program name	Program type
Agricultural Communication	BS
Agricultural Science	BS
Agricultural Education	Master of

The Agricultural Education and Communication Department offers a Bachelor of Science degree in Agricultural Communication, a Bachelor of Science degree in Agricultural Science, and a Master of Agricultural Education.

### Continuing Education in Agriculture

Cal Poly and the Agricultural Education and Communication Department play an active role in the professional development and continuing education of high school and community college teachers of agriculture. Instructional staff and facilities are provided for workshops and training programs cooperatively sponsored by the University and the State of California. The campus offers an annual summer skills program. The content varies, depending upon the needs and desires of the teachers, as expressed through the California Agricultural Teachers' Association. Cal Poly faculty provide up-to-date training in the technical phases of agriculture and offer instruction in teaching methods.

## Undergraduate Programs

### BS Agricultural Communication

The BS Agricultural Communication program prepares students to become professional communicators in the agriculture industry and related fields. Graduates of the program are effective oral and written communicators with an applied knowledge of emerging new media. All students within the major take a common series of courses. The Brock Center for Agricultural Communication provides students the opportunity for industry linkages and professional preparation in this rapidly growing career area.

### BS Agricultural Science

The BS Agricultural Science program offers a choice of one of six concentrations plus approved electives that may be selected from one of two career pathways: preparation of future agriculture teachers for the public secondary schools of California, or professional preparation for broad-based agricultural occupations.

The teaching credential program provides for early field experience and professional education coursework in the undergraduate curriculum. Specialized preprofessional and professional courses are offered for undergraduate and graduate students.

Postbaccalaureate work is required of students seeking the Single Subject in Agriculture, and Agricultural Specialist credentials. Students interested in teaching agriculture may receive a B.S. degree in any of the agricultural science, production or management fields. Coursework

toward the teaching credential should be started early in order to complete the total curriculum most effectively.

Student teaching is a vital part of the program for the agriculture credential. Candidates must complete a minimum of 45 units of postgraduate coursework necessary for the preliminary teaching credential. For more information see, Teaching Credential Programs.

## Concentrations

### Agricultural Engineering Technology

Designed to develop knowledge and ability necessary to perform agricultural engineering/mechanical operations and processes.

### Agricultural Supplies and Services

Study of the consumable supplies and services needed in the production and post harvest phases of agriculture.

### Animal Science

Principles and practices related to the economic use of resources in the production of livestock and poultry.

### Crop and Soil Science

Principles and practices related to the economic use of resources in the culture and production of agricultural plants.

### Forestry and Natural Resources

Principles and practices involved in the conservation, multiple use or improvement of natural resources.

### Ornamental Horticulture

Principles and practices involved with the culture of plants used for ornamental or aesthetic purposes.

## Minor Program

In association with the Brock Center for Agricultural Communication, selected interdisciplinary courses in Journalism, Graphic Communications, English, Communication Studies and Agriculture make up the Agricultural Communication minor. Career preparation includes a breadth and depth in agriculture along with a foundation in journalism, and an industry internship. For more information about the minor, see College of Agriculture, Food and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>)

## Graduate Program

### Master of Agricultural Education

#### General Characteristics

The Master of Agricultural Education program provides students with the opportunity to focus their graduate study in agricultural education, with an emphasis on preparing candidates for positions as teachers of agricultural education in public schools. The degree is a non-thesis, terminal program that provides practitioners with opportunities for professional development. At least one year of successful high school or community college teaching is required for completion of this degree program. Working with their advisor and graduate committee, students generally complete projects for coursework in the program that enhance their employment settings, or assist them to become compliant with statewide standards in agricultural education.

## Prerequisites

For consideration as a graduate student, an applicant will have completed a bachelor's degree from an accredited college or university with a minimum grade point average of 2.75 in the last 90 quarter units. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing. An applicant not meeting these academic standards, but who meets the basic CSU standards of a grade point average of 2.5 in the last 90 quarter units attempted, may be conditionally admitted.

All applicants who do not speak and write English as their primary language are required to complete the Test of English as a Foreign Language (TOEFL), with a minimum score of 550, and the Test of Written English (TWE), with a minimum score of 4.5.

## Program of Study

Graduate students must file a formal study plan for the degree with the Graduate Coordinator of the College of Agriculture, Food and Environmental Sciences no later than the end of the quarter in which the 12th unit of approved courses is completed. The formal program of study must include at least 45 units of committee-approved graduate coursework; at least half of the units required by the committee as reflected on the formal study plan must be at the 500 level. Students should refer to the course descriptions in the catalog for credit limitations of individual courses; for example, total credit for AG 500, Individual Study, is limited to six units. All candidates must meet the current Graduation Writing Requirement.

All students are required to pass an oral comprehensive examination which is normally given during the final quarter of the program of study. A written comprehensive exam is required of all students in the Master of Agricultural Education degree program.

## BS Agricultural Communication

### Program Learning Objectives

1. Demonstrate and apply excellent written, verbal, listening and visual communication skills.
2. Demonstrate knowledge of current communications practices, including effective writing, layout and design, photography, computer skills, and oral communication.
3. Demonstrate the ability to work in a professional communications setting through experiential-learning (i.e. internships, work experience, student organizations).
4. Analyze and communicate effectively about major issues in agriculture.
5. Understand the importance of effective communication in the agriculture industry.
6. Use and evaluate technologies that enhance the communication process.
7. Apply ethical practices in daily work and recognize media and corporate roles and responsibilities in society.
8. Demonstrate awareness and sensitivity to cultural demographics of an increasingly global agriculture industry.
9. Develop a high degree of agricultural literacy and an adequate reservoir of skills and knowledge in agricultural subjects to meet the need of the agricultural communication profession and the industry.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#MINIMUMREQUIREMENTSFORGRADUATION>) section of this catalog, including:

- 2.0 GPA
- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major courses may be taken as credit/no credit.

### MAJOR COURSES

AGC 102	Orientation to Agricultural Communication	2
AGC 339	Internship in Agricultural Communications	4
AGC 407	Agricultural Publications	4
AGC 426	Presentation Methods in Agricultural Communication	4
AGED 404	Agricultural Leadership	3
AGED 460	Research Methodology in Agricultural Education and Communication	1
AGC 461	Senior Project I	1
AGC 462	Senior Project II	1
BIO 111	General Biology (B2 & B4) <sup>1</sup>	4
or BIO 161	Introduction to Cell and Molecular Biology	
CHEM 110	World of Chemistry (B3 & B4) <sup>1</sup>	4
COMS 301	Business and Professional Communication	4
COMS 416	Intercultural Communication (USCP)	4
ECON 222	Macroeconomics (D2) <sup>1</sup>	4
ENGL 310	Corporate Communication	4
GRC 377	Web and Print Publishing	4
or JOUR 390	Visual Communication for the Mass Media	
JOUR 203	News Reporting and Writing	4
JOUR 205	Agricultural Communications	4
JOUR 312	Public Relations	4
MATH 118	Precalculus Algebra (B1) <sup>1, 2</sup>	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
or STAT 218	Applied Statistics for the Life Sciences	

### Agricultural Business and Economics

AGB 212	Agricultural Economics	4
AGB 301	Food and Fiber Marketing	4
AGB 312	Agricultural Policy	4

### Agricultural Systems Technology

BRAE 121	Agricultural Mechanics	2
BRAE 141	Agricultural Machinery Safety	3

### Animal Science

ASCI 112	Principles of Animal Science	4
Select from the following:		4
ASCI 221	Introduction to Beef Production	

ASCI 222	Systems of Swine Production	
ASCI 223	Systems of Sheep Management	
ASCI 224	Equine Science	
ASCI 225	Introduction to Poultry Management	
DSCI 230	General Dairy Husbandry	
<b>Diversity of Agriculture</b>		
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	4
<b>Environment and Natural Resources</b>		
SS 121	Introductory Soil Science	4
or SS 131	Soils in Environmental and Agricultural Systems	
AG 360	Holistic Management (F) <sup>1</sup>	4
BRAE 340	Irrigation Water Management	4
NR 308	Fire and Society (D5) <sup>1</sup>	4
or NR 323	Human Dimensions in Natural Resources Management	
<b>Food Science</b>		
FSN 230	Elements of Food Processing	4
FSN 275	Elements of Food Safety	4
<b>Plant Science</b>		
HCS 120	Principles of Horticulture and Crop Science	4
<b>Agricultural Issues</b>		
Select from the following:		4
AG 452	Issues Affecting California Agriculture	
BOT/HCS 329	Plants, Food, and Biotechnology	
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		44
<b>FREE ELECTIVES</b>		
Free Electives		7
Total units		180

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> MATH 116 and MATH 117 substitute

## General Education (GE) Requirements

- 72 units required, 28 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4

C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Major) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (4 units in Major) <sup>1</sup>	0
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective (4 units in Major) <sup>1</sup>	0
Total units		44

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> MATH 116 and MATH 117 substitute

## BS Agricultural Science

### Program Learning Objectives

1. Possess the well-rounded subject matter breadth and depth required to effectively teach subject matter in agriculture.
2. Professionally communicate and articulate knowledge to others in multi modal, succinct and creative teaching styles.
3. Can lead and direct individuals and groups in thought and action.
4. Analyze and communicate effectively about major issues in agriculture.
5. Demonstrate cultural competencies in an increasingly global agricultural industry and society.
6. Develop a high degree of agricultural literacy.
7. Demonstrate critical thinking and problem solving skills.
8. Seamlessly and professionally integrate technology into instructional practices.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, student must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

AGED 102	Introduction to Agricultural Education	2
AGED 404	Agricultural Leadership	3
AGED 460	Research Methodology in Agricultural Education and Communication	1

AGED 461	Senior Project I	1
AGED 462	Senior Project II	1
Select from the following:		4
AG 360	Holistic Management	
AG 450	Applied Holistic Management	
AG 452	Issues Affecting California Agriculture	
AGB 202	Sales, Communication and Leadership in Agribusiness	4
AGB 301	Food and Fiber Marketing	4
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)	4
ASCI 112	Principles of Animal Science (B2)	4
ASCI 225	Introduction to Poultry Management	4
BRAE 121	Agricultural Mechanics	2
BRAE 141	Agricultural Machinery Safety	3
Select from the following:		4
CRSC 123	Forage Crops	
FRSC 230	California Fruit Growing	
VGSC 190	California Vegetable Production	
VGSC 230	Introduction to Vegetable Science	
DSCI 230	General Dairy Husbandry	4
Select from the following:		4
DSCI 231	General Dairy Manufacturing	
FSN 230	Elements of Food Processing	
EHS 230	Environmental Horticulture	4
HCS 120	Principles of Horticulture and Crop Science	4
SS 121	Introductory Soil Science	4
Concentration courses (see below)		22

**SUPPORT COURSES**

CHEM 110	World of Chemistry (B3 & B4) <sup>1</sup>	4
BRAE 340	Irrigation Water Management (Area F) <sup>1</sup>	4
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
KINE 250	Healthy Living (D4) <sup>1</sup>	4
MATH 118	Precalculus Algebra (B1) <sup>1,2</sup>	4
or MATH 119	Precalculus Trigonometry	
NR 308	Fire and Society (D5) <sup>1</sup>	4
or NR 323	Human Dimensions in Natural Resources Management	
Approved Electives <sup>3</sup>		28

Select either the teaching agriculture or individualized career area:

**Teaching Agriculture**

BUS 212	Financial Accounting for Nonbusiness Majors	
or AGB 214	Agribusiness Financial Accounting	
or AGB 321	Farm Records	
AGED 303	FFA and Supervised Agricultural Experience	
& AGED 350	and Early Field Experience in Agriculture Education	
or AGED 330	FFA and Supervised Agriculture Programs	
AGED 410	Computer Applications in Agricultural Education	
EDUC 410	Social, Historical and Ethical Perspectives on Teaching and Learning	
EDUC 412	Access to Learning in a Pluralistic Society	

EDUC 414	Curriculum and Inquiry in Public Schools	
Select from the following:		

Any course with a prefix in AG, AGB, ASCI, BRAE, CRSC, DSCI, ERSC, FRSC, FSN, HCS, NR, PPSC, RPTA, SS, VGSC, WVIT;

AGED 220	Agricultural Youth Conferences	
BUS 207	Legal Responsibilities of Business	
IME 142	Manufacturing Processes: Materials Joining	
ECON 222	Macroeconomics	
KINE 305	Drug Education	
PHYS 121	College Physics I	

**Individualized**

Courses that meet the requirements leading to a minor at Cal Poly.

16 to 23 units must be at the 300-400 level depending on concentration.

**GENERAL EDUCATION (GE)**

(See GE program requirements below.)

44

**FREE ELECTIVES**

Free Electives <sup>4</sup>	1
Total units	180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> MATH 116 and MATH 117 substitute

<sup>3</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>4</sup> Note: Electives within the College (CAFES), excluding AGED courses, are required for teaching credential candidates.

**Concentrations (Select one)**

- Agricultural Engineering Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agriculturaleducationcommunication/bsagriculturalscience/agriculturalengineeringtechnologyconcentration>)
- Agricultural Supplies and Services (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agriculturaleducationcommunication/bsagriculturalscience/agriculturalsuppliesandservicesconcentration>)
- Animal Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agriculturaleducationcommunication/bsagriculturalscience/animalscienceconcentration>)
- Crop and Soil Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agriculturaleducationcommunication/bsagriculturalscience/cropandsoilscienceconcentration>)
- Forestry and Natural Resources (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/>)

agricultural education communication/bs agricultural science/ forestry and natural resources concentration)

- Ornamental Horticulture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agricultural education communication/bs agricultural science/ ornamental horticulture concentration>)

## General Education (GE) Requirements

- 72 units required, 28 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup>	4
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Support) <sup>1</sup>	0
D5	Upper-division elective (4 units in Support) <sup>1</sup>	0
Area F	Technology	
F	Upper-division elective (4 units in Support) <sup>1</sup>	0
Total units		44

<sup>1</sup> Required in Support; also satisfies GE

## Agricultural Engineering Technology Concentration

Note: MATH 119 is a prerequisite for some BRAE courses.

BRAE 133	Introduction to Engineering Design Graphics	1
BRAE 237	Introduction to Engineering Surveying	2
BRAE 321	Agricultural Safety	3
BRAE 335	Internal Combustion Engines	4

### Approved Electives <sup>1,2</sup>

Select from the following:	12
BRAE 142	Agricultural Power and Machinery Management
BRAE 151	CAD for Agricultural Engineering
BRAE 152	3-D Solids Modeling
BRAE 239	Engineering Surveying
BRAE 240	Agricultural Engineering Laboratory
BRAE 301	Hydraulic and Mechanical Power Systems
BRAE 324	Principles of Agricultural Electrification
BRAE 331	Irrigation Theory
BRAE 337	Landscape Irrigation
BRAE 348	Energy for a Sustainable Society
BRAE 438	Drip/Micro Irrigation
BRAE 439	Vineyard Water Management
BRAE 481	Advanced Agricultural Mechanics
PHYS 121	College Physics I
Total units	22

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> 3 units at 300–400 level

## Agricultural Supplies and Services Concentration

AGB 212	Agricultural Economics	4
AGB 214	Agribusiness Financial Accounting	4
AGB 310	Agribusiness Credit and Finance	4
AGB 312	Agricultural Policy	4

### Approved Electives <sup>1</sup>

Select from the following:	6
AGB 303	Introduction to the Horse Racing Industry
AGB 313	Agriculture Economic Analysis
AGB 314	Fair and Fair Facility Management
AGB 318	Global Agricultural Marketing and Trade
AGB 322	Principles of Agribusiness Management
AGB 323	Agribusiness Managerial Accounting
AGB 331	Farm Accounting
AGB 370	World Food Economy
AGB 404	Food Retail Management
AGB 409	California Agricultural Law
AGB 410	Agricultural Lending
AGB 440	Field Studies in Agribusiness
AGB 445	Produce Marketing
AGB 455	Advanced Fair Management Seminar
WVIT 343	Branded Wine Marketing
Total units	22

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.



## Animal Science Concentration

Select from the following:	8
ASCI 211 Meat Science	
ASCI 221 Introduction to Beef Production	
ASCI 222 Systems of Swine Production	
ASCI 223 Systems of Sheep Management	
ASCI 220 Introductory Animal Nutrition and Feeding	4
or DSCI 201 Introduction to Dairy Nutrition and Feed Ingredients	
DSCI 330 Artificial Insemination and Embryo Biotechnology	4
<b>Approved Electives</b> <sup>1</sup>	
Select from the following:	6
ASCI 305 Game Bird Propagation and Management	
ASCI 311 Advanced Beef Cattle System Management	
ASCI 325 Egg Production, Processing and Distribution	
ASCI 329 Principles of Range Management	
ASCI 330 Poultry Meat Production and Processing	
ASCI 342 Poultry Business Management	
ASCI 384 Processed Meat Products	
ASCI 415 HACCP for Meat and Poultry Operations	
ASCI 425 Meat Industry Study Tour	
ASCI 430 Animal Feed Processing	
ASCI 476 Issues in Animal Agriculture	
ASCI 480 Advanced Integration of Livestock and Meat Production	
DSCI 301 Dairy Cattle Nutrition	
DSCI 333 Dairy Animal Health, Safety and Applied Technology	
Total units	22

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Crop and Soil Science Concentration

ERSC 202 Soil Erosion and Water Conservation	4
Select course not taken in major:	4
CRSC 123 Forage Crops	
FRSC 230 California Fruit Growing	
VGSC 190 California Vegetable Production	
VGSC 230 Introduction to Vegetable Science	
PPSC 311 Agricultural Entomology	4
SS 221 Fertilizers and Plant Nutrition	4
<b>Approved Electives</b> <sup>1</sup>	
Select from the following:	6
CRSC 333 Greenhouse Vegetable Production	
CRSC 445 Cropping Systems	
FRSC 342 Citrus and Avocado Fruit Production	
HCS 421 Postharvest Technology of Horticultural Crops	

VGSC 423 Advanced Vegetable Science

Total units 22

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Forestry and Natural Resources Concentration

BIO 227 Wildlife Conservation Biology	4
NR 142 Environmental Management	3
NR 208 Dendrology	4
NR 306 Natural Resource Ecology and Habitat Management	4

### Approved Electives<sup>1</sup>

Select from the following:	7
NR 312 Technology of Wildland Fire Management	
NR 320 Watershed Management and Restoration	
NR 321 Water Systems Technology, Issues and Impacts	
NR 402 Forest Health	
NR/CRP 404 Environmental Law	
NR/CRP 408 Water Resource Law and Policy	
NR/ES 308 Fire and Society	
or NR 323 Human Dimensions in Natural Resources Management	
NR/ES 360 Ethnicity and the Land	
NR/GEOG/LA 317 The World of Spatial Data and Geographic Information Technology	
NR/LA 218 Applications in GIS	

Total units 22

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Ornamental Horticulture Concentration

EHS 123 Landscape Installation and Maintenance	4
HCS 124 Plant Propagation	4
EHS 438 Teaching Methods in Environmental Horticulture	4

### Approved Electives<sup>1</sup>

Select from the following:	10
EHS 343 Turfgrass Management	
EHS 402 Retailing Horticultural Products	
EHS 424 Nursery Crop Production	
EHS 433 Golf Course Management Operations	
EHS 434 Landscape Management	
EHS 437 Park and Public Space Management	
EHS/RPTA 430 Sports Field Construction and Management	

Total units 22

- <sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## **Master of Agricultural Education**

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### **Required Courses**

AGED 520	Program Development in Agricultural Education	3
AGED 522	Instructional Programs in Agricultural Mechanics	3
AGED 539	Graduate Internship in Agricultural Education	6
Approved Electives <sup>1</sup>		33
Total units		45

- <sup>1</sup> Any 400- and 500-level courses approved by the student's graduate committee.  
 No fewer than 11 units must be at the 500 level.  
 Students are required to complete one year of successful teaching prior to the comprehensive written and oral examinations.

## Animal Science

Agriculture Bldg. (10), Room 141  
Phone: 805.756.2419; Fax: 805.756.5069  
<http://animalscience.calpoly.edu>

Department Head: Jaymie Noland

### Academic Programs

Program name	Program type
Animal Science	BS
Equine Science	Minor
Meat Science and Processing	Minor
Poultry Management	Minor
Rangeland Resources	Minor

Animal Science offers students the opportunity to apply the principles of animal biology, husbandry and behavior, with molecular biology and other life sciences to a variety of species. Students can apply these principles to farm animals, exotic animals, laboratory animals, and to their own pets. The curriculum is very flexible, which allows students to work with their faculty advisor to plan an individual curriculum in line with their interests and career goals. This is a comprehensive "hands-on, learn-by-doing" program, so students work with animals of several species on a regular basis. Students learn the science and practical applications to be effective problem-solvers and leaders as they move on to professional and graduate schools, animal production and management, food processing, or numerous other career opportunities.

Students may select coursework in one of the following areas: pre-veterinary medicine, food animal production, equine science, poultry management, agribusiness, biotechnology, comparative animal biology studies, rangeland resource management, and meat science.

The department offers a wide assortment of co-curricular activities including five different student clubs, competitive livestock and horse judging teams and intercollegiate dressage and equestrian teams. Students participate in organizing and conducting service meetings, seminars and field days sponsored by the department.

In addition, students are involved with faculty in research and development of new technologies related to animal health and production, using state-of-the-art equipment, facilities and technologies. Through extensive undergraduate research opportunities, students are prepared for careers in discovery, science and innovation.

### Experiential Learning

The Animal Science Department has extensive modern animal facilities for hands-on experience. The department is supported by state-of-the-art biotechnology labs, a new beef center, beef cattle evaluation center, new animal nutrition center for animal food manufacturing, and an extensive equine center with breeding barn, labs, new stalls and training arenas. Additionally, students are able to use nearly 6,000 acres of rangeland, a swine center, sheep center, a state-of-the-art poultry center, an on-campus veterinary clinic for student learning and a new meat processing center.

The department maintains beef cattle, horses, sheep, swine, and poultry. These animal operations are supported by an on-campus veterinary clinic, meat processing facilities, and an animal nutrition center. By actively participating in the management of the herds and

flocks, students simulate the larger commercial operations of the industry. The enterprise system is another valuable experience for students, and industry internships are strongly encouraged.

The department has an active role in the management of the Swanton-Pacific Ranch and is developing environmentally sound resource management practices including intensive controlled grazing, multiple species grazing, and using the grazing animal as a tool to enhance the total environment of the ranch. Cal Poly's Animal Science major provides the knowledge and understanding to apply new technologies for the fast-changing, technology-driven world in which we live. The department's focus is to help students build a plan for personal and professional growth. Students develop the ability to apply and manage technology, and they also learn how to be team players, with the ability to solve problems utilizing leadership and professional communication skills. Most importantly, students are taught how to learn so they can adapt to the future.

## Undergraduate Programs

### BS Animal Science

Students in the Animal Science Department study a variety of disciplines including pre-veterinary medicine, animal biotechnology, food animal production in beef, sheep and swine, comparative animal biology, equine science, poultry management, range resource management and meat science.

Through the use of Cal Poly's extensive rangelands, irrigated pastures, housing and handling structures, as well as laboratory and research facilities, students experientially learn about the different areas of study. This learn-by-doing education gives students opportunities not only to work closely with animals, but also their professors. Because the animal science major incorporates a vast assortment of interests, the curriculum is very flexible to work with students' career goals.

### Equine Science Minor

The Equine Science minor is designed for students interested in developing a knowledge of, and competency in, the areas of equine training, nutrition and reproduction. This science-based program exposes students to various aspects of the horse industry, including basic equine management, training, and breeding farm management. By completing this minor, students gain an understanding of the principles and practices used within the equine industry.

### Meat Science and Processing Minor

The minor incorporates knowledge of general food science, basic meat science and the principles and practices of adding value to raw materials through livestock harvesting, carcass fabrication and the manufacture of further processed meat and poultry products. Opportunities for business and management training are available. The minor meets the requirements needed to become eligible for jobs with the government or commercial meat processing firms and other businesses associated with the production of food products containing meat or poultry. In addition to the required courses, selected courses address basic principles of microbiology, food science, food sanitation and safety, food chemistry and process control procedures, and other optional courses are offered in agribusiness.

### Poultry Management Minor

The Poultry Management minor prepares students for a wide variety of positions in the commercial poultry industry and in many allied services

related directly to the industry. Career opportunities are many and varied.

Students have an opportunity to conduct enterprise projects in the production of market eggs, hatching eggs, meat birds, replacement pullets, turkey, and game birds, which give them valuable experience in production techniques as well as exposure to a number of business activities related to production. Advanced students may have opportunities to study special topics related to problems in management of commercial poultry flocks.

The program is supported by a state-of-the-art poultry production facility. Cal Poly's Poultry Unit is now considered one of the best in the Western United States; it accommodates commercial laying hen operation, egg processing facility, hatching, meat processing facility and battery and floor pen research facilities. These production facilities allow students to gain hands-on learning which complements their formal class work, and provides real-world experience.

## Rangeland Resources Minor

The department participates in offering an interdisciplinary minor in Rangeland Resources. Please see College of Agriculture, Food and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>) section for more information.

## Graduate Programs

Cal Poly offers a Master of Science degree in Agriculture with a specialization in Animal Science. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>) section of the College of Agriculture, Food and Environmental Sciences.

## BS Animal Science

### Program Learning Objectives

1. ASCI graduates will demonstrate problem solving skills.
2. ASCI graduates demonstrate a proficiency in working as a leader and as a part of a team to achieve common goals.
3. ASCI graduates are able to integrate and apply technical and conceptual knowledge.
4. ASCI graduates exhibit an understanding of their professional and ethical responsibilities as animal scientists.
5. ASCI graduates can communicate effectively in a professional manner.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA

- U.S. Cultural Pluralism (USCP)

Note: No major or support courses that are graded may be taken as credit/no credit.

### MAJOR COURSES

ASCI 101	Introduction to the Animal Sciences	2
ASCI 112	Principles of Animal Science	4
ASCI 211	Meat Science	4
ASCI 220	Introductory Animal Nutrition and Feeding	4
ASCI 229	Anatomy and Physiology of Farm Animals	4
ASCI 290	Animal Production and Management Enterprise <sup>1</sup>	4
ASCI 304	Animal Genomics	3
ASCI 351	Reproductive Physiology	4
ASCI 363	Undergraduate Seminar	2
ASCI 477	Senior Project - Research Experience in Animal Science	3
or ASCI 478	Senior Project - Advanced Internship Experience in Animal Science	
or ASCI 479	Senior Project - Current Topics in Animal Science	

### Production courses

Select one from each of the three categories: 12

#### Ruminants

- ASCI 221 Introduction to Beef Production  
or ASCI 223 Systems of Sheep Management

#### Nonruminants

- ASCI 222 Systems of Swine Production  
or ASCI 225 Introduction to Poultry Management

#### Companion Animals

- ASCI 224 Equine Science  
or ASCI 227 Companion Animal Science

From the Biochemistry/Chemistry, Nutrition, Physiology, Technology/Management and Approved Electives courses, 26-27 units must be upper-division, depending on the number of upper-division units taken in Support courses.

### Biochemistry/Chemistry

Select from the following: 4-5

- ASCI 320 Physiological Chemistry of Animals  
CHEM 313 Survey of Biochemistry and Biotechnology  
CHEM 371 Biochemical Principles

### Nutrition

Select from the following: 3-4

- ASCI 346 Equine Nutrition  
ASCI 350 Applied Nonruminant Nutrition  
ASCI 355 Ruminant Nutrition  
ASCI 420 Animal Metabolism and Nutrition

### Physiology

Select from the following: 3-5

- ASCI 333 Equine Reproduction  
ASCI 347 Equine Exercise Physiology  
ASCI 366 Veterinary Pharmacology  
ASCI 405 Domestic Livestock Endocrinology  
ASCI 406 Applied Animal Embryology and Assisted Reproduction  
ASCI 438 Systemic Animal Physiology

ASCI 440	Immunology and Diseases of Animals	
<b>Technology/Management</b>		
Select from the following:		6-9
AG 360	Holistic Management	
or AG 450	Applied Holistic Management	
ASCI 310	Technical Veterinary Skills	
ASCI 311	Advanced Beef Cattle System Management	
ASCI 312	Production Medicine	
ASCI 325	Egg Production, Processing and Distribution	
ASCI 329	Principles of Range Management	
ASCI 330	Poultry Meat Production and Processing	
ASCI 342	Poultry Business Management	
ASCI 384	Processed Meat Products	
ASCI 403	Applied Biotechnology in Animal Science	
ASCI 406	Applied Animal Embryology and Assisted Reproduction	
ASCI 407	Assisted Reproduction Technologies of Gametes and Embryos Laboratory	
ASCI 410	Applied Animal Behavior Science	
ASCI 415	HACCP for Meat and Poultry Operations	
ASCI 440	Immunology and Diseases of Animals	
ASCI 450	Computer Applications in Animal Science: Spreadsheet Analysis	
ASCI 455	Advanced Equine Reproductive Technologies	
<b>Approved electives</b>		
Select courses from a career elective area (CEA); see Approved Electives Guide, below		28
<b>SUPPORT COURSES</b>		
BIO 111	General Biology (B2 & B4) <sup>2</sup>	4
or BIO 161	Introduction to Cell and Molecular Biology	
BIO 302	Human Genetics	4-5
or BIO 303	Survey of Genetics	
or BIO 351	Principles of Genetics	
CHEM 111	Survey of Chemistry (B3 & B4) <sup>2</sup>	5-4
or CHEM 127	General Chemistry for Agriculture and Life Science I	
CHEM 312	Survey of Organic Chemistry <sup>3</sup>	5
or CHEM 316	Organic Chemistry I	
MATH 118	Precalculus Algebra <sup>4</sup>	4
or MATH 161	Calculus for the Life Sciences I	
STAT 218	Applied Statistics for the Life Sciences (B1) <sup>2</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(see GE program requirements below.)		56
<b>FREE ELECTIVES</b>		
Free Electives		0-9
Total units		180

## Approved Electives Guide

Approved electives have been categorized by career area to guide students in their selections. Advisor approval of electives is not required, but consultation with an advisor is recommended to ensure that the required number of upper-division units is met. Also, bear in

mind that selection may impact pursuit of post-baccalaureate studies and/or goals.

### Approved Career Elective Areas

Select Career Elective Area (CEA) of choice: 28

### Pre-Veterinary Medicine Career Elective Area

a) Core (26 units):

BIO 162	Introduction to Organismal Form and Function
CHEM 128	General Chemistry II
CHEM 129	General Chemistry III
CHEM 317	Organic Chemistry II
PHYS 121	College Physics I
PHYS 122	College Physics II

b) Select 2 units from the following:

ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 315	Equine Biomechanics <sup>6</sup>
ASCI 320	Physiological Chemistry of Animals <sup>6</sup>
ASCI 333	Equine Reproduction <sup>6</sup>
ASCI 339	Internship in Animal Science <sup>5</sup>
ASCI 347	Equine Exercise Physiology <sup>6</sup>
ASCI 366	Veterinary Pharmacology <sup>6</sup>
ASCI 405	Domestic Livestock Endocrinology <sup>6</sup>
ASCI 420	Animal Metabolism and Nutrition <sup>6</sup>
ASCI 438	Systemic Animal Physiology <sup>6</sup>
ASCI 440	Immunology and Diseases of Animals <sup>6</sup>
BIO 161	Introduction to Cell and Molecular Biology <sup>6</sup>
BIO 303	Survey of Genetics <sup>6</sup>
BIO 351	Principles of Genetics <sup>6</sup>
CHEM 318	Organic Chemistry III
CHEM 371	Biochemical Principles <sup>6</sup>
CHEM 372	Metabolism
DSCI 330	Artificial Insemination and Embryo Biotechnology <sup>6</sup>

MATH/HNRS 141	Calculus I (B1) <sup>6</sup>
or MATH 161	Calculus for the Life Sciences I
MATH/HNRS 142	Calculus II (B1)
or MATH 162	Calculus for the Life Sciences II
MCRO 221	Microbiology
PHYS 123	College Physics III

### Biotechnology Career Elective Area

ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 339	Internship in Animal Science <sup>5</sup>
ASCI 366	Veterinary Pharmacology <sup>6</sup>
ASCI 403	Applied Biotechnology in Animal Science <sup>6</sup>



ASCI 405	Domestic Livestock Endocrinology <sup>6</sup>	DSCI 330	Artificial Insemination and Embryo Biotechnology
ASCI 406	Applied Animal Embryology and Assisted Reproduction <sup>6</sup>	NR 142	Environmental Management
ASCI 407	Assisted Reproduction Technologies of Gametes and Embryos Laboratory	NR/LA 218	Applications in GIS
ASCI 440	Immunology and Diseases of Animals <sup>6</sup>	SPAN 101	Elementary Spanish I
BIO 161	Introduction to Cell and Molecular Biology <sup>6</sup>	SS 121	Introductory Soil Science
BIO 162	Introduction to Organismal Form and Function	<b>Comparative Animal Biology Studies Career Elective Area</b>	
BIO 351	Principles of Genetics <sup>6</sup>	ASCI 203	Animal Parasitology
BIO/CHEM 475	Molecular Biology Laboratory	ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
BIO/CHEM 476	Gene Expression Laboratory	or ASCI 490	Advanced Animal Production and Management Enterprise
CHEM 128	General Chemistry II	ASCI 321	Zoonoses and Veterinary Public Health Concerns
CHEM 129	General Chemistry III	ASCI 339	Internship in Animal Science <sup>5</sup>
CHEM 316	Organic Chemistry I <sup>6</sup>	BIO 162	Introduction to Organismal Form and Function
CHEM 317	Organic Chemistry II	BIO 227	Wildlife Conservation Biology
CHEM 373	Molecular Biology	BIO 263	Introductory Ecology and Evolution
CHEM 377	Chemistry of Drugs and Poisons	BIO 325	General Ecology
CHEM 474	Protein Techniques Laboratory	BIO 327	Wildlife Ecology
CHEM 477	Biochemical Pharmacology	BIO 442	Behavioral Ecology
CHEM 478	Pharmaceutical Development	PSY 458	Learning
MCRO 221	Microbiology	ZOO 321	Mammalogy
MCRO 224	General Microbiology I	ZOO 323	Ornithology
MCRO 225	General Microbiology II	ZOO 341	Herpetology
SCM 201	Orientation to Biotechnology	ZOO 425	Parasitology
<b>Food Animal Production Career Elective Area</b>		<b>Equine Science Career Elective Area</b>	
AG 360	Holistic Management (GE Area F) <sup>6</sup>	ASCI 214	Equine Management
AGB 321	Farm Records	ASCI 224	Equine Science <sup>6</sup>
AGB 322	Principles of Agribusiness Management	ASCI 228	Equine Evaluation
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)	ASCI 265	Equine Behavior and Training
ASCI 221	Introduction to Beef Production <sup>6</sup>	ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
ASCI 222	Systems of Swine Production <sup>6</sup>	or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 223	Systems of Sheep Management <sup>6</sup>	ASCI 315	Equine Biomechanics <sup>6</sup>
ASCI 225	Introduction to Poultry Management <sup>6</sup>	ASCI 324	Advanced Equine Evaluation
ASCI 226	Livestock Evaluation	ASCI 329	Principles of Range Management <sup>6</sup>
ASCI 290	Animal Production and Management Enterprise <sup>5</sup>	ASCI 333	Equine Reproduction <sup>6</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise	ASCI 339	Internship in Animal Science <sup>5</sup>
ASCI 311	Advanced Beef Cattle System Management <sup>6</sup>	ASCI 344	Equine and Human Communication
ASCI 312	Production Medicine <sup>6</sup>	ASCI 345	Equine Behavior Modification
ASCI 329	Principles of Range Management <sup>6</sup>	ASCI 346	Equine Nutrition <sup>6</sup>
ASCI 339	Internship in Animal Science <sup>5</sup>	ASCI 347	Equine Exercise Physiology <sup>6</sup>
ASCI 450	Computer Applications in Animal Science: Spreadsheet Analysis <sup>6</sup>	ASCI 455	Advanced Equine Reproductive Technologies <sup>6</sup>
BIO 427	Wildlife Management	<b>Poultry Management Career Elective Area</b>	
CRSC 123	Forage Crops	a) Core (23 units):	
DSCI 230	General Dairy Husbandry	ASCI 225	Introduction to Poultry Management <sup>6</sup>
DSCI 301	Dairy Cattle Nutrition	ASCI 325	Egg Production, Processing and Distribution <sup>6</sup>
		ASCI 330	Poultry Meat Production and Processing <sup>6</sup>
		ASCI 342	Poultry Business Management
		ASCI 350	Applied Nonruminant Nutrition <sup>6</sup>

ASCI 415	HACCP for Meat and Poultry Operations <sup>6</sup>
b) Select 5 units from the following:	
AGB 310	Agribusiness Credit and Finance
AGB 409	California Agricultural Law
ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 339	Internship in Animal Science <sup>5</sup>
ASCI 440	Immunology and Diseases of Animals <sup>6</sup>
BUS 207	Legal Responsibilities of Business
BUS 212	Financial Accounting for Nonbusiness Majors
BUS 346	Principles of Marketing
ENGL 310	Corporate Communication
FSN 275	Elements of Food Safety
FSN 334	Food Packaging
FSN 335	Food Quality Assurance
FSN 370	Food Plant Sanitation and Prerequisite Programs

#### Rangeland Resource Management Career Elective Area

AG 360	Holistic Management (GE Area F) <sup>6</sup>
ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 311	Advanced Beef Cattle System Management <sup>6</sup>
ASCI 329	Principles of Range Management <sup>6</sup>
ASCI 370	Rangeland Improvements
ASCI 460	Rangeland Assessment and Planning
BIO 263	Introductory Ecology and Evolution
BIO 435	Plant Physiology
NR 306	Natural Resource Ecology and Habitat Management
NR 320	Watershed Management and Restoration
NR 335	Conflict Management in Natural Resources
NR 418	Applied GIS
NR/CRP 404	Environmental Law
NR/LA 218	Applications in GIS
SS 121	Introductory Soil Science
SS 321	Soil Morphology

#### Meat Science Career Elective Area

ASCI 216	Meat Grading and Evaluation
ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 339	Internship in Animal Science <sup>5</sup>
ASCI 384	Processed Meat Products <sup>6</sup>
ASCI 415	HACCP for Meat and Poultry Operations <sup>6</sup>
ASCI 425	Meat Industry Study Tour
ASCI 480	Advanced Integration of Livestock and Meat Production
FSN 125	Introduction to Food Science
FSN 275	Elements of Food Safety

FSN 370	Food Plant Sanitation and Prerequisite Programs
MCRO 221	Microbiology
MCRO 421	Food Microbiology
<b>Agribusiness Career Elective Area</b>	
AGB 212	Agricultural Economics
AGB 214	Agribusiness Financial Accounting
or AGB 321	Farm Records
or BUS 212	Financial Accounting for Nonbusiness Majors
AGB 301	Food and Fiber Marketing
AGB 310	Agribusiness Credit and Finance
AGB 312	Agricultural Policy
AGB 313	Agriculture Economic Analysis
AGB 315	Land Economics
AGB 322	Principles of Agribusiness Management
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)
ASCI 290	Animal Production and Management Enterprise <sup>5</sup>
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 311	Advanced Beef Cattle System Management <sup>6</sup>
ASCI 329	Principles of Range Management <sup>6</sup>
ASCI 384	Processed Meat Products <sup>6</sup>
ASCI 415	HACCP for Meat and Poultry Operations <sup>6</sup>

Total units 28

- 1 ASCI 490 may be substituted for ASCI 290.
- 2 Required in Support; also satisfies GE
- 3 Transfer equivalents CHEM 212, CHEM 216
- 4 MATH 116 and MATH 117 substitute
- 5 A maximum of 6 units of CR/NC courses may be counted toward approved electives.
- 6 If any of these courses is taken to meet a major/support requirement, it cannot be double-counted as an approved elective.

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4

C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		56

<sup>1</sup> Required in Support; also satisfies GE

## Equine Science Minor

### Required Courses

ASCI 112	Principles of Animal Science (B2)	4
ASCI 220	Introductory Animal Nutrition and Feeding	4
ASCI 224	Equine Science	4
ASCI 315	Equine Biomechanics	3-4
or ASCI 347	Equine Exercise Physiology	
ASCI 333	Equine Reproduction	5
ASCI 346	Equine Nutrition	4
Select from the following:		3
May not include courses taken in the Required courses section		

ASCI 315	Equine Biomechanics
ASCI 324	Advanced Equine Evaluation
ASCI 329	Principles of Range Management
ASCI 339	Internship in Animal Science
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 344	Equine and Human Communication
ASCI 345	Equine Behavior Modification
ASCI 347	Equine Exercise Physiology

Total units 27-28

## Meat Science and Processing Minor

Prerequisite: One quarter of chemistry.

### Required Courses

ASCI 211	Meat Science	4
ASCI 384	Processed Meat Products	4
or ASCI 330	Poultry Meat Production and Processing	
ASCI 415	HACCP for Meat and Poultry Operations	3
MCRO 221	Microbiology	4

### Selected Courses

Select from the following:	12-15
7 units must be at upper-division level	

Last updated: 04/22/15

ASCI 112	Principles of Animal Science
ASCI 226	Livestock Evaluation
ASCI 290	Animal Production and Management Enterprise
ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 339	Internship in Animal Science
ASCI 450	Computer Applications in Animal Science: Spreadsheet Analysis
ASCI 479	Senior Project - Current Topics in Animal Science
AG 360	Holistic Management
DSCI 444	Dairy Microbiology
FSN 125	Introduction to Food Science
or FSN 230	Elements of Food Processing
FSN 364	Food Chemistry
FSN 370	Food Plant Sanitation and Prerequisite Programs
MCRO 421	Food Microbiology
Any upper-division AGB course	

Total units 27-30

## Poultry Management Minor

### Required Courses

ASCI 225	Introduction to Poultry Management	4
ASCI 325	Egg Production, Processing and Distribution	4
ASCI 330	Poultry Meat Production and Processing	4
ASCI 342	Poultry Business Management	4
ASCI 350	Applied Nonruminant Nutrition	4
ASCI 415	HACCP for Meat and Poultry Operations	3

### Approved Electives

Select from the following:	4
AGB 310	Agribusiness Credit and Finance
ASCI 290	Animal Production and Management Enterprise
or ASCI 490	Advanced Animal Production and Management Enterprise
ASCI 339	Internship in Animal Science
BUS 212	Financial Accounting for Nonbusiness Majors
BUS 346	Principles of Marketing
ENGL 310	Corporate Communication
FSN 275	Elements of Food Safety
FSN 334	Food Packaging
FSN 335	Food Quality Assurance
FSN 370	Food Plant Sanitation and Prerequisite Programs

Total units 27

# BioResource & Agricultural Engineering

BioResource & Agricultural Engineering Bldg. (08), Room 101  
Phone: 805.756.2378; Fax: 805.756.2626  
<http://brae.calpoly.edu/>

Department Head: Art MacCarley

## Academic Programs

Program name	Program type
Agricultural Systems Management	BS
BioResource and Agricultural Engineering	BS

The department offers two programs leading to a Bachelor of Science degree: BioResource and Agricultural Engineering and Agricultural Systems Management.

The BioResource and Agricultural Engineering Department is an engineering-based educational organization consisting of professionals whose mission is the study, teaching, and practice of engineering and systems management support for agriculture. The department is nationally recognized as a leader in this field, and for balancing theory with application and principle with practice.

Department facilities include well-equipped laboratories for hydraulic systems, evaluation and testing of power units, fabrication of agricultural machinery, agricultural electrical systems, design and construction of agricultural structures, photogrammetry, microcomputers and controllers.

Outdoor facilities include a water resources center with multiple pumping systems and operational canals, a field for evaluation of various irrigation systems including an operating linear move and land for experience in the mechanical production of farm products and safe operation of agricultural machinery.

Students are encouraged to participate in the student clubs of the department. The Agricultural Engineering Society is involved in a broad range of activities and services including Open House displays. The student branch of the American Society of Agricultural Engineers offers professional and co-curricular activities.

## Undergraduate Programs

### BS Agricultural Systems Management

The mission of the Agricultural Systems Management program is to provide a "learn by doing" undergraduate educational experience that prepares students for systems management practice in support of agriculture and related industries throughout the West.

Students receive broad agricultural training with a business and management emphasis in one of the following areas: plant production, livestock production, food and fiber processing, environmental information management, water/irrigation, and processing and manufacturing. Students have the opportunity to develop management expertise through interdisciplinary experiences in agricultural technology and business oriented coursework.

The objectives of the Agricultural Systems Management program are to produce graduates who, in 3-5 years after graduation, are successful as one of the following:

- Individuals that are successful in technical, business, or management positions within agriculture or related industries
- Applying unique engineering problem-solving skills and principles so that they are "industry ready" to undertake technological, business, or management projects and make significant contributions from day one on the job
- Actively pursuing professional development such as a degree in an advanced degree program, professional license, or technical certification

Agricultural Systems Management graduates demonstrate a knowledge and understanding of basic agricultural technologies and agribusiness principles necessary for technical operations and business management careers in agriculture and related industries; an understanding of modern science and practice within a specialized agricultural area of interest; and ability to apply quantitative, analytical processes for developing solutions to technological, business or management problems associated with production, processing, or the distribution of products and support services in agriculture and related industries; an understanding of the interconnected "systems" of agriculture; and ability to safely and properly handle the materials, machines, sensors, tools and techniques of modern agricultural or technical operations; and an ability to communicate and perform as effective agricultural systems management professionals in the solution of problems crossing discipline or cultural boundaries.

Career opportunities are available in the manufacturing, sales, and service of agricultural equipment and machinery; management and production of animals and crops; processing of food and fiber; and management of water/irrigation facilities. The program is recognized by the American Society of Agricultural Engineers.

### BS BioResource and Agricultural Engineering

The bioresource/agricultural engineer represents the most general type of engineer, adept at utilizing electrical and mechanical energy sources, water resources, and designing structural units. The curriculum features a unique combination of engineering and applied science coursework, with a focus on preparing graduates for practice in professional engineering.

The mission of the BioResource and Agricultural Engineering program is to provide a "learn by doing" undergraduate educational experience that prepares students for engineering practice in support of agriculture and related industries throughout the West.

The objectives of the BioResource and Agricultural Engineering program are to produce graduates who, in 3-5 years after graduation, are successful as one of the following:

- Engineers in positions of professional responsibility and leadership in a modern multi-disciplinary, system-oriented environment that emphasizes problem solving
- Actively pursuing professional development such as a degree in an advanced degree program, professional license, or technical certification
- Applying unique engineering problem-solving skills and principles within a career outside traditional engineering environments, such as management, teaching, research, or other professional fields

BioResource and Agricultural Engineering graduates demonstrate a knowledge and understanding of the basic mathematics, physical and engineering sciences necessary for modern agricultural engineering

practice; the ability to design components, systems or processes to meet specified objectives, including prudent use of resources; an understanding of their professional and ethical responsibilities as agricultural engineers, including the societal impact of engineering solutions and the need to engage in life-long learning; the ability to plan, design, execute and evaluate engineering solutions to problems/projects that are real, practical and of a complexity representative of projects encountered in beginning professional practice; and the ability to communicate and perform as effective engineering professionals in both individual and team-based project environments.

Cal Poly's "learn by doing" philosophy is emphasized by the numerous design-centered laboratories and the senior project. In the senior design project, which is completed in a three-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Consistent with program accreditation requirements regarding a graduate's ability to function on multidisciplinary teams, the BioResource and Agricultural Engineering program has adopted an explicit graduation requirement in this area. This provides students an opportunity to practice team skills. Such experience is important for practicing engineers given the ever-increasing diversity of engineering science and applications. Methods to fulfill this requirement include items such as:

- Team senior project
- CO-OP or internship employment
- Certain club activities
- Working with faculty on a sponsored project
- Project embedded in curriculum
- Taking certain technical electives
- Service learning project

Career opportunities exist in the design, evaluation and management of systems -- irrigation, drainage, hydrology, soil conservation; agricultural machinery; food processing; and agricultural environments. The program is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

## Minors

The department participates in offering interdisciplinary minors in Water Science and Geographic Information Systems. Please see College of Agriculture, Food and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>) section for more information.

## Graduate Program

Cal Poly offers the MS in Agriculture with specializations in Agricultural Engineering Technology and in Irrigation, and the MS in Engineering with a specialization in Water Engineering. Please see College of Agriculture, Food and Environmental Sciences and College of Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>) sections for more information.

# BS Agricultural Systems Management

## Program Learning Objectives

1. An ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
2. An ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
3. An ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
4. An ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
5. An ability to function effectively as a member or leader on a technical team;
6. An ability to identify, analyze, and solve broadly-defined engineering technology problems;
7. An ability to apply written, oral, and graphical communication in both technical and non-technical environments; and an ability to identify and use appropriate technical literature;
8. An understanding of the need for and an ability to engage in self-directed continuing professional development;
9. An understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
- 10A knowledge of the impact of engineering technology solutions in a societal and global context; and
- 11A commitment to quality, timeliness, and continuous improvement.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

BRAE 128	Careers in Bioresource and Agricultural Engineering	2
BRAE 129	Laboratory Skills and Safety	1
BRAE 133	Introduction to Engineering Design Graphics	1
BRAE 141	Agricultural Machinery Safety	3
BRAE 142	Agricultural Power and Machinery Management	4
BRAE 151	CAD for Agricultural Engineering	1
BRAE 152	3-D Solids Modeling	1



BRAE 203	Agricultural Systems Analysis	4
BRAE 237	Introduction to Engineering Surveying	2-4
or BRAE 239	Engineering Surveying	
BRAE 301	Hydraulic and Mechanical Power Systems	4
BRAE 321	Agricultural Safety	3
BRAE 324	Principles of Agricultural Electrification	4
BRAE 340	Irrigation Water Management	4
BRAE 342	Agricultural Materials	4
BRAE 343	Mechanical Systems Analysis	4
BRAE 348	Energy for a Sustainable Society (Area F) <sup>1</sup>	4
BRAE 418	Agricultural Systems Management I	4
BRAE 419	Agricultural Systems Management II	4
BRAE 425	Computer Controls for Agriculture	3
BRAE 432	Agricultural Buildings	4
BRAE 460	Senior Project Organization	1
BRAE 461	Senior Project I	2
BRAE 462	Senior Project II	2

**Approved Electives <sup>2</sup>**

See Approved Electives below 15

**SUPPORT COURSES**

AGB 212	Agricultural Economics	4
AGB 301	Food and Fiber Marketing	4
AGB 310	Agribusiness Credit and Finance	4
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)	4
BUS 212	Financial Accounting for Nonbusiness Majors	4
or AGB 214	Agribusiness Financial Accounting	
CHEM 110	World of Chemistry (B3&B4) <sup>1</sup>	4-5
or CHEM 111	Survey of Chemistry	
ENGL 148	Reasoning, Argumentation and Professional Writing (A3) <sup>1</sup>	4
or ENGL 145	Reasoning, Argumentation, and Writing	
Select from the following:		4
MATH 119	Precalculus Trigonometry (B1) <sup>1</sup>	
STAT 217	Introduction to Statistical Concepts and Methods	
or STAT 218	Applied Statistics for the Life Sciences	
MATH 221	Calculus for Business and Economics (B1)	4
PHYS 121	College Physics I	4
SS 121	Introductory Soil Science	4

**Animal or plant production course**

Any ASCI, CRSC, DSCI, FRSC, HCS, PPSC, VGSC course except for internship or enterprise courses. 3

**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 52

**FREE ELECTIVES**

Free Electives 0

Total units 180-183

**Approved Electives**

Minimum of 6 units must be upper division

No more than 4 units of internship or enterprise may be used

Select from the following: 15

Last updated: 04/22/15

Any AGB course eligible for the Agribusiness minor

AGED 102	Introduction to Agricultural Education
AGED 330	FFA and Supervised Agriculture Programs
BRAE 152	3-D Solids Modeling
BRAE 236	Principles of Irrigation
BRAE 302	Servo Hydraulics
BRAE 331	Irrigation Theory
BRAE 335	Internal Combustion Engines
BRAE 337	Landscape Irrigation
BRAE 344	Fabrication Systems
BRAE 345	Aerial Photogrammetry and Remote Sensing
BRAE 405	Chemigation
BRAE 435	Drainage
BRAE 438	Drip/Micro Irrigation
BRAE 439	Vineyard Water Management
BRAE 440	Agricultural Irrigation Systems
BRAE 447	Advanced Surveying with GIS Applications
BRAE 448	Bioconversion
BRAE 532	Water Wells and Pumps
CHEM 212	Introduction to Organic Chemistry
FSN 125	Introduction to Food Science
FSN 204	Food Processing Operations
FSN 230	Elements of Food Processing
FSN 275	Elements of Food Safety
FSN 330	Introduction to Principles of Food Engineering
FSN 334	Food Packaging
FSN 341	Wines and Fermented Foods
FSN 354	Packaging Function in Food Processing
FSN 370	Food Plant Sanitation and Prerequisite Programs
FSN 375	Food Safety
FSN 444	Food Engineering
IME 141	Manufacturing Processes: Net Shape
IME 142	Manufacturing Processes: Materials Joining
IME 143	Manufacturing Processes: Material Removal
IME 144	Introduction to Design and Manufacturing
IME 157	Electronics Manufacturing
IME 319	Human Factors Engineering
IME 320	Human Factors and Technology
IT 330	Packaging Fundamentals
IT 341	Packaging Polymers and Processing
NR 218	Applications in GIS
NR 306	Natural Resource Ecology and Habitat Management
NR 408	Water Resource Law and Policy
NR 416	Environmental Impact Analysis and Management
SS 221	Fertilizers and Plant Nutrition

**Plant or Animal Production Course**

Any ASCI, CRSC, DSCI, FRSC, HCS, PPSC, VGSC course except for internship or enterprise courses

- <sup>1</sup> Required in Major/Support; also satisfies GE
- <sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## General Education (GE) Requirements

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective (4 units in Major) <sup>1</sup>	0
Total units		52

- <sup>1</sup> Required in Major/Support; also satisfies GE

## BS BioResource and Agricultural Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering,
2. An ability to design and conduct experiments, as well as to analyze and interpret data,
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability,

4. An ability to function on multidisciplinary teams,
5. An ability to identify, formulate, and solve engineering problems,
6. An understanding of professional and ethical responsibility,
7. An ability to communicate effectively,
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context,
9. A recognition of the need for, and an ability to engage in life-long learning,
10. A knowledge of contemporary issues,
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice,

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

BRAE 128	Careers in Bioresource and Agricultural Engineering	2
BRAE 129	Laboratory Skills and Safety	1
BRAE 133	Introduction to Engineering Design Graphics	1
BRAE 151	CAD for Agricultural Engineering	1
BRAE 152	3-D Solids Modeling	1
BRAE 216	Fundamentals of Electricity	4
BRAE 232	Agricultural Structures Planning	4
BRAE 234	Introduction to Mechanical Systems in Agriculture	4
BRAE 236	Principles of Irrigation	4
BRAE 239	Engineering Surveying	4
BRAE 312	Hydraulics	4
BRAE 320	Principles of Bioresource Engineering	4
BRAE 328	Measurements and Computer Interfacing	4
BRAE 331	Irrigation Theory	3
BRAE 403	Agricultural Systems Engineering	4
BRAE 414	Irrigation Engineering	4
BRAE 421	Equipment Engineering	3
BRAE 422	Equipment Engineering	4
BRAE 433	Agricultural Structures Design	4
BRAE 460	Senior Project Organization	1
BRAE 461	Senior Project I	2
BRAE 462	Senior Project II	2

### Approved Electives <sup>2</sup>

Select from the following:		6-8
BRAE 302	Servo Hydraulics	

BRAE 335	Internal Combustion Engines	
BRAE 345	Aerial Photogrammetry and Remote Sensing	
BRAE 348	Energy for a Sustainable Society	
BRAE 405	Chemigation	
BRAE 427	Agricultural Process Engineering	
BRAE 435	Drainage	
BRAE 447	Advanced Surveying with GIS Applications	
BRAE 448	Bioconversion	
BRAE 532	Water Wells and Pumps	
BRAE 533	Irrigation Project Design	
any upper division CE course		
CHEM 312	Survey of Organic Chemistry	
any upper division ENVE course		
IME 319	Human Factors Engineering	
MCRO 421	Food Microbiology	
any upper division ME course		
<b>SUPPORT COURSES</b>		
Select from the following:		4
BIO 213	Life Science for Engineers	
ENGR/BRAE 213	Bioengineering Fundamentals	
or MCRO 221 Microbiology		
Select from the following:		6
CE 201	Mechanics of Materials	
CE 204	Mechanics of Materials I	
& CE 207	and Mechanics of Materials II	
CHEM 124	General Chemistry for the Engineering Disciplines I (B3 & B4) <sup>1</sup>	4
CHEM 125	General Chemistry for the Engineering Disciplines II (Add'l Area B) <sup>1</sup>	4
Select from the following:		2-3
CSC 231	Programming for Engineering Students	
or CSC 232	Computer Programming for Scientists and Engineers	
or CSC 234	C and Unix	
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
or ECON 222	Macroeconomics	
EE 321	Electronics	4
& EE 361	and Electronics Laboratory	
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
ME 302	Thermodynamics I	3
PHYS 141	General Physics IA	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
SS 121	Introductory Soil Science	4

Last updated: 04/22/15

STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
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**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 36

**FREE ELECTIVES**

Free Electives 0

Total units 188-191

<sup>1</sup> Required in Support; also satisfies GE<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.**General Education (GE) Requirements**

- 72 units required, 36 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	no additional units are required
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		36

<sup>1</sup> Required in Support; also satisfies GE

## Dairy Science

Building 10, Room 121  
Phone: 805.756.2560; Fax: 805.756.6667  
dsci.calpoly.edu

Interim Department Head: Charlie Crabb

### Academic Programs

Program name	Program type
Dairy Products Technology	MPS
Dairy Science	BS, Minor

### Experiential Learning

Excellent facilities are provided for students. The dairy herd includes 110 each of milking-age registered Jerseys and Holsteins, located on a well-planned unit where feeding, milking, calf raising, artificial insemination, and management are carried out. Both herds are recognized for their high production and outstanding type.

The modern dairy facility includes the Dairy Cattle Instructional Building, containing the milking parlor, meetings rooms and classrooms, a nutrition and physiology lab, a microbiology lab, and a computer lab dedicated to dairy management and application software.

The campus creamery is well-equipped with modern processing equipment. Students are employed on a part-time basis to work in both the production and processing areas.

### Dairy Products Technology Center

The Dairy Products Technology Center (DPTC) focuses on multidisciplinary dairy foods research and training activities designed to support the dairy industry and consumers of dairy products. Current research areas are: cheese chemistry and technology, bioseparation processes, and new product and process development. The Center has state-of-the-art research and development as well as technology transfer facilities. Students may conduct dairy foods related research projects under the guidance of Dairy Science faculty. Opportunities also exist to work on joint projects with other institutions.

## Undergraduate Programs

### BS Dairy Science

The Bachelor of Science degree in Dairy Science is designed to prepare students for employment in the various phases of the dairy industry, as well as related fields. All students within the major take a common core of courses and select additional courses in an area of interest, which may include: dairy farm or plant management, processing technology, agriculture communication, management, preparation for graduate or veterinary school, and agriculture teaching.

### Dairy Science Minor

The purpose of this minor is to help students from other disciplines gain a basic understanding of the terminology and practices used within the field of dairy science. The curriculum is flexible enough to accommodate students' interests in animal and/or food-oriented aspects of Dairy Science. After completion of the minor, students should have a basic understanding of cattle, dairy nutrition, milk production and management as well as dairy food processing, quality

and regulatory control. Specific programs are designed to reflect the individual student's interests and needs.

The Dairy Science Minor requires two introductory courses. Students must obtain prior program approval from the Dairy Science Minor Coordinator in selecting an additional five courses according to their interests and goals. A minimum of 26 hours is required for the minor, at least half of which must be at the 300 and 400 level.

## Graduate Programs

### MS Agriculture, Specialization in Dairy Products Technology

Cal Poly offers a Master of Science degree in Agriculture with a specialization in Dairy Products Technology. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>) section of the College of Agriculture, Food and Environmental Sciences.

### MPS Dairy Products Technology

#### *New program, effective Fall 2013*

The Master of Professional Studies in Dairy Products Technology is an innovative program designed to prepare students from technical disciplines for rewarding and lucrative careers in the large-scale industrial dairy foods manufacturing industry. The program recruits students with critical thinking and analytical skills they will have developed while obtaining degrees in physical sciences, certain life sciences, or other technical disciplines. Through the use of experience based learning and project-based learning students will develop the essential knowledge to succeed in the international dairy foods industry.

### Program of Study

Graduate students in the MPS in Dairy Products Technology program will be required to take a prescribed program of study that will give them the understanding of the industry structure, unit operations, sanitation, quality control and regulatory requirements. In addition, graduates will have developed the leadership skills and experience that is necessary to control and guide teams in industrial dairy plant operations. Three quarters of on campus course work will be followed by a one-quarter internship related to industrial dairy foods manufacturing. To graduate with the MPS in Dairy Products Technology students must pass a one-day practical examination following the internship.

### Admission Requirements

A Bachelor degree obtained in a field with substantial analytical and critical thinking. Preference is given for degrees in physical or life sciences. Prospective students are required to submit a cover letter identifying interests, goals, and experience relevant to the MPS program and a resume. Submit a Graduate Record Exam (GRE) General Test scores electronically to Institution Code: 4038.

Those who do not possess a bachelor degree from a postsecondary institution where English is the principal language of instruction must take either the Test of English as a foreign language (TOEFL) or the International English Language Testing System (IELTS) exam.

The TOEFL must have been taken within the last two years with a minimum score of 550 (paper version), 213 (computerized version) or 80 (internet based). The minimum score for the IELTS is 6.0.

## BS Dairy Science

### Program Learning Objectives

1. Technical competency within the disciplines of Dairy Science (Dairy Husbandry and Dairy Products Technology), with particular emphasis on the science, industry and practice.
2. Effective communication skills and leadership.
3. An advanced level of critical thinking skills and problem solving capability.
4. The capability of maintaining consistent, professional behavior and performance in a rapidly changing work environment.
5. Strong awareness of society as a whole and of agriculture's place in society.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

#### MAJOR COURSES

DSCI 100	Enterprise Project	2
or DSCI 339	Internship in Dairy Science	
DSCI 121	Elements of Dairying	4
or DSCI 230	General Dairy Husbandry	
DSCI 123	Dairy Science Orientation	1
DSCI 201	Introduction to Dairy Nutrition and Feed Ingredients	4
DSCI 223	Frozen Dairy Foods	4
or DSCI 241	Dairy Cattle Selection, Breeds, Fitting and Showing	
DSCI 231	General Dairy Manufacturing	4
DSCI 233	Milk Processing and Inspection	4
DSCI 234	Dairy Foods Evaluation	2
DSCI 301	Dairy Cattle Nutrition	4
or DSCI 401	Physical and Chemical Properties of Dairy Products	
DSCI 321	Lactation Physiology	4
or DSCI 444	Dairy Microbiology	
DSCI 330	Artificial Insemination and Embryo Biotechnology	4
or DSCI 434	Cheese and Fermented Dairy Foods	
DSCI 333	Dairy Animal Health, Safety and Applied Technology	4
or DSCI 402	Quality Assurance and Control of Dairy Products	
DSCI 422	Breeding and Genetics of Dairy Cattle	4
or DSCI 435	Concentration/Fractionation and Butter Technology	

DSCI 432	Advanced Dairy Herd Management	4
or DSCI 433	Dairy Plant Management and Equipment	
DSCI 461	Senior Project	3
DSCI 463	Undergraduate Seminar	2

#### SUPPORT COURSES

MCRO 221	Microbiology (B2 & B4) <sup>1</sup>	4
CHEM 111	Survey of Chemistry (B3 & B4) <sup>1</sup>	4-5
or CHEM 127	General Chemistry for Agriculture and Life Science I	
BIO 111	General Biology	4-5
or BIO 161	Introduction to Cell and Molecular Biology	
or CHEM 312	Survey of Organic Chemistry	
MATH 118	Precalculus Algebra <sup>1, 2</sup>	4

#### Approved electives <sup>3</sup>

At least 18 units must be 300-400 level

Consult with academic advisor regarding career tracks

Select from the following:		45
AGB 212	Agricultural Economics	
AGB 214	Agribusiness Financial Accounting	
AGB 301	Food and Fiber Marketing	
AGB 310	Agribusiness Credit and Finance	
AGB 321	Farm Records	
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
AGED 102	Introduction to Agricultural Education	
AGED 330	FFA and Supervised Agriculture Programs	
AGED 404	Agricultural Leadership	
ASCI 112	Principles of Animal Science	
ASCI 211	Meat Science	
ASCI 216	Meat Grading and Evaluation	
ASCI 221	Introduction to Beef Production	
ASCI 226	Livestock Evaluation	
ASCI 229	Anatomy and Physiology of Farm Animals	
ASCI 304	Animal Genomics	
ASCI 310	Technical Veterinary Skills	
ASCI 311	Advanced Beef Cattle System Management	
ASCI 312	Production Medicine	
ASCI 351	Reproductive Physiology	
ASCI 366	Veterinary Pharmacology	
ASCI 405	Domestic Livestock Endocrinology	
ASCI 420	Animal Metabolism and Nutrition	
ASCI 438	Systemic Animal Physiology	
ASCI 440	Immunology and Diseases of Animals	
BIO 162	Introduction to Organismal Form and Function	
BIO 303	Survey of Genetics	
BRAE 121	Agricultural Mechanics	
BRAE 141	Agricultural Machinery Safety	
BUS 212	Financial Accounting for Nonbusiness Majors	
CHEM 128	General Chemistry II	
CHEM 129	General Chemistry III	
CHEM 216	Organic Chemistry for Life Sciences I	
CHEM 217	Organic Chemistry for Life Sciences II	



CHEM 312	Survey of Organic Chemistry
CHEM 313	Survey of Biochemistry and Biotechnology
CHEM 316	Organic Chemistry I
CHEM 317	Organic Chemistry II
CHEM 371	Biochemical Principles
COMS 301	Business and Professional Communication
CRSC 123	Forage Crops
Any DSCI course	
EHS 230	Environmental Horticulture
FRSC 230	California Fruit Growing
FSN 125	Introduction to Food Science
FSN 230	Elements of Food Processing
FSN 275	Elements of Food Safety
FSN 330	Introduction to Principles of Food Engineering
FSN 335	Food Quality Assurance
FSN 370	Food Plant Sanitation and Prerequisite Programs
JOUR 203	News Reporting and Writing
JOUR 205	Agricultural Communications
MCRO 342	Sanitary Microbiology
MCRO 421	Food Microbiology
NR 141	Introduction to Forest Ecosystem Management
PHYS 121	College Physics I
PHYS 122	College Physics II
STAT 313	Applied Experimental Design and Regression Models
VGSC 230	Introduction to Vegetable Science
Any courses used in the following minors:	
Agribusiness	
Agricultural Communication	
Crop Science	
Equine Science	
Food Science	
Poultry Management	
Soil Science	
<b>GENERAL EDUCATION (GE)</b>	
(See GE program requirements below.)	
60	
<b>FREE ELECTIVES</b>	
Free Electives	3-5
<b>Total Hours</b>	180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> MATH 116 and MATH 117 substitute

<sup>3</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A Communication</b>	
A1	Expository Writing 4
A2	Oral Communication 4
A3	Reasoning, Argumentation and Writing 4
<b>Area B Science and Mathematics</b>	
B1	Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup> 4
B2	Life Science (4 units in Support) <sup>1</sup> 0
B3	Physical Science (4 units in Support) <sup>1</sup> 0
B4	One lab taken with either a B2 or B3 course
<b>Area C Arts and Humanities</b>	
C1	Literature 4
C2	Philosophy 4
C3	Fine/Performing Arts 4
C4	Upper-division elective 4
Area C elective	(Choose one course from C1-C5) 4
<b>Area D/E Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement) 4
D2	Political Economy 4
D3	Comparative Social Institutions 4
D4	Self Development (CSU Area E) 4
D5	Upper-division elective 4
<b>Area F Technology</b>	
F	Upper-division elective 4
Total units	
60	

<sup>1</sup> Required in Support; also satisfies GE

## Dairy Science Minor

### Required Courses

DSCI 121	Elements of Dairying	4
or DSCI 230	General Dairy Husbandry	
DSCI 231	General Dairy Manufacturing	4

### Approved Electives <sup>1</sup>

Select from the following, with approval of minor coordinator: 18

DSCI 201	Introduction to Dairy Nutrition and Feed Ingredients
DSCI 202	Dairy Promotion and Marketing
DSCI 223	Frozen Dairy Foods
DSCI 233	Milk Processing and Inspection
DSCI 234	Dairy Foods Evaluation
DSCI 241	Dairy Cattle Selection, Breeds, Fitting and Showing
DSCI 301	Dairy Cattle Nutrition
DSCI 321	Lactation Physiology
DSCI 330	Artificial Insemination and Embryo Biotechnology
DSCI 333	Dairy Animal Health, Safety and Applied Technology
DSCI 340	Dairy Waste Management and Resource Recovery

DSCI 401	Physical and Chemical Properties of Dairy Products	
DSCI 402	Quality Assurance and Control of Dairy Products	
DSCI 411	Integrative Dairy Cattle Management	
DSCI 412	Dairy Farm Consultation	
DSCI 422	Breeding and Genetics of Dairy Cattle	
DSCI 432	Advanced Dairy Herd Management	
DSCI 433	Dairy Plant Management and Equipment	
DSCI 434	Cheese and Fermented Dairy Foods	
DSCI 435	Concentration/Fractionation and Butter Technology	
DSCI 444	Dairy Microbiology	
DSCI 470	Selected Advanced Topics	
Total units		26

DSCI 541	Quality Assurance, Quality Control and Food Safety	4
DSCI 565	Industrial Plant Considerations for Sustainable Operation	4
DSCI 581	Graduate Seminar in Dairy Science (1, 1, 1)	3
DSCI 582	Dairy Processing and Plant Management (2, 2)	4
Total units		45

<sup>1</sup> At least 13 units must be upper division (300-400) level.

## MPS Dairy Products Technology

### Program Learning Objectives

After successfully completing the Master of Professional Studies in Dairy Product Technology, students will be able to:

1. Demonstrate mastery of the technical foundation knowledge necessary to enter a management role in large-scale global dairy foods manufacturing organizations.

- Chemistry, biochemistry and the chemical changes that occur in dairy foods induced by processing
- Analytical chemistry and instrumentation
- Microbiology and its role in both food processing and food safety
- Dairy foods ingredient functionality
- Food safety, quality assurance and control
- Sanitary design and cleaning
- Raw materials receiving and control
- Food laws and regulations
- Food sensory evaluation and process quality
- Unit operations in dairy foods processing

2. Employ leadership principles and recognize importance of leadership in management.

3. Apply critical thinking and analytical skills to solve problems, evaluate alternatives, synthesize solutions, and predict outcomes in a large dairy food production environment.

4. Develop a strong awareness of the dairy foods industry's place in society and can apply that awareness to formulate plans that benefit their company and society.

#### Required Courses

DSCI 501	Dairy Chemistry	3
DSCI 502	Dairy Chemistry Laboratory	2
DSCI 510	Dairy Foods: Issues and Practices	2
DSCI 520	Dairy Processing and Manufacturing I	3
DSCI 521	Dairy Processing and Manufacturing II	4
DSCI 524	Dairy Processing and Manufacturing III	4
DSCI 535	Dairy Foods Ingredient Functionality	4
DSCI 539	Graduate Internship in Dairy Science	4
DSCI 540	Graduate Dairy Microbiology	4

## Food Science & Nutrition

Agricultural Sciences Bldg. (11), Room 244

Phone: 805.756.2660

<http://fsn.calpoly.edu/>

Department Head: Gour Choudhury

### Academic Programs

Program name	Program type
Food Science	BS, Minor
Nutrition	BS, Minor

The department offers two degree programs designed to prepare graduates for employment in the general areas of human nutrition and food science and technology. Graduates in Nutrition enjoy rewarding careers in public health, dietetics and clinical nutrition, healthcare, food industry, food systems management and education. Food Science graduates hold responsible positions in food processing and product development, sales, research, quality assurance and government regulation. Opportunities for private consulting and entrepreneurship are available to graduates in both majors. The department also offers minors in Food Science and Nutrition.

Students are involved in a number of clubs and teams, including the Nutrition Club, Food Science Club, Global Food Tasters Club and Fair Trade Club. Club activities involve a wide range of social, professional and service projects. Clubs provide opportunity for leadership training and participation in professional societies and organizations. Our students compete on teams in regional and national scholastic competitions such as Food Product Development teams and Nutrition and Food Science College Bowls.

#### Learn by Doing in FSN

The department is equipped with a food processing pilot plant, and laboratories for food safety, food chemistry, nutritional science, metabolism, and culinary science. These facilities are designed for teaching courses in nutrition, foodservice management, sensory evaluation of foods, food chemistry, food product development, food processing and quality control. Students get hands-on experience with pilot scale commercial processing equipment.

Student can manufacture and market various food products, which are sold throughout the community. Projects are designed to simulate industry and business practices. Classroom learning in nutrition is complemented with opportunities for service, outreach and research in the community. Students are encouraged to gain valuable experience by working during the summer or by participating in internship programs.

### Undergraduate Programs

#### BS Food Science

The program is designed to prepare students for employment in the food industry, government and for graduate study. Principal areas of instruction are food engineering, food processing, food safety and sanitation, quality assurance, food microbiology, food chemistry and analysis, product development, and sensory evaluation. Employment opportunities are strong in each of these areas.

### Concentrations

#### Advanced Food Science

is the curriculum approved by the Institute of Food Technologists (IFT.org (<http://www.ift.org>)), the key international professional society for food scientists. Students are strongly advised to follow this concentration if they anticipate graduate study following completion of the BS. Students enrolled in this concentration are eligible for IFT scholarships.

#### Applied Food Technology

allows students to select coursework focused in a commodity or other area where they have career interest. For example, with proper selection of approved electives and concentration area courses, students can earn minors in meat science, wine and viticulture, or packaging. Course selections could also focus in dairy products, culinary science, or business.

#### Culinary

is designed for students wanting to apply a strong science background in ingredient development, food product development, or in entrepreneurial pursuits. This concentration serves the need for food scientists who are positioned to make decisions that require a blend of management training, culinary expertise, and a technical science background. Graduates are prepared to pursue advanced degrees in food science or may choose to attend a professional culinary program.

#### BS Nutrition

The program offers a broad preparation in nutritional science. In addition to preparatory science courses such as chemistry and biology, the program offers coursework in nutrient metabolism, clinical nutrition, community nutrition, and lifecycle nutrition, foods and food system management.

### Concentrations

#### Applied Nutrition

Applied Nutrition prepares students for careers in various areas of nutrition, including dietetics, food systems management, nutrition communications, and community nutrition. This concentration is a Didactic Program in Dietetics (DPD), accredited by the Accreditation Council for Education in Nutrition and Dietetics (ACEND), of the Academy of Nutrition and Dietetics (formerly ADA), 120 River-side Plaza, Suite 2000, Chicago, IL 60606-6995, (312) 899-4876. Students in this concentration who graduate with a minimum higher education overall GPA of 2.75 and receive a Verification Statement are eligible to apply for admission to an accredited dietetic internship, upon completion of which the graduate must pass a national examination administered by the Commission on Dietetic Registration to qualify as a registered dietitian (RD). Graduates also are prepared to pursue advanced degrees in foods and nutrition, public health, and food systems management.

#### Nutrition and Food Industries

Nutrition and Food Industries is designed for students who want to apply knowledge of nutrition to careers in the food industry and related organizations (such as commodity and other non-profit organizations, pharmaceutical companies, or government). A Food Science or Agricultural Communications minor can be earned with proper course selection within this concentration and within the 180 unit degree requirement. Students are prepared for positions in food product research and development, quality and regulatory operations, food

and health communications, public relations, extension, and technical sales. In addition, students are prepared for graduate study in food science, nutrition, or related fields.

## Nutrition Science

Nutrition Science emphasizes a strong background in basic sciences and human nutrition for students planning further study in graduate school or a health-related profession such as medicine, dentistry, nursing, pharmacy or physical therapy. Students need to check with their advisors for specific requirements for various health-related professions.

## Minors

The department offers minors in either food science or nutrition to qualified students from across campus. Specific criteria apply to entering into the minor program and interested students should see either of the minor advisors.

## Food Science Minor

The minor is principally designed for students majoring in related academic disciplines who desire employment in the food industry. Students acquire the fundamental technical skills necessary to understand basic issues and concepts in food science such as food processing, food safety, and quality assurance. See the department Food Science minor coordinator for criteria for admission into the Food Science minor.

## Nutrition Minor

The minor is designed for students majoring in science disciplines (Chemistry, Biological Sciences, Kinesiology), Agribusiness or Agricultural Communications, and other interested majors such as Business or Psychology. Students can enhance career opportunities or qualification for admission into graduate programs or allied health fields. See the department Nutrition minor coordinator for criteria for admission into the Nutrition minor.

## Interdisciplinary Minors

The department participates in offering interdisciplinary minors in Packaging (see Orfalea College of Business (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness>) section).

## Graduate Program

Cal Poly offers an MS in Agriculture with a specialization in Food Science and Nutrition. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>) section in the College of Agriculture, Food and Environmental Sciences.

## Dietetic Internship

Cal Poly's post-baccalaureate dietetic internship is accredited by the Accreditation Council for Education in Nutrition and Dietetics (ACEND) of the Academy of Nutrition and Dietetics (formerly ADA). This competitive program consists of at least 1,200 hours of supervised practice and at least 108 hours of class, seminars, and professional meetings. Upon completion, interns must pass a national examination administered by the Commission of Dietetic Registration to qualify as a Registered Dietitian (R.D.). Applications for fall quarter are due mid-February.

# BS Food Science

## Program Learning Objectives

1. Graduates demonstrate critical thinking skills in addressing food science issues.
2. Graduates demonstrate the knowledge, ethics, and technical skills needed to succeed in food science fields and post-graduate studies.
3. Graduates demonstrate effective written and oral communication skills.
4. Graduates demonstrate the ability to work effectively as part of a problem-solving team.
5. Graduates demonstrate cultural competence with interacting diverse populations.

## Program Educational Outcomes

- Food Science program graduates can integrate and apply principles of food chemistry, analysis, microbiology, processing and engineering to assure food quality and safety.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

FSN 101	Orientation to the Food Science and Nutrition Majors	1
FSN 125	Introduction to Food Science	4
FSN 204	Food Processing Operations	4
FSN 210	Nutrition	4
FSN 250	Food and Nutrition: Customs and Culture (USCP) (D4 ) <sup>1</sup>	4
FSN 311	Sensory Evaluation of Food	4
FSN 330	Introduction to Principles of Food Engineering	4
FSN 334	Food Packaging	3
FSN 335	Food Quality Assurance	4
FSN 364	Food Chemistry	4
FSN 368	Food Analysis	4
FSN 370	Food Plant Sanitation and Prerequisite Programs	4
FSN 374	Food Laws and Regulations	4
FSN 375	Food Safety	4
FSN 408	Food Composition Science and Product Development	4
FSN 461	Senior Project I	3
FSN 462	Senior Project II	3

Concentration courses (see below)	19-20
<b>SUPPORT COURSES</b>	
AGB 214 Agribusiness Financial Accounting	4
or BUS 212 Financial Accounting for Nonbusiness Majors	
BIO 111 General Biology (B2 & B4) <sup>1</sup>	4
CHEM 127 General Chemistry for Agriculture and Life	8
& CHEM 128 Science I	
and General Chemistry II (B3 & B4) <sup>1</sup>	
CHEM 312 Survey of Organic Chemistry	5
CHEM 313 Survey of Biochemistry and Biotechnology	5
ECON 201 Survey of Economics (D2) <sup>1</sup>	4
MATH 118 Precalculus Algebra (B1) <sup>1</sup>	4
MCRO 221 Microbiology	4
MCRO 421 Food Microbiology	4
PHYS 121 College Physics I	4
STAT 218 Applied Statistics for the Life Sciences (B1) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>	
(See GE program requirements below.)	48
<b>FREE ELECTIVES</b>	
Free Electives	0-1
Total units	180

<sup>1</sup> Required in Major/Support; also satisfies GE

## Concentrations

- Advanced Food Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodsciencenutrition/bsfoodscience/advancedfoodscienceconcentration>)
- Applied Food Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodsciencenutrition/bsfoodscience/appliedfoodtechnologyconcentration>)
- Culinary (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodsciencenutrition/bsfoodscience/culinaryconcentration>)

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics (no additional units required)</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0

B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		48

<sup>1</sup> Required in Major/Support; also satisfies GE

## Advanced Food Science Concentration

FSN 444	Food Engineering	4
FSN 474	Advanced Food Processing	4
MATH 161	Calculus for the Life Sciences I	4
MATH 162	Calculus for the Life Sciences II	4

### Approved Electives

Select from the following:		4
AGB 212	Agricultural Economics	
AGB 301	Food and Fiber Marketing	
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
ASCI 211	Meat Science	
ASCI 384	Processed Meat Products	
ASCI 415	HACCP for Meat and Poultry Operations	
BUS 207	Legal Responsibilities of Business	
BUS 384	Human Resources Management	
CHEM 129	General Chemistry III	
CHEM 217	Organic Chemistry for Life Sciences II	
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 319	Advanced Organic Chemistry Laboratory	
DSCI 223	Frozen Dairy Foods	
DSCI 230	General Dairy Husbandry	
DSCI 231	General Dairy Manufacturing	
DSCI 401	Physical and Chemical Properties of Dairy Products	
DSCI 434	Cheese and Fermented Dairy Foods	
DSCI 435	Concentration/Fractionation and Butter Technology	
DSCI 444	Dairy Microbiology	
ENVE 330	Environmental Quality Control	



FRSC 210	Viticultural Practices	
FRSC 230	California Fruit Growing	
FRSC 311	Survey of Viticulture	
FSN 121	Fundamentals of Food	
FSN 201	Enterprise Project	
FSN 244	Cereal and Bakery Science	
FSN 285	Certified Organic Food Processing	
FSN 304	Advanced Culinary Principles and Practice	
FSN 321	Contemporary Issues in Food Choice and Preparation	
FSN 322	French Foods in French	
FSN 341	Wines and Fermented Foods	
FSN 343	Institutional Foodservice I	
FSN 401	Advanced Enterprise Project	
FSN 410	Nutritional Implications of Food Industry Practices	
FSN 426	Food Systems Management	
HCS 421	Postharvest Technology of Horticultural Crops	
IT 330	Packaging Fundamentals	
IT 341	Packaging Polymers and Processing	
MCRO 320	Emerging Infectious Diseases	
MCRO 342	Sanitary Microbiology	
POLS 333	World Food Systems	
PSY 201	General Psychology	
or PSY 202	General Psychology	
One quarter of foreign language		
Total units		20

## Applied Food Technology Concentration

FSN 410	Nutritional Implications of Food Industry Practices	4
FSN 444	Food Engineering	4
FSN 474	Advanced Food Processing	4
<b>Approved electives</b>		
Select from the following:		8
AGB 212	Agricultural Economics	
AGB 301	Food and Fiber Marketing	
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
ASCI 211	Meat Science	
ASCI 384	Processed Meat Products	
ASCI 415	HACCP for Meat and Poultry Operations	
BUS 207	Legal Responsibilities of Business	
BUS 384	Human Resources Management	
CHEM 129	General Chemistry III	
CHEM 217	Organic Chemistry for Life Sciences II	
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 319	Advanced Organic Chemistry Laboratory	
DSCI 223	Frozen Dairy Foods	
DSCI 230	General Dairy Husbandry	
DSCI 231	General Dairy Manufacturing	

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DSCI 401	Physical and Chemical Properties of Dairy Products	
DSCI 434	Cheese and Fermented Dairy Foods	
DSCI 435	Concentration/Fractionation and Butter Technology	
DSCI 444	Dairy Microbiology	
FRSC 210	Viticultural Practices	
FRSC 230	California Fruit Growing	
FRSC 311	Survey of Viticulture	
FSN 121	Fundamentals of Food	
FSN 201	Enterprise Project	
FSN 244	Cereal and Bakery Science	
FSN 285	Certified Organic Food Processing	
FSN 304	Advanced Culinary Principles and Practice	
FSN 321	Contemporary Issues in Food Choice and Preparation	
FSN 322	French Foods in French	
FSN 343	Institutional Foodservice I	
FSN 344	Institutional Foodservice II	
FSN 401	Advanced Enterprise Project	
FSN 426	Food Systems Management	
HCS 421	Postharvest Technology of Horticultural Crops	
IT 330	Packaging Fundamentals	
IT 341	Packaging Polymers and Processing	
MCRO 320	Emerging Infectious Diseases	
MCRO 342	Sanitary Microbiology	
POLS 333	World Food Systems	
PSY 201	General Psychology	
or PSY 202	General Psychology	
One quarter of foreign language		
Total units		20

## Culinary Concentration

FSN 121	Fundamentals of Food	4
FSN 304	Advanced Culinary Principles and Practice	4
FSN 321	Contemporary Issues in Food Choice and Preparation	4
FSN 343	Institutional Foodservice I	3
FSN 344	Institutional Foodservice II	4
Total units		19

## BS Nutrition

### Program Learning Objectives

1. Graduates demonstrate critical thinking skills in addressing nutrition issues.
2. Graduates demonstrate the knowledge, ethics, and technical skills needed to succeed in nutrition-related fields and post-graduate studies.
3. Graduates demonstrate effective written and oral communication skills.
4. Graduates demonstrate the ability to work effectively as part of a problem-solving team.

5. Graduates demonstrate cultural competence interacting with diverse populations.

## Program Educational Outcomes

- Graduates can apply the knowledge of nutrients and foods to meet the nutritional and health needs of individuals and groups throughout the life cycle.
- Graduates can apply the principles of social, physical and biological sciences to address human nutrition issues.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

FSN 101	Orientation to the Food Science and Nutrition Majors	1
FSN 121	Fundamentals of Food	4
FSN 210	Nutrition	4
FSN 230	Elements of Food Processing	4
FSN 250	Food and Nutrition: Customs and Culture (USCP) (D4) <sup>1</sup>	4
FSN 310	Maternal and Child Nutrition	4
FSN 315	Nutrition in Aging	4
FSN 328 & FSN 329	Nutrient Metabolism I and Nutrient Metabolism II	8
FSN 415	Nutrition Education and Communications	4
FSN 420	Critical Evaluation of Nutrition Research	4
FSN 461	Senior Project I	3
MCRO 221 or MCRO 224	Microbiology (B2 & B4) <sup>1</sup> General Microbiology I	4
CHEM 127	General Chemistry for Agriculture and Life Science I (B3 & B4) <sup>1</sup>	4
CHEM 128	General Chemistry II	4
CHEM 312 or CHEM 216	Survey of Organic Chemistry <sup>2</sup> Organic Chemistry for Life Sciences I	5
CHEM 313 or CHEM 371	Survey of Biochemistry and Biotechnology <sup>2</sup> Biochemical Principles	5
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
MATH 118	Precalculus Algebra (B1) <sup>1, 3</sup>	4
STAT 218	Applied Statistics for the Life Sciences (B1) <sup>1</sup>	4
BIO 161	Introduction to Cell and Molecular Biology	4
Concentration courses (see concentrations below)		49-50

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 48

#### FREE ELECTIVES

Free Electives	0-1
Total units	180

- <sup>1</sup> Required in Major; also satisfies GE
- <sup>2</sup> Most Nutrition majors should take CHEM 312 and CHEM 313. Students choosing the Nutrition Science concentration may need to take CHEM 216 and CHEM 371, depending on their career goals and approved electives. Students selecting CHEM 216 must also take CHEM 217 and CHEM 218. See advisor.
- <sup>3</sup> MATH 116 and MATH 117 substitute

## Concentrations

- Applied Nutrition (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodsciencenutrition/bsnutrition/appliednutritionconcentration>)
- Nutrition and Food Industries (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodsciencenutrition/bsnutrition/nutritionandfoodindustriesconcentration>)
- Nutrition Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodsciencenutrition/bsnutrition/nutritionscienceconcentration>)

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics (no additional units required)	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Major) <sup>1</sup>	0

D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		48

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics (no additional units required)</b>	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Major) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		48

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4

A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics (no additional units required)</b>	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Major) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		48

<sup>1</sup> Required in Major; also satisfies GE

<sup>1</sup> Required in Major; also satisfies GE

## Applied Nutrition Concentration

FSN 321	Contemporary Issues in Food Choice and Preparation	4
FSN 343 & FSN 344	Institutional Foodservice I and Institutional Foodservice II	7
FSN 416	Community Nutrition	4
FSN 417	Nutrition Counseling	4
FSN 426	Food Systems Management	4
FSN 429 & FSN 430	Clinical Nutrition I and Clinical Nutrition II	8
BIO 302 or BIO 303	Human Genetics Survey of Genetics	4
PSY 201 or PSY 202	General Psychology	4
ZOO 331 & ZOO 332	Human Anatomy and Physiology I and Human Anatomy and Physiology II	10
Total units		49

## Nutrition Science Concentration

FSN 416	Community Nutrition	4
FSN 429	Clinical Nutrition I	4
FSN 430	Clinical Nutrition II	4
BIO 302	Human Genetics	4

or BIO 303	Survey of Genetics	
or BIO 351	Principles of Genetics	
PHYS 121	College Physics I	4
ZOO 331	Human Anatomy and Physiology I	10
& ZOO 332	and Human Anatomy and Physiology II	

**Approved electives<sup>1</sup>**

Select from the following:		20
ASCI 403	Applied Biotechnology in Animal Science	
ASCI 503	Advanced Molecular Techniques in Animal Science	
BIO 160	Diversity and History of Life	
BIO 162	Introduction to Organismal Form and Function	
BIO 253	Orientation to Health Professions	
BIO 305	Biology of Cancer	
BIO 405	Developmental Biology	
BIO 426	Immunology	
BIO 452	Cell Biology	
BIO 476	Gene Expression Laboratory	
BOT/HCS 329	Plants, Food, and Biotechnology	
BUS 207	Legal Responsibilities of Business	
BUS 212	Financial Accounting for Nonbusiness Majors	
CHEM 129	General Chemistry III	
CHEM 217	Organic Chemistry for Life Sciences II	
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 231	Quantitative Analysis	
CHEM 319	Advanced Organic Chemistry Laboratory	
CHEM 331	Quantitative Analysis	
CHEM 372	Metabolism	
CHEM 373	Molecular Biology	
CHEM 377	Chemistry of Drugs and Poisons	
CHEM 458	Instrumental Organic Qualitative Analysis	
CHEM 474	Protein Techniques Laboratory	
CHEM 475	Molecular Biology Laboratory	
CHEM 477	Biochemical Pharmacology	
COMS 418	Health Communication	
ECON 303	Economics of Poverty, Discrimination and Immigration	
FSN 417	Nutrition Counseling	
FSN 463	Professional Practice in Nutrition and Dietetics	
KINE 181	First Aid/CPR/AED	
KINE 301	Functional Muscle Anatomy	
KINE 302	Biomechanics	
KINE 303	Physiology of Exercise	
KINE 304	Pathophysiology and Exercise	
KINE 305	Drug Education	
KINE 308	Motor Development	
KINE 402	Motor Learning and Control	
KINE 406	Neuroanatomy	
KINE 445	Electrocardiography	
KINE 446	Echocardiography	
MATH 161	Calculus for the Life Sciences I	
or MATH 141	Calculus I	

MATH 162	Calculus for the Life Sciences II	
or MATH 142	Calculus II	
MATH 143	Calculus III	
MCRO 225	General Microbiology II	
MCRO 320	Emerging Infectious Diseases	
MCRO 342	Sanitary Microbiology	
MCRO 402	General Virology	
MCRO 421	Food Microbiology	
MCRO 423	Medical Microbiology	
MCRO 433	Microbial Biotechnology	
PHIL 339	Biomedical Ethics	
PHYS 122	College Physics II	
PHYS 123	College Physics III	
PSY 201	General Psychology	
or PSY 202	General Psychology	
PSY 256	Developmental Psychology	
PSY 310	Psychology of Death	
PSY 317	Psychology of Stress	
PSY 318	Psychology of Aging	
PSY 330	Behavioral Effects of Psychoactive Drugs	
PSY 340	Biopsychology	
PSY 372	Multicultural Psychology	
PSY 405	Abnormal Psychology	
PSY 460	Child Abuse and Neglect	
SCM 101	Introduction to the Health Professions	
SCM 325	Genetic Engineering Technology	
SCM 363	Health Professions Internships	
SCM 451	Ethics in the Sciences	
SOC 326	Sociology of the Life Cycle	
ZOO 422	Functional Histology	
ZOO 425	Parasitology	
ZOO 428	Hematology	
One quarter of foreign language		

Total units 50

<sup>1</sup> Please consult the FSN advising materials and catalog for prerequisites.

## Nutrition and Food Industries Concentration

FSN 275	Elements of Food Safety	4
FSN 311	Sensory Evaluation of Food	4
FSN 364	Food Chemistry	4
FSN 368	Food Analysis	4
FSN 374	Food Laws and Regulations	4
FSN 408	Food Composition Science and Product Development	4
FSN 410	Nutritional Implications of Food Industry Practices	4
Select from the following:		4
DSCI 230	General Dairy Husbandry	
FRSC 230	California Fruit Growing	

VGSC 230 Introduction to Vegetable Science

**Approved electives<sup>1</sup>**

Select from the following: 18

AGB 315	Land Economics
AG/EDES/ HUM/SCM 350	The Global Environment
AGC 407	Agricultural Publications
AGED 404	Agricultural Leadership
ASCI 211	Meat Science
ASCI 384	Processed Meat Products
ASCI 415	HACCP for Meat and Poultry Operations
BIO 307	World Aquaculture: Applications, Methodologies and Trends
BOT/HCS 329	Plants, Food, and Biotechnology
COMS 301	Business and Professional Communication
DSCI 231	General Dairy Manufacturing
ENGL 210	New Media Technology
ENGL 310	Corporate Communication
FSN 204	Food Processing Operations
FSN 244	Cereal and Bakery Science
FSN 304	Advanced Culinary Principles and Practice
FSN 321	Contemporary Issues in Food Choice and Preparation
FSN 330	Introduction to Principles of Food Engineering
FSN 334	Food Packaging
FSN 335	Food Quality Assurance
FSN 341	Wines and Fermented Foods
FSN 343	Institutional Foodservice I
FSN 344	Institutional Foodservice II
FSN 370	Food Plant Sanitation and Prerequisite Programs
FSN 426	Food Systems Management
FSN 444	Food Engineering
FSN 463	Professional Practice in Nutrition and Dietetics
FSN 474	Advanced Food Processing
JOUR 203	News Reporting and Writing
JOUR 205	Agricultural Communications
JOUR 312	Public Relations
JOUR 331	Contemporary Advertising
JOUR 342	Public Relations Writing and Editing
JOUR 407	Feature Writing
MCRO 421	Food Microbiology
PHYS 121	College Physics I
PSY 201 or PSY 202	General Psychology
SCM 325	Genetic Engineering Technology

Total units 50

<sup>1</sup> Please consult the FSN advising materials and catalog for prerequisites.

## Food Science Minor

**Required Courses**

FSN 125	Introduction to Food Science	4
or FSN 230	Elements of Food Processing	
FSN 204	Food Processing Operations	4
FSN 335	Food Quality Assurance	4

**Emphasis area**

Select from the following courses (3 of which must be 300-400 level): 16

ASCI 211	Meat Science
ASCI 384	Processed Meat Products
ASCI 415	HACCP for Meat and Poultry Operations
FSN 244	Cereal and Bakery Science
FSN 275	Elements of Food Safety
FSN 285	Certified Organic Food Processing
FSN 311	Sensory Evaluation of Food
FSN 330	Introduction to Principles of Food Engineering
FSN 341	Wines and Fermented Foods
FSN 354	Packaging Function in Food Processing
FSN 364	Food Chemistry
FSN 368	Food Analysis
FSN 370	Food Plant Sanitation and Prerequisite Programs
FSN 374	Food Laws and Regulations
FSN 375	Food Safety
FSN 408	Food Composition Science and Product Development
FSN 410	Nutritional Implications of Food Industry Practices
FSN 444	Food Engineering
FSN 474	Advanced Food Processing
DSCI 231	General Dairy Manufacturing
MCRO 421	Food Microbiology

Total units 28

## Nutrition Minor

**Required Courses**

FSN 210	Nutrition (B5)	4
FSN 310	Maternal and Child Nutrition	4
FSN 315	Nutrition in Aging	4

**Emphasis area**

Select one area: 15-16

Clinical: (CHEM 313 and ZOO 331, ZOO 332 or equivalents as prerequisites)

FSN 328	Nutrient Metabolism I
FSN 329	Nutrient Metabolism II
FSN 429	Clinical Nutrition I
FSN 430	Clinical Nutrition II

Community: (CHEM 313 or equivalent as prerequisite)

FSN 328	Nutrient Metabolism I
FSN 329	Nutrient Metabolism II
FSN 416	Community Nutrition



Select one of the following:

FSN 250 Food and Nutrition: Customs and Culture

FSN 415 Nutrition Education and Communications

ANT 401 Culture and Health

COMS 418 Health Communication

POLS/UNIV World Food Systems

333

RPTA 450 Resource and Grant Development

SOC 323 Social Stratification

Culinary Science and Food Service Management:

FSN 121 Fundamentals of Food

FSN 321 Contemporary Issues in Food Choice and Preparation

FSN 343 Institutional Foodservice I

FSN 304 Advanced Culinary Principles and Practice

or FSN 344 Institutional Foodservice II

Sports Nutrition: (CHEM 313 or equivalent as prerequisite)

FSN 328 Nutrient Metabolism I

FSN 329 Nutrient Metabolism II

KINE 303 Physiology of Exercise

KINE 451 Nutrition for Fitness and Sport

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Total units

27-28

## Horticulture & Crop Science

Agricultural Sciences Bldg. (11), Room 230  
Phone: 805.756.2279 or 805.756.1237; Fax: 805.756.6504  
<http://aepps.calpoly.edu>

Interim Department Head: Scott Steinmaus

### Academic Programs

Program name	Program type
Agricultural and Environmental Plant Sciences	BS
Crop Science	Minor
Fruit Science	Minor
Landscape Horticulture	Minor
Plant Protection	Minor

The department offers the Agricultural and Environmental Plant Sciences major leading to the Bachelor of Science degree. Within this major are seven concentrations: Crop Science, Fruit Science, Greenhouse and Nursery Plant Production, Plant Protection Science, Public Horticulture, Sustainable Landscape Management and Design, and Turfgrass and Sports Field Management. Each concentration is well-grounded in the sciences and designed to prepare students for many attractive career opportunities.

### Experiential Learning Opportunities and Facilities

The Horticulture and Crop Science Department has well-equipped laboratories for instruction in plant biotechnology, insect and weed pest management, postharvest technology, plant production, and landscape horticulture, including CAD capabilities and plant materials.

Students have hands-on experiences in production and marketing of landscape and ornamental plants using comprehensive facilities at the 16-acre Environmental Horticulture Unit. This unit includes 35,000 square feet of greenhouses, a 5,000 square-foot retractable roof greenhouse, 7,500 square feet of shade houses, a 10,000-square foot U.S. Golf Association specification experimental green, an extensive field container growing area, and a five-acre arboretum. Additionally there are six horticulture laboratories, four of which are fitted with "smart-room" technologies for state-of-the-art teaching capabilities. The Leaning Pine Arboretum and Gardens is an outdoor laboratory. In addition, the 200 acres of landscaped campus are planted with many interesting and unusual trees and shrubs from all over the world, as well as native plant materials. The plant specimens are frequently used for laboratory instruction.

The Crops Unit has 70 acres of productive citrus, avocados, grapes, deciduous fruit trees, and berries, with additional nonbearing acreage for instructional use. There are also approximately 35 acres of annual vegetable and forage crops, of which eleven acres are certified organic. There is a modern building containing two teaching labs with prep rooms, six greenhouses, cooler, hydroponic vegetable production facility and a state-of-the-art fruit and vegetable processing line.

The technological aspects of instruction are enhanced by an array of equipment required in crop and fruit production systems, postharvest handling, biotechnology, seed processing, pesticide application, nursery and greenhouse operations, parks and sport grounds maintenance and landscape construction. Field trips supplement instruction and are strongly encouraged for most classes.

Students are encouraged to gain experience and earn income by participating in the enterprise project program or by working on the campus farm. Enterprise projects are run under faculty supervision but are student-operated. These projects provide students with a "no risk" glimpse of a commercial enterprise. The department offers enterprise project experiences in commercial-scale production of vegetable crops, citrus, avocados, deciduous fruit and nut crops, floriculture, nursery plants, and forage crops. Available marketing outlets range from contract sales of vegetable seeds, wholesaling to area supermarkets, and direct marketing at local farmers' markets, garden centers, florist shops, and other campus outlets. Certified organic produce is marketed through a biweekly Farmers Market or farmed and sold to local restaurants and markets.

The department supports co-curricular activities for its students, including three student clubs. Student teams in horticultural science, flower judging, floral design and the landscape industry continue to win national championships.

### Undergraduate Programs

#### BS Agricultural and Environmental Plant Sciences

The Horticulture and Crop Science Department at Cal Poly offers students an opportunity not just to learn, but to learn-by-doing. Our students benefit from a broad spectrum of opportunities ranging from hands-on experiences in our working fields, groves, nurseries, and greenhouses to real world applications through internships and other collaborations with our industry partners. We also excel in providing a foundational plant science background and instilling a passion for plants as we produce the next generation of leaders in the agricultural and environmental plant sciences.

Students in this major begin with core courses that provide a thorough introduction to the various concentrations. Each concentration, in turn, has required courses, which may be shared by other concentrations. In their first year, students explore curriculum and professional opportunities to enable them to choose a concentration. In consultation with their advisor, students have the flexibility to select electives within the concentrations according to their career goals and interests.

Internships are readily available to students and are highly recommended. Interns are typically placed with private industry and public facilities all across the United States and in several foreign countries. Over \$100,000 of scholarships are also available to students as are several undergraduate student assistantships which are sponsored by industry. Program alumni are employed nationally and internationally and are often leaders in their industries. Graduates of the department are in great demand. Typically there are more internship and job opportunities than there are students to fill them.

An extensive list of periodicals covering all of the related disciplines in the department is available to students through the Robert E. Kennedy Library on campus.

### Concentrations

Each concentration offers introductory, intermediate and advanced classes. The concentrations offer their own course of study (including required courses and electives) as well as opportunities for cross-training and multi-disciplinary learning.

## Crop Science

A crop scientist develops cropping systems that are both profitable and ecologically sustainable. Students learn about the management of irrigation and equipment, the timing of planting and harvesting, plant and insect pest management, fertilization, postharvest handling and marketing techniques and a variety of other ways to efficiently and sustainably produce food and fiber. The concentration focuses on areas of innovation and development such as postharvest technology, plant biotechnology, integrated pest management and precision farming.

## Fruit Science

This concentration prepares students for the current and future challenges of the multi-billion dollar fruit and nut crop industry. The curriculum focuses on the fundamentals of crop growth and production. Students experience innovative production and propagation methods, including sustainable irrigation, fertilization and pest-management techniques, and learn about high-density orchard design and postharvest technology. The concentration is also flexible enough to allow students to pursue minors in Agricultural Business or Plant Protection Science.

## Greenhouse and Nursery Plant Production

This concentration focuses on the production, utilization and maintenance of trees, flowers, shrubs and house plants. It provides unique opportunities to study a wide range of plant life in the micro-climates that exist close to campus. Students acquire a solid understanding of the science behind the practical techniques used to grow, propagate and maintain plants. Students also learn which plants are best adapted to specific environments, precision growing techniques, the use of controlled environments, and hydroponics. This concentration offers a technical education which prepares students to meet the present and future demands of the greenhouse and nursery plant industries.

## Plant Protection Science

Approximately one-third of the world's food crops are destroyed each year by insects, rodents, diseases and other pests. Finding ways to reduce these losses is the challenge of the plant protection specialist. In this concentration, students learn a broad range of pest management subjects including entomology, plant pathology and weed control. Students develop an understanding of crop production principles, ecology, biotechnology, pesticide toxicology and environmental science. As environmental regulations continue to increase, employment opportunities will grow for those holding professional licenses, and this concentration prepares students to take the California Pest Control Advisor (PCA) license exam.

## Public Horticulture

This concentration is for students interested in a professional career promoting horticulture, horticultural education, native plant restoration, green roofs and walls, and the public displays of plants. Possible careers include positions in city or urban horticulture, urban forestry, the directorship of a botanical garden or park, professional garden writing and editing, and horticultural therapy. Students also have the opportunity to prepare for a career managing corporate horticultural environments, including corporate grounds and building interiors.

## Sustainable Landscape Management and Design

This concentration provides students with real-world experience in the landscape industry while teaching the skills to design, install and

maintain landscapes and gardens. Students develop knowledge of landscape plants and plant care, and learn the basics of landscape contracting, including the construction processes and materials used in the landscape industry. Opportunities are also provided to acquire more advanced skills in design and plant care, both for interior and exterior landscapes.

## Turfgrass and Sports Field Management

This concentration gives students a well-rounded education in turfgrass species selection and their uses in sports field management. Students study turfgrass physiology – especially as affected by various environmental conditions – and design technology. Students also gain a solid understanding of the cultural procedures and equipment needed for turfgrass propagation, mowing, irrigation, fertilization and cultivation, and the pest control programs required to maintain turf. This concentration offers students a science-based education that prepares them to manage sports complexes, golf courses and commercial landscape turf operations.

## Crop Science Minor

Designed for students majoring in related academic disciplines who desire careers in crop production or associated industries. The minor offers a broad-based knowledge of the science and technology of agronomy and vegetable production, especially as practiced in California.

## Fruit Science Minor

The minor is designed for students majoring in related academic disciplines who desire to seek careers in fruit production or associated industries. The minor offers a broad-based knowledge of the science and technology of fruit and nut production.

## Landscape Horticulture Minor

The minor provides students with an understanding of the landscape horticultural industry and provides them with basic skills to understand design, installation and maintenance of landscapes. Students develop knowledge of landscape plants and plant care as well as the basics of landscape contracting, including construction processes and materials used in the landscape industry. Students learn of the wide range of career opportunities in the industry. Depending on which electives are chosen, students also learn more advanced skills and concepts in the areas of design, plant care (both interior and exterior), and computer applications for design and presentation techniques.

## Plant Protection Minor

This program emphasizes both plant protection and plant production. Within the plant protection field of study, the student is exposed to a broad range of pest management subjects including entomology, plant pathology, and weed control. Within the production area the student may emphasize fruit production, crop production, ornamental horticulture, or natural resource management.

## Interdisciplinary Minors

The department participates in offering interdisciplinary minors in Geographic Information Systems for Agriculture, Land Rehabilitation, and Sustainable Agriculture. Please see College of Agriculture, Food and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>) section for more information.

## Graduate Programs

Cal Poly offers a Master of Science degree in Agriculture with specializations in Crop Science, Environmental Horticultural Science, and Plant Protection Science, among others. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>) section of the College of Agriculture, Food and Environmental Sciences.

## BS Agricultural and Environmental Plant Sciences

### Program Learning Objectives

1. HCS graduates will be technically competent in their concentration.
  - a. Demonstrate an understanding of the theoretical sciences upon which horticulture and agronomy are based.
    - i Utilize a basic knowledge of chemistry, botany, entomology, plant pathology, physical science, and soils to evaluate and adapt plant production and maintenance practices.
  - b. Demonstrate knowledge of important food and fiber crops.
    - i Recognize/identify a minimum of 30 species of fruit, vegetable, or field crops.
    - ii Discuss basic cultural practices and requirements of important food and fiber crops.
    - iii Discuss economic uses of important food and fiber crops.
  - c. Demonstrate knowledge of the design principles employed in the use of ornamental horticultural products.
    - i Design residential and small business landscapes.
    - ii Create floral designs.
  - d. Demonstrate an ability to produce fruits, vegetables, and field crops using modern and sustainable methods.
    - i Prepare land for direct seeding or transplanting.
    - ii Utilize soil and plant tissue analyses to optimize plant nutrition.
    - iii Establish populations of trees, vines, or annual crops in the field.
    - iv Utilize irrigation technology and other cultural practices to optimize the efficiency of water use.
    - v Utilize integrated pest management (IPM) to protect crops in a sustainable manner.
    - vi Utilize harvest and post-harvest techniques appropriate to individual crop requirements.
  - e. Demonstrate an ability to produce ornamental plants utilizing modern and sustainable techniques.
    - i Produce, utilize and adapt plant media.
    - ii Utilize environmental modification techniques to produce plants.
    - iii Propagate plants in a variety of ways including seeds, cuttings, grafting, and tissue culture.
    - iv Utilize soil and foliar analysis to optimize plant nutrition.
  - f. Demonstrate an ability to design, install, and maintain a landscape.
    - i Draft a landscape design utilizing both manual and computerized techniques.
    - ii Install a landscape employing appropriate soil management, construction, irrigation, plant installation and sustainable landscape techniques.
    - iii Utilize sustainable pruning, fertilizer, irrigation, and pest management techniques to maintain a landscape.
  - g. Demonstrate knowledge of the uses and cultural requirements of ornamental plants.
    - i Recognize, appropriately utilize, and maintain a minimum of 400 different landscape plants.
    - ii Utilize knowledge of plant taxonomy and appropriate references to identify and research unfamiliar landscape plants.
  - h. Demonstrate an ability to diagnose and resolve plant-health problems.
    - i Identify common pests and utilize knowledge of pest/host-plant biology to manage them in a sustainable manner.
    - ii Develop sustainable pest management plans in production and landscape settings.
    - iii Diagnose abiotic plant problems and utilize scientific principles to correct them in a sustainable manner.
    - iv Utilize natural enemies, low-risk plant protection products, conventional pesticides, and a variety of application techniques to control pest problems.
2. HCS graduates will have knowledge of the business aspects of their concentration.
  - a. Demonstrate a basic knowledge of accounting.
    - i Utilize basic small business software to maintain business records.
    - ii Manually maintain business records utilizing basic double-entry bookkeeping practices.
  - b. Demonstrate knowledge of licensing requirements.
    - i Discuss the branches of horticulture and crop science with licensing requirements and the steps necessary to obtain licenses.
  - c. Demonstrate a basic knowledge of business practices and ethics.
    - i Articulate the relationship between productivity and profit.
    - ii Discuss the ethical basis or lack thereof of business practices.
3. HCS graduates will possess the appropriate management skills that will enable effective leadership, planning, and decision-making.
  - a. Prioritize goals and objectives.
    - i Clearly state primary and subsidiary objectives.
  - b. Consider others' points-of-view

- i Display listening skills
- c. Critically evaluate multiple options and decide on the best course for goal completion.
  - i Distinguish between factors influencing and not influencing the problem.
  - ii Evaluate those factors affecting goal completion.
- d. Evaluate the steps necessary to accomplish a goal and plan for their completion.
  - i Determine the steps to reach the goal.
  - ii Prioritize the steps to goal completion.
- e. Inspire others to actively participate in accomplishing a goal.
  - i Clearly explain the importance of the goal to others.
  - ii Convince others of the importance of their contributions in the attainment of the goal.
- 4. HCS graduates will have excellent interpersonal and communication skills that will facilitate their working in teams in a diverse work environment. They will:
  - a. Demonstrate an ability to clearly convey an idea or point of view in a written format.
    - i Write high quality scientific papers/technical reports.
    - ii Write effective factual and persuasive essays.
    - iii Edit essays written by others.
  - b. Demonstrate an ability to clearly convey an idea or point of view in an oral format.
    - i Deliver effective factual and persuasive oral presentations.
    - ii Effectively utilize presentation software in oral presentation.
    - iii Effectively utilize other media techniques.
  - c. Demonstrate an ability to work effectively with people from diverse backgrounds.
    - i Work in teams to complete professional projects.
    - ii Demonstrate an appreciation of the variety of cultural, racial, economic, and sexual identities in the population so that the work environment is accepting and safe for everyone.
    - iii Develop an appreciation of a foreign language.
  - d. Consider viewpoints from a variety of perspectives.
    - i Demonstrate an ability to gather and integrate information in order to successfully participate in a respectful and informed intellectual debate.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units upper division
- GWR
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit unless so listed.

## MAJOR COURSES

HCS 110	Orientation to Horticulture and Crop Science	2
HCS 120	Principles of Horticulture and Crop Science	4
HCS 124	Plant Propagation	4
HCS 304	Plant Breeding	4
HCS 327	Abiotic Plant Problems	3
HCS 410	Crop Physiology	4
HCS 461	Senior Project I	2
HCS 462	Senior Project II	2
HCS 463	Senior Seminar <sup>2</sup>	1
PPSC 311	Agricultural Entomology	4
PPSC 321	Weed Biology and Management	4
BOT 121	General Botany (B2 & B4) <sup>1</sup>	4
BOT 323	Plant Pathology	4
SS 121	Introductory Soil Science	4
Concentration courses (see below)		42

## SUPPORT COURSES

BRAE 340	Irrigation Water Management (Area F) <sup>1</sup>	4
BUS 212	Financial Accounting for Nonbusiness Majors	4
CHEM 111	Survey of Chemistry (B3 & B4) <sup>1</sup>	5
CHEM 312	Survey of Organic Chemistry	5
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
SPAN 111	Elementary Hispanic Language and Culture (USCP)	4
SS 221	Fertilizers and Plant Nutrition	4
STAT 218	Applied Statistics for the Life Sciences (B1) <sup>1</sup>	4

## GENERAL EDUCATION (GE)

(See GE program requirements below.) 48

## FREE ELECTIVES

Free Electives	6
Total units	180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> May substitute 1 unit of any upper-division free elective.

## Concentrations (select one)

- Crop Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/cropscienceconcentration>)
- Fruit Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/fruitscienceconcentration>)
- Greenhouse and Nursery Plant Production (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/greenhouseandnurseryplantproductionconcentration>)



- Plant Protection Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/plantprotectionscienceconcentration>)
- Public Horticulture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/publichorticultureconcentration>)
- Sustainable Landscape Management and Design (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/sustainablelandscape management and design concentration>)
- Turfgrass and Sports Field Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/horticulturecropscience/bsagricultureandenvironmentalplantscience/turfgrassandsportsfieldmanagementconcentration>)

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics (no additional units required)	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective (4 units in Support)	0
Total units		48

<sup>1</sup> Required in Support; also satisfies GE

## Crop Science Concentration

VGSC 190	California Vegetable Production	4
VGSC 202	Enterprise Project	2
or CRSC 203	Organic Farming Enterprise Project	
HCS 231	Commercial Seed Production	4
CRSC 411	Experimental Techniques and Analysis	4
HCS 421	Postharvest Technology of Horticultural Crops	4
CRSC 445	Cropping Systems	4

### Approved electives <sup>1</sup>

Select from the following: 20

AG 315	Organic Agriculture
AG 360	Holistic Management
AGB 301	Food and Fiber Marketing
AGB 310	Agribusiness Credit and Finance
AGB 312	Agricultural Policy
AGB 321	Farm Records
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations
CRSC 123	Forage Crops
CRSC 244	Precision Farming
CRSC 333	Greenhouse Vegetable Production
CRSC 402	Enterprise Project Management
or VGSC 402	Enterprise Project Management
FRSC 132	Pomology I
FRSC 231	Viticulture I
FRSC 331	Viticulture II
FRSC 342	Citrus and Avocado Fruit Production
HCS 200	Special Problems for Undergraduates <sup>2</sup>
HCS 339	Internship in Horticulture and Crop Science <sup>2</sup>
HCS 340	Principles of Greenhouse Environment
HCS 400	Special Problems for Advanced Undergraduates <sup>2</sup>
PPSC 327	Vertebrate Pest Management
PPSC 405	Advanced Weed Management
PPSC 421	Plant-Pest Interactions
PPSC 427	Disease and Pest Control Systems for Ornamental Plants
PPSC 431	Insect Pest Management
PPSC 441	Biological Control for Pest Management
SS 321	Soil Morphology
SS 322	Soil Plant Relationships
VGSC 423	Advanced Vegetable Science

Total units 42

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> HCS 200 and HCS 400 up to 2 units each; HCS 339 up to 4 units.

## Fruit Science Concentration

FRSC 123	Beekeeping	3
FRSC 132	Pomology I	4
FRSC 133	Pomology II	4
FRSC 202	Enterprise Project	2
FRSC 231	Viticulture I	4
FRSC 331	Viticulture II	4
FRSC 342	Citrus and Avocado Fruit Production	4
CRSC 411	Experimental Techniques and Analysis	4
HCS 421	Postharvest Technology of Horticultural Crops	4

### Approved electives <sup>1</sup>

Select from the following:		9
AGB 260	Agribusiness Information Technology	
AGB 301	Food and Fiber Marketing	
AGB 310	Agribusiness Credit and Finance	
AGB 315	Land Economics	
AGB 321	Farm Records	
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
CRSC 333	Greenhouse Vegetable Production	
CRSC 445	Cropping Systems	
CRSC 402	Enterprise Project Management	
or FRSC 402	Enterprise Project Management	
or VGSC 402	Enterprise Project Management	
FRSC 415	Grapevine Physiology	
HCS 200	Special Problems for Undergraduates <sup>2</sup>	
HCS 339	Internship in Horticulture and Crop Science <sup>1, 3</sup>	
HCS 400	Special Problems for Advanced Undergraduates <sup>2</sup>	
PPSC 327	Vertebrate Pest Management	
PPSC 405	Advanced Weed Management	
PPSC 414	Grape Pest Management	
PPSC 421	Plant-Pest Interactions	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	
SS 321	Soil Morphology	
SS 322	Soil Plant Relationships	
VGSC 190	California Vegetable Production	
VGSC 423	Advanced Vegetable Science	
WVIT 433	Wine Sales and E-Commerce	

Total units 42

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> HCS 200 and HCS 400 up to 2 units each

<sup>3</sup> HCS 339 up to 4 units

## Greenhouse and Nursery Plant Production Concentration

EHS 127	Horticulture and Landscape Design	4
EHS 210	Enterprise Project I <sup>1</sup>	2
or EHS 310	Enterprise Project II	
EHS 231	Plant Materials I	4
EHS 232	Plant Materials II	4
EHS 245	Horticultural Production Techniques	3
EHS 315	Herbaceous and Specialty Plant Production	4
EHS 342	Potted Plant Production	4
HCS 340	Principles of Greenhouse Environment	4
PPSC 427	Disease and Pest Control Systems for Ornamental Plants	4

### Approved electives <sup>2</sup>

Select from the following:		9
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
BUS 310	Introduction to Entrepreneurship	
BUS 346	Principles of Marketing	
BUS 409	Law of Real Property	
CRSC 333	Greenhouse Vegetable Production	
EHS 210	Enterprise Project I	
or EHS 310	Enterprise Project II	
EHS 324	Interior Plant Management	
EHS 341	Cut Flower Production	
EHS 381	Native Plants for California Landscapes	
EHS 382	Restoration Horticulture	
EHS 402	Retailing Horticultural Products	
EHS 424	Nursery Crop Production	
HCS 200	Special Problems for Undergraduates <sup>3</sup>	
HCS 339	Internship in Horticulture and Crop Science <sup>1, 4</sup>	
HCS 400	Special Problems for Advanced Undergraduates <sup>3</sup>	
HCS 421	Postharvest Technology of Horticultural Crops	
PPSC 327	Vertebrate Pest Management	
PPSC 405	Advanced Weed Management	
PPSC 421	Plant-Pest Interactions	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	

Total units 42

<sup>1</sup> The course selected to satisfy this requirement may not be taken again for credit as an approved elective.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>3</sup> HCS 200 and HCS 400 up to 2 units each

<sup>4</sup> HCS 339 up to 4 units

## Plant Protection Science Concentration

CRSC 411	Experimental Techniques and Analysis	4
Select from the following:		2
CRSC 402	Enterprise Project Management	
EHS 210	Enterprise Project I	
EHS 310	Enterprise Project II	
FRSC 202	Enterprise Project	
FRSC 402	Enterprise Project Management	
VGSC 202	Enterprise Project	
VGSC 402	Enterprise Project Management	
PPSC 327	Vertebrate Pest Management	4
PPSC 405	Advanced Weed Management	4
PPSC 421	Plant-Pest Interactions	4
PPSC 431	Insect Pest Management	4
PPSC 441	Biological Control for Pest Management	4

### Approved electives<sup>1</sup>

Select from the following:		16
AG 315	Organic Agriculture	
BIO 114	Plant Diversity and Ecology	
BOT 326	Plant Ecology	
BRAE 331	Irrigation Theory	
CHEM 313	Survey of Biochemistry and Biotechnology	
CRSC 123	Forage Crops	
CRSC 244	Precision Farming	
CRSC 333	Greenhouse Vegetable Production	
CRSC 445	Cropping Systems	
EHS 245	Horticultural Production Techniques	
EHS 315	Herbaceous and Specialty Plant Production	
EHS 341	Cut Flower Production	
EHS 342	Potted Plant Production	
EHS 343	Turfgrass Management	
FRSC 132	Pomology I	
FRSC 133	Pomology II	
FRSC 231	Viticulture I	
FRSC 331	Viticulture II	
FRSC 342	Citrus and Avocado Fruit Production	
HCS 200	Special Problems for Undergraduates <sup>2</sup>	
HCS 231	Commercial Seed Production	
HCS 339	Internship in Horticulture and Crop Science <sup>1, 3</sup>	
HCS 340	Principles of Greenhouse Environment	
HCS 400	Special Problems for Advanced Undergraduates <sup>2</sup>	
HCS 421	Postharvest Technology of Horticultural Crops	
MCRO 221	Microbiology	
MCRO 436	Environmental Microbiology	
PPSC 427	Disease and Pest Control Systems for Ornamental Plants	
SS 322	Soil Plant Relationships	
SS 422	Soil Microbiology and Biochemistry	

## VGSC 190 California Vegetable Production

Total units 42

- 1 Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- 2 HCS 200 and HCS 400 up to 2 units each
- 3 HCS 339 up to 4 units

## Public Horticulture Concentration

EHS 123	Landscape Installation and Maintenance	4
EHS 127	Horticulture and Landscape Design	4
EHS 231	Plant Materials I	4
EHS 232	Plant Materials II	4
EHS 343	Turfgrass Management	4
EHS 437	Park and Public Space Management	4
PPSC 427	Disease and Pest Control Systems for Ornamental Plants	4

### Approved electives<sup>1</sup>

Select from the following:		14
BRAE 331	Irrigation Theory	
BRAE 337	Landscape Irrigation	
EHS 215	Floral Design I	
EHS 225	Floral Design II	
EHS 301	Principles of Landscape Design	
EHS 324	Interior Plant Management	
EHS 381	Native Plants for California Landscapes	
EHS 382	Restoration Horticulture	
EHS 402	Retailing Horticultural Products	
EHS 421	Arboriculture	
EHS 427	Advanced Landscape Design	
EHS 434	Landscape Management	
HCS 200	Special Problems for Undergraduates <sup>2</sup>	
HCS 339	Internship in Horticulture and Crop Science <sup>1, 3</sup>	
HCS 340	Principles of Greenhouse Environment	
HCS 400	Special Problems for Advanced Undergraduates <sup>2</sup>	
PPSC 405	Advanced Weed Management	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	
May select up to two of the following:		
BOT 313	Taxonomy of Vascular Plants	
BOT 326	Plant Ecology	
SS 433	Land Use Planning	
Total units		42

- 1 Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- 2 HCS 200 and HCS 400 up to 2 units each
- 3 HCS 339 up to 4 units

## Sustainable Landscape Management and Design Concentration

EHS 123	Landscape Installation and Maintenance	4
EHS 126	Landscape Construction	3
EHS 127	Horticulture and Landscape Design	4
EHS 231	Plant Materials I	4
EHS 232	Plant Materials II	4
EHS 331	Landscape Contracting	4
EHS 343	Turfgrass Management	4

### Approved electives <sup>1</sup>

Select from the following: 15

AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
BRAE 331	Irrigation Theory	
BRAE 337	Landscape Irrigation	
EHS 301	Principles of Landscape Design	
EHS 324	Interior Plant Management	
EHS 381	Native Plants for California Landscapes	
EHS 382	Restoration Horticulture	
EHS 421	Arboriculture	
EHS 427	Advanced Landscape Design	
EHS 433	Golf Course Management Operations	
EHS 434	Landscape Management	
EHS 437	Park and Public Space Management	
HCS 200	Special Problems for Undergraduates <sup>2</sup>	
HCS 339	Internship in Horticulture and Crop Science <sup>1, 3</sup>	
HCS 400	Special Problems for Advanced Undergraduates <sup>2</sup>	
PPSC 327	Vertebrate Pest Management	
PPSC 405	Advanced Weed Management	
PPSC 421	Plant-Pest Interactions	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	

Total units 42

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> HCS 200 and HCS 400 up to 2 units each

<sup>3</sup> HCS 339 up to 4 units

## Turfgrass and Sports Field Management Concentration

EHS 123	Landscape Installation and Maintenance	4
EHS 126	Landscape Construction	3
EHS 231	Plant Materials I	4
or EHS 232	Plant Materials II	
EHS 343	Turfgrass Management	4

EHS 430	Sports Field Construction and Management	4
EHS 433	Golf Course Management Operations	4
HCS 339	Internship in Horticulture and Crop Science	4
PPSC 427	Disease and Pest Control Systems for Ornamental Plants	4

### Approved electives <sup>1</sup>

Select from the following: 11

BOT 326	Plant Ecology	
BRAE 331	Irrigation Theory	
BRAE 337	Landscape Irrigation	
CRSC 411	Experimental Techniques and Analysis	
EHS 301	Principles of Landscape Design	
EHS 324	Interior Plant Management	
EHS 381	Native Plants for California Landscapes	
EHS 421	Arboriculture	
EHS 434	Landscape Management	
EHS 437	Park and Public Space Management	
HCS 200	Special Problems for Undergraduates <sup>2</sup>	
HCS 400	Special Problems for Advanced Undergraduates <sup>2</sup>	
PPSC 327	Vertebrate Pest Management	
PPSC 405	Advanced Weed Management	
PPSC 431	Insect Pest Management	
SS 322	Soil Plant Relationships	

Total units 42

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> HCS 200 and HCS 400 up to 2 units each

## Crop Science Minor

### Required Courses

HCS 120	Principles of Horticulture and Crop Science	4
CRSC 244	Precision Farming	4
VGSC 190	California Vegetable Production	4
CRSC 203	Organic Farming Enterprise Project	2
or VGSC 202	Enterprise Project	
BRAE 340	Irrigation Water Management	4

### Approved Electives

Select from the following: 12

CRSC 333	Greenhouse Vegetable Production	
CRSC 445	Cropping Systems	
HCS 304	Plant Breeding	
HCS 421	Postharvest Technology of Horticultural Crops	
PPSC 311	Agricultural Entomology	
PPSC 321	Weed Biology and Management	

Total units 30

## Fruit Science Minor

### Required Courses

HCS 120	Principles of Horticulture and Crop Science	4
FRSC 132	Pomology I	4
FRSC 133	Pomology II	4
FRSC 342	Citrus and Avocado Fruit Production	4
FRSC 202	Enterprise Project	2

### Approved Electives

Select from the following:		10
BRAE 340	Irrigation Water Management	
BOT 323	Plant Pathology	
CRSC 445	Cropping Systems	
FRSC 311	Survey of Viticulture	
FRSC 402	Enterprise Project Management	
HCS 329	Plants, Food, and Biotechnology	
HCS 421	Postharvest Technology of Horticultural Crops	
PPSC 311	Agricultural Entomology	
PPSC 321	Weed Biology and Management	
PPSC 327	Vertebrate Pest Management	

Total units 28

## Landscape Horticulture Minor

### Required Courses

EHS 123	Landscape Installation and Maintenance	4
EHS 126	Landscape Construction	3
EHS 127	Horticulture and Landscape Design	4
EHS 231	Plant Materials I	4
or EHS 232	Plant Materials II	
EHS 331	Landscape Contracting	4

### Approved Electives

Select from the following:		11
EHS 301	Principles of Landscape Design	
EHS 315	Herbaceous and Specialty Plant Production	
EHS 324	Interior Plant Management	
EHS 343	Turfgrass Management	
EHS 381	Native Plants for California Landscapes	
EHS 421	Arboriculture	
EHS 434	Landscape Management	
EHS 437	Park and Public Space Management	

Total units 30

## Plant Protection Minor

### Required Courses

Advanced versions of the following courses may be substituted by production majors.

HCS 120	Principles of Horticulture and Crop Science	4
or BOT 121	General Botany	
BOT 323	Plant Pathology	4
PPSC 311	Agricultural Entomology	4
PPSC 321	Weed Biology and Management	4

### Courses in area of emphasis

Students elect one Emphasis based on their major. 12

#### Emphasis I: for Plant Production Majors (12 units)

For majors in: Agricultural and Environmental Plant Sciences, Forestry and Natural Resources (Forestry Concentration), and Wine and Viticulture.

PPSC 327	Vertebrate Pest Management
PPSC 405	Advanced Weed Management
PPSC 414	Grape Pest Management
PPSC 421	Plant-Pest Interactions
PPSC 427	Disease and Pest Control Systems for Ornamental Plants
PPSC 431	Insect Pest Management
PPSC 441	Biological Control for Pest Management

#### Emphasis II: for Non-Plant Production Majors (12 units)

Select 8 units of specified agriculture production courses from the following: <sup>1</sup>

AG 360	Holistic Management
AG 450	Applied Holistic Management
ASCI 112	Principles of Animal Science
ASCI 311	Advanced Beef Cattle System Management
ASCI 329	Principles of Range Management
CRSC 123	Forage Crops
CRSC 203	Organic Farming Enterprise Project
CRSC 244	Precision Farming
CRSC 333	Greenhouse Vegetable Production
CRSC 402	Enterprise Project Management
CRSC 445	Cropping Systems
DSCI 121	Elements of Dairying
DSCI 230	General Dairy Husbandry
DSCI 333	Dairy Animal Health, Safety and Applied Technology
EHS 123	Landscape Installation and Maintenance
EHS 210	Enterprise Project I
EHS 230	Environmental Horticulture
EHS 231	Plant Materials I
EHS 232	Plant Materials II
EHS 245	Horticultural Production Techniques
EHS 310	Enterprise Project II
EHS 324	Interior Plant Management
EHS 341	Cut Flower Production
EHS 342	Potted Plant Production
EHS 343	Turfgrass Management
EHS 381	Native Plants for California Landscapes
EHS 382	Restoration Horticulture
EHS 421	Arboriculture
EHS 424	Nursery Crop Production
EHS 433	Golf Course Management Operations
FRSC 123	Beekeeping
FRSC 132	Pomology I
FRSC 133	Pomology II
FRSC 202	Enterprise Project
FRSC 210	Viticultural Practices



FRSC 230	California Fruit Growing
FRSC 231	Viticulture I
FRSC 331	Viticulture II
FRSC 342	Citrus and Avocado Fruit Production
FRSC 402	Enterprise Project Management
HCS 110	Orientation to Horticulture and Crop Science
HCS 120	Principles of Horticulture and Crop Science
HCS 124	Plant Propagation
HCS 231	Commercial Seed Production
HCS 340	Principles of Greenhouse Environment
NR 141	Introduction to Forest Ecosystem Management
NR 260	Forest Practices and Environmental Protection
NR 350	Urban Forestry
NR 365	Silviculture and Vegetation Management
NR 414	Sustainable Forest Management
NR 503	Tropical Forest Ecosystem
NR 504	Agroforestry Systems
VGSC 190	California Vegetable Production
VGSC 202	Enterprise Project
VGSC 230	Introduction to Vegetable Science
VGSC 402	Enterprise Project Management
VGSC 423	Advanced Vegetable Science
Select 4 units from the following: <sup>1</sup>	
PPSC 327	Vertebrate Pest Management
PPSC 405	Advanced Weed Management
PPSC 414	Grape Pest Management
PPSC 421	Plant-Pest Interactions
PPSC 427	Disease and Pest Control Systems for Ornamental Plants
PPSC 431	Insect Pest Management
PPSC 441	Biological Control for Pest Management
<hr/>	
Total units	28

<sup>1</sup> Approval of minor advisor required.

## Military Science

Dexter Bldg. (34), Room 115  
Phone: 805.756.7682

Department Head: Major Joshua Gillen

### Programs

Program name	Program type
ROTC	Four-Year Program
Military Science	Minor

### Four-Year Program

The Military Science Department conducts a dynamic four-year program of instruction which develops the mental and physical qualifications of graduates in preparation for positions of leadership within the military and civilian communities. Students may enroll at any time for full academic elective credit without incurring any military service obligation. However, the last two years of the program are oriented toward preparing the student for a military career.

The innovative and well-taught courses complement all major areas of study by broadening the student's basic education. The complete curriculum includes both military leadership and management courses; courses which provide an awareness of the heritage of the U.S. military; the Armed Forces' role in national defense strategy; professional military subjects; and military ethics.

Students desiring to attain a highly sought-after commission as a Second Lieutenant in the U.S. Army must meet eligibility requirements and complete the entire Military Science/ROTC (Reserve Officers' Training Corps) Advanced Course (25 units). To be eligible for participation in the Cal Poly ROTC Program, a student must be enrolled full time (12 units) at Cal Poly, have at least two years remaining as a university student to permit completion of the advanced course prior to reaching the 30th birthday, and be physically qualified.

### Financial Assistance

Many opportunities for financial assistance are available to students. Three areas of opportunities are: ROTC cadets who sign a contract for Advanced Phase, students who earn an ROTC scholarship, and cadets who train with Reserve or National Guard units. All ROTC cadets sign a contract to participate in the Advanced Phase of ROTC and receive a \$300 - \$500 a month allowance. Criteria to participate in the Advanced Phase are stated later. Highly competitive two-, two and a half, three-, and four-year ROTC scholarships are available. The scholarship provides payment of either full tuition or room and board (student's choice), books, supplies, and the \$300 - 500 a month allowance for the duration of the scholarship. Students interested in ROTC scholarship should contact the Military Science Department. Reserve or National Guard training provides an additional two sources of financial assistance: approximately \$165 a month for one weekend drill and approximately \$190 a month tuition assistance from the National Guard/Army Reserve "New GI Bill" benefits.

### Equipment and Uniforms

All necessary equipment, uniforms and textbooks for participation in the Military Science/ROTC program are furnished to the student by the United States Government free of charge. Title to this property, other than expendable items, remains with the government.

## Phases of Four-Year Program

The four-year program elective military science curriculum is divided into two diverse phases. The basic phase is primarily for freshmen and sophomores, and the advanced phase is for junior and senior level students.

### Basic Phase

The Basic Phase is a two-year challenging opportunity where students may, without obligation, investigate the ROTC Program and the military as a full- or part-time career. Students may enter and leave this phase during any quarter. The curriculum for the basic phase is listed below and offers many exciting opportunities for all students. To become an ROTC cadet during this phase requires the student be registered for a Military Science class, completion of an ROTC enrollment form (obtained at the Military Science Department, Dexter Building, Room 115), and an interview with the ROTC Enrollment Officer. Because this phase is for students to examine the ROTC Program without obligation, participation in ROTC activities is encouraged but not mandatory.

Entry to the challenging Advanced Phase is accomplished either by successfully completing the Basic Phase classes, completing ROTC Leader's Training Course or completing any military basic training program. Students have the option of contracting any time during their second year of the Basic Phase of study.

### ROTC Leader's Training Course (Summer Session only)

One method to qualify for the Advanced Phase is to successfully complete the four-week challenging ROTC Leader's Training Course (LTC). Students normally attend LTC during the summer between their second and third academic years. Transfer students may complete the camp during the summer immediately prior to their matriculation at Cal Poly. It is important that potential transfer students who plan to participate in the two-year ROTC program make their intentions known directly to the Military Science Department no later than June 1 of the year they plan to register at the university even though this date may precede the date of their final acceptance by the university.

The government provides a transportation allowance to and from LTC and pay at the rate of one-half of a Second Lieutenant's basic pay. All equipment, uniforms, room, board and medical care are furnished free while at camp. A maximum of 7 units elective credit may be earned for attending LTC. No military obligation is incurred for attending this camp.

### Basic Training

Outstanding students who have successfully served on active duty, regardless of the branch of service, are qualified to enter the Advanced Phase because they have completed basic training for their particular branch of service. Also, students who have been or are members of Reserve or National Guard units and have completed basic training are qualified for the Advanced Phase.

### Advanced Phase

The Advanced Phase is a two-year period where ROTC cadets receive advanced leadership and management training. The cadets receive many hours of hands-on, practical leadership experiences to prepare them for a military career or a management position in the civilian sector. To become a cadet in the Advanced Phase a student must complete the Basic Phase, ROTC Summer Leader's Training Course (LTC) or Basic Training. The student must also make a commitment

to attend all required training activities and sign a contract to accept a prestigious commission in the United States Army. In return for the student's commitment, the Military Science Department provides \$450-500 a month (which is based on program year), classroom instruction, real leadership opportunities, and continuous professional development of their leadership skills.

After their first year of the Advanced Phase, cadets usually attend a four-week camp where their leadership skills are further developed and assessed. All equipment, uniforms, room, board, and medical care are furnished free while at this camp. The cadets also receive approximately \$800 during the five weeks. Upon successful completion of the Advanced Phase and graduation from the university, the cadet is commissioned as a Second Lieutenant in the United States Army.

## Simultaneous Membership Program

Students can serve simultaneously in either the California National Guard or Army Reserve while they are cadets in ROTC and receive pay from both their unit and ROTC. Those who complete the ROTC Advanced Phase prior to graduation may continue serving in the Reserve or National Guard in the Simultaneous Membership Program. Since students can earn as much as \$4,000 each year, this program provides both substantial financial benefits and leadership experience.

## Military Science Minor

The minor emphasizes the following personal and technical skills: time, personnel, and resource management under duress; knowledge of U.S. military heritage, customs, and courtesies; planning and briefing under time constraints; current national defense issues; equal opportunity, sexual harassment, and military ethics; military justice; physical fitness; map reading and orienteering; leadership, management, and counseling skills under duress; oral, visual, and written communication skills in accordance with Army norms; small unit tactics. It provides marketable skills to students interested in government service, personnel management, and law enforcement. The Military Science Minor is limited to contracted ROTC cadets only. A minimum GPA of 2.5 is required in all units counted for completion of the minor.

## Basic Phase

### Freshman

MSL 101	Foundation of Officership I	1
MSL 102	Foundation of Officership II	1
MSL 103	Basic Leadership	1
MSL 110	Exercises in Military Leadership	1
MSL 111	Orienteering	2
MSL 112	The Army Physical Fitness Program	1

### Sophomore

MSL 201	Foundations of Leadership I	2
MSL 202	Foundations of Leadership II	2
MSL 203	Foundations of Leadership III	2
MSL 212	Leader's Training Course <sup>1</sup>	1-7
MSL 229	Ranger Challenge	2
MSL 240	American Military History and the Evolution of Western Warfare <sup>2</sup>	4

<sup>1</sup> LTC is an optional 5-week summer training course (1-7 units) at Fort Knox, Kentucky.

<sup>2</sup> MSL 240 or equivalent is required for commissioning of all cadets; approved substitutions are HIST 320, HIST 321 and HIST 322.

## Advanced Phase

### Junior

MSL 301	Tactical Leadership I	3
MSL 302	Tactical Leadership II	3
MSL 303	Applied Leadership	3
MSL 310	Advanced Leadership of Military Exercises	1
MSL 312	Leadership of the Army Physical Fitness Program	1
MSL 314	Leadership Development and Assessment Course <sup>1</sup>	6

### Senior

MSL 400	Special Problems for Advanced Undergraduates	2
MSL 401	Developmental Leadership I	3
MSL 402	Developmental Leadership II	3
MSL 403	Adaptive Leadership	3
MSL 410	Administration and Evaluation of Exercises in Military Leadership	1
MSL 412	Administration and Evaluation of the Army Physical Fitness Program	1
MSL 470	Selected Advanced Topics	1-4

<sup>1</sup> LDAC is a required 5-week summer training experience at Fort Lewis, Washington (6 credits).

## Military Science Minor

### Required Courses

Select from the following:		4
MSL 240	American Military History and the Evolution of Western Warfare	
HIST 320	Colonial and Revolutionary America	
HIST 321	Civil War America	
HIST 322	Modern America	
MSL 301	Tactical Leadership I	3
MSL 302	Tactical Leadership II	3
MSL 303	Applied Leadership	3
MSL 401	Developmental Leadership I	3
MSL 402	Developmental Leadership II	3
MSL 403	Adaptive Leadership	3

### Approved Electives

Select from the following:		6
MSL 101	Foundation of Officership I	
MSL 102	Foundation of Officership II	
MSL 103	Basic Leadership	
MSL 110	Exercises in Military Leadership	
MSL 111	Orienteering	
MSL 112	The Army Physical Fitness Program	
MSL 201	Foundations of Leadership I	
MSL 202	Foundations of Leadership II	
MSL 212	Leader's Training Course	
MSL 229	Ranger Challenge	

MSL 310	Advanced Leadership of Military Exercises
MSL 312	Leadership of the Army Physical Fitness Program
MSL 314	Leadership Development and Assessment Course (ROTC Only)
MSL 410	Administration and Evaluation of Exercises in Military Leadership
MSL 412	Administration and Evaluation of the Army Physical Fitness Program
MSL/RPTA 275	Challenge Course Facilitation
<hr/>	
Total units	28

## Natural Resources Management and Environmental Sciences

Baker Center for Sciences and Mathematics Bldg. (180), Room 209  
Phone: 805.756.2702; Fax: 805.756.1402  
<http://www.nres.calpoly.edu>

Interim Department Head: Richard Thompson

### Academic Programs

Program name	Program type
Disaster Management and Homeland Security	Minor
Environmental Earth Science	BS
Environmental Management and Protection	BS
Environmental Soil Science	BS, Minor
Forestry and Natural Resources	BS
Forestry Sciences	MS
Indigenous Studies in Natural Resources and the Environment	Minor

The Natural Resources Management and Environmental Sciences department offers four undergraduate majors – Environmental Earth Sciences (ERSC), Environmental Management and Projection (ENVM), Forestry and Natural Resources (FNR) and Environmental Soil Science (SS). Students have access to several thousand acres of agricultural, forest, and range land managed by the college. Students gain hands-on experience with equipment and techniques in common use by foresters, natural resources managers, soil scientists, agricultural scientists, geologists, and environmental scientists. The department is equipped for analysis of soil, plant, tree, rock, and water samples. Analytical methods available to students include inductively coupled plasma – atomic emission spectroscopy (ICP-AES) flame atomic absorption spectrometry (FL-AAS), high temperature combustion analysis of carbon, nitrogen, and sulfur, petrographic microscopy with digital image analysis, as well as a suite of geographic and geospatial analytical techniques and instrumentation.

The department maintains greenhouse research space with an outdoor erosion research facility, providing opportunities for students to assess erosion control practices used to protect and improve water quality. Additionally, the department operates state-of-the-art weather monitoring equipment on Cal Poly rangelands, providing data for a wide variety of interdisciplinary research projects.

### Experiential Learning

The Natural Resources Management and Environmental Sciences Department has a number of outdoor field sites where faculty and student learn-by-doing projects and research are conducted. Facilities sited at the Cal Poly campus include a Forestry Skills Center, computer labs, GIS laboratories, Coastal Resources Institute Research field lab and several well-equipped greenhouses. Most importantly, the department plays a lead role in administering the Swanton Pacific Ranch and School Forest near Santa Cruz, California. This 3800-acre ranch includes redwood forests, salmonid-bearing streams, agricultural land and many other ecosystems. The Swanton Pacific Ranch provides hands-on learning of active forest, ranch, agricultural, and watershed management activities. The management of these forest resources is internationally certified by the Forest Stewardship Council. Students make extensive use of these facilities. Significant field work and laboratory activities occur in all undergraduate and

graduate programs requiring field clothing and associated safety equipment.

In addition to these campus-based learning experiences, the NRES department places great importance on work experience before graduation. Work experience validates the student's career goals, confirms the relevance of their classroom education, while offering a pathway to employment. Students can earn course credit through internship, and similar supervisory courses, for volunteer or paid work positions related to their major.

Students are encouraged to reinforce their education, develop professional contacts, and strengthen their career potential by participating in any of the following activities: the Earth, Soil, and Water Conservation Club; the Soil Judging Team; Association of Environmental Professionals Student Chapter (AEP); Society of American Foresters Student Chapter (SAF); Logging Team; Student Association of Fire Ecology; and/or Xi Sigma Pi Forestry Honorary Society; attending international and national conferences; and internships and cooperative education programs with government and industry. Each of these opportunities, combined with a friendly, helpful atmosphere, provide students a college experience that is highly personal as well as rewarding. Students also are encouraged to investigate opportunities for international education. Please see the Cal Poly International Program (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/academicervicesandprograms/calpolyinternationalcenter>) program section of this catalog. Significant field work and laboratory activities occur in all undergraduate and graduate programs required field clothing and associated safety equipment.

## Undergraduate Programs

### BS Environmental Earth Science

The BS in Environmental Earth Sciences provides a strong foundation for understanding and improving the utilization of land, water, and atmospheric resources. The program emphasizes a wide range of disciplines in natural resources and in the cultures that use and modify them. The core of the earth sciences curriculum is composed of geography, geology, and soil science, and is strengthened by a diverse array of related topical and technical specialties.

The Environmental Earth Sciences major provides detailed and thorough training in the natural and cultural processes that govern the relationship between humans and their habitats. The program also furnishes students the marketable expertise to assess, manage, repair, and improve this fragile relationship while acquiring a well-rounded education in both the natural and social sciences. In addition, majors can meet the educational requirements for professional certification in a number of areas and find their training ideal for graduate school preparation in a number of related disciplines.

Due to the multidisciplinary nature of the Environmental Earth Sciences major, students have access to diverse faculty and laboratories in several colleges on campus. California's Central Coast offers a diverse environmental and cultural setting for real-world training and experiences in the earth sciences.

Undergraduate students majoring in Environmental Earth Sciences earn the credentials for useful careers in resource assessment and administration. They graduate with a substantial and well rounded education in the natural and social sciences. Moreover, Environmental Earth Sciences graduates possess the understanding, flexibility, and



tools to appreciate and adapt to a changing world and its employment opportunities.

## Concentrations

In addition to the required major courses, students select one of the following concentrations or individualized course of study based upon their interests and career goals.

### Climate Change Studies

Students gain knowledge and understanding of the applied sciences of meteorology and climatology. This foundational knowledge is coupled with an understanding of how a rapidly changing climate affects humans economically, socially, and politically, and affects global environments. Students are equipped to pursue careers in environmental science and policy and contribute to the understanding of climate change and how to mitigate the impacts of humans.

### Environmental Interpretation and Assessment

Prepares students for careers in environmental assessment, impact analysis, planning, and government administration. Students gain skill in the analysis of environmental utilization and modification and the current legal and regulatory environment. This concentration also provides a strong foundation for graduate school in geography and environmental studies.

### Geology

Students learn the fundamentals of a broad variety of geologic subdisciplines, including mineralogy, petrology, seismology, stratigraphy, geochemistry, geomorphology and structural geology. Each of these fundamental subdisciplines are supported by curriculum that emphasizes methods of data collection, interpretation and professional communication of results. Upon completion of this concentration, students are able to critically evaluate geologic reports within the context of our evolving societal needs, and are prepared to pursue post graduate degrees in the geosciences and/or careers in the geotechnical industry.

### Geosciences Teaching

Prepares students to meet California State Board of Education Earth Sciences Content Standards. Prepares students to seek a teaching credential for teaching earth sciences in elementary or secondary schools.

### Land and Water Resources

Prepares students for professional opportunities in the mitigation and conservation of land and water resources. Emphasis is on the processes that endanger these ecosystems and the knowledge necessary to protect and maintain them. Additional training in soils and hydrological studies along with enhanced technological skills is provided. This concentration also prepares students for graduate study in disciplines that specialize in land and water.

### Individualized Course of Study

Students may pursue an academic minor or create a program, with faculty approval, based upon their interests and career goals. The coursework may be specifically tailored for a career in industry, education, government, or as preparation for graduate school.

## BS Environmental Management and Protection

This major is an undergraduate, interdisciplinary course of study integrating the biophysical and social/economical/ political sciences

in natural resource management. The curriculum emphasizes management and protection of ecosystem structures and processes that sustain uses of environmental resources. The major provides students with the science and management background that, when properly integrated, can guide consumptive uses of resources in a sustainable manner for current and future generations.

Since environmental problems arise from human demands and stresses on the environment, solutions must focus on the human dimension of ecosystems. Thus, environmental management is the management of both people and resources to attain human goals while protecting environmental values in order to sustain natural systems.

Graduates are prepared for a broad range of professional careers in environmental assessment, impact analysis, project management and impact mitigation monitoring.

Knowledge of the legal and regulatory environment is balanced with study of ecological and economic theories and practices to solving social conflicts over environmental uses and impacts.

The Environmental Management and Protection major is endorsed and supported by the California Association of Environmental Professionals (AEP), a professional association representing the full range of environmental professions in both private and public sectors.

## Concentrations

In addition to the required major courses, students select one of the following:

### Environmental Impact Mitigation Strategies

Students may pursue an academic minor or create a program, with faculty approval, based upon their interests and career goals. The coursework may be specifically tailored for a career in industry, education, government, or as preparation for graduate school.

### Environmental Policy and Management

Through further study in land use analysis and planning, economics, regulation, administration, and law, students are prepared for careers in environmental planning and policy analysis or graduate school. Typical careers include analysts or lobbyists for non-governmental organizations (NGOs), trade associations, and government regulatory agencies.

### Watershed Management and Hydrology

Provides students a focused and encompassing program including a proficiency in watershed hydrology in forest ecosystems and Mediterranean ecosystems, rangeland hydrology, post-fire watershed evaluation, watershed and stream restoration and urban/wildland hydrologic implications. There are two tracks beyond the core coursework. Students pursuing Track 1 coursework can qualify as hydrologists under U.S. Government OPM guidelines.

### Wildlife Biology Concentration

This specialized course of study prepares students for wildlife biology certification and employment in the fish and wildlife areas of law enforcement, management, and production.

### Individualized Course of Study

This option for the student is planned, designed and developed through guidance from the student's advisor, and allows development of a program to meet the student's interests and career goals. It allows students to pursue existing minors/concentrations in areas such as water science, land rehabilitation, geographic information systems,

soil science, rangeland resources, public administration, sustainable environments, or wildlife biology.

## **BS Environmental Soil Science**

Three-fourths of the world's food and nearly all of its fiber come from the fragile, thin skin of the land's surface—the soil. Also, soil absorbs and transmits rain and snow, which replenish our groundwater; and it captures great quantities of environmental wastes. Soil scientists are responsible for the management of soil, one of our most precious natural resources.

The Bachelor of Science degree in Environmental Soil Science provides fundamental knowledge and skills needed for field, laboratory, management, and teaching positions, as well as for graduate studies. Concentrations are offered in Land Resources, Environmental Management, and Environmental Science and Technology. These high quality programs help ensure that our graduates are well prepared for the diverse opportunities awaiting them. Also, graduates can meet educational requirements for professional certification by the American Registry of Certified Professionals in Agronomy, Crops and Soils, and as Certified Professional Erosion and Sediment Control Specialists.

The undergraduate environmental soil science program ranks among the largest and strongest in the nation. Graduates are employed from Alaska to Mexico, Maine to Hawaii, and on every continent. Their Cal Poly experience has provided them with the strong scientific foundation, practical skills and balanced general education needed to be flexible and competitive in today's diverse, and often unpredictable, job market.

Undergraduate and graduate students majoring in environmental soil science earn a solid, useful education; likewise, students from other fields who select soil science courses as electives, or who select the soil science minor, can augment their skills and knowledge, making them more adaptable to changing professional opportunities. All students can discover soil's vital role in their lives, and the human dependence on the quality of soil for quality of life.

Cal Poly offers a Master of Science in Agriculture degree with a specialization in Soil Science. For information regarding this degree program, please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodandenvironmentalsciences/#graduatetext>) section.

## **Concentrations**

### **Environmental Management**

Offers a solid scientific back-ground melded with environmental policy and administration, site analysis, and resource planning. The program helps prepare students for managerial positions dealing with today's complicated environmental problems and opportunities.

### **Environmental Science and Technology**

Provides the strongest foundation for evaluating and solving complex environmental problems, including land and water degradation and contamination by hazardous wastes. Additionally, the concentration includes courses needed for admission to rigorous graduate programs.

### **Land Resources**

Prepares students for professional opportunities in soil and water conservation, farm advisement, fertilizer and agricultural chemicals industries, forest and range soils, urban land enhancement, laboratory analysis, soil surveying, environmental issues, and international agriculture. The flexibility of this concentration allows students to select

(with departmental approval) from nearly any minor offered by the University. Students are encouraged to consider the minors in Land Rehabilitation, Water Science, and Geographic Information Systems, offered through the College of Agriculture, Food and Environmental Sciences. In addition, students may design their programs to prepare for graduate studies.

## **BS Forestry and Natural Resources**

The Bachelor of Science degree program in Forestry and Natural Resources prepares students for careers in the protection and management of our forest and natural resources. Students may specialize in recreation management; urban forestry; environmental assessment and planning; watershed management and hydrology, fire and fuels management, forest and environmental practices, wildlife biology, or an individualized course of study.

Graduates qualify for such positions as: forester, environmental planner and assessor, natural resource manager, urban forester, park administrator, watershed manager, hydrologist, fire and fuels manager, and many other related environmental career areas. Cal Poly graduates are employed throughout the world: establishing, managing and sustaining forests and urban wildland areas; providing opportunities for a full range of uses; teaching; extension; research; and protecting and managing the environment.

Most students are required to complete an internship equivalent to half-time work. Paid internships are available at Swanton Pacific Ranch, or the student may choose to pursue a seasonal job, volunteer work, or a cooperative education program. Work experience for academic credit must be documented by work supervisor and approved by student's academic advisor.

Students are required to purchase 8-inch+ high field boots, hard-hats (OSHA approved), hand calculator capable of linear regression, 10X hand lens, and an engineers scale ruler prior to taking 200- or 300-level major courses. Students are strongly encouraged to purchase a laptop before beginning 300-level major courses.

The Society of American Foresters accredits the Forestry and Natural Resources program. Also, the U.S. Office of Personnel Management (OPM) recognizes employment as a forester with the Federal Government upon graduation.

## **Concentrations**

Concentrations prepare students for entry into the profession of forestry and natural resources. Extensive field training occurs concurrently with classroom instruction.

### **Environmental Planning and Assessment**

Prepares students for employment as professionals in the environmental management and protection subdisciplines of environmental planning, impact assessment, analysis and monitoring. Graduates from this concentration are academically qualified for Cal EPA's Registered Environmental Assessor I and II.

### **Forest and Environmental Practices**

Specialized areas of study are available through this concentration. Students integrate real-world management practices with environmental concerns and balance both views in their profession. The program has a strong industry connection and professional career orientation. Offered at Swanton Pacific Ranch in Santa Cruz County and only available by application and acceptance.

## Urban Forestry

Management problems resulting from the continued trend of urbanization into the urban-wildland interface are studied. Urban Forestry focuses on the urban ecosystem including lesser vegetation, wildlife, and open space, as well as the trees. The curriculum emphasizes the application of forestry skills for management of urban forest ecosystems. Students taking this concentration are eligible to compete for two scholarships of \$2000 and \$1000.

## Watershed Management and Hydrology

Provides students a focused and encompassing program in watershed management including a proficiency in watershed hydrology in forest ecosystems and Mediterranean ecosystems, rangeland hydrology, post-fire watershed evaluation, watershed and stream restoration and urban/wildland hydrologic implications. There are two tracks beyond the core coursework. Students pursuing Track 1 can qualify as hydrologists under U.S. Government OPM guidelines.

## Wildland Fire and Fuels Management

Focused study on the management of fire and fuels on landscapes ranging from the wildlands to the urban interface. Emphasis on the technologies, issues and policies in managing fire, using fire as an ecosystem management tool and social and economic impacts of fire.

## Wildlife Biology Concentration

This specialized course of study prepares students for wildlife biology certification and employment in the fish and wildlife areas of law enforcement, management, and production.

## Other Concentrations Available

The Outdoor, Adventure, and Resource Recreation concentration, offered by the Recreation, Parks, and Tourism Administration Department, is available to Forestry and Natural Resources majors, preparing them for careers in the planning, development, leadership, and management of outdoor recreation opportunities on public and private lands.

## Individualized Course of Study

Students have the option of developing an individualized course of study. The intent of this option is to give students the opportunity to pursue a minor in related areas, such as geographic information systems, land rehabilitation, soil science, and others.

## Disaster Management and Homeland Security Minor

**NOTE: Applications to the Disaster Management and Homeland Security minor are not currently being accepted. Contact the Natural Resources Management and Environmental Sciences Department for further information.**

The program is a multidisciplinary cooperative effort between the Natural Resources Management Department, Continuing Education, California Emergency Management Agency, and the California State Fire Marshal's Office. It includes a broad understanding of the nature, impact and recovery methods of natural and human caused disasters on the wildland and built environments.

The program includes courses in policy, planning and operational components of disaster management and homeland security, including opportunities to gain practical experience and work with current incident management technologies. The minor prepares students from

various majors whose careers will be related to disaster management and homeland security.

## Soil Science Minor

Students from major fields other than Soil Science may broaden their education, and enhance their career opportunities, by selecting the minor in Soil Science.

## Additional Minors

### Geographic Information Systems for Agriculture

An interdisciplinary minor sponsored by the departments of BioResource and Agricultural Engineering, Natural Resources Management, and Horticulture and Crop Science. For more information, see the College of Agriculture, Food and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>) section.

### Indigenous Studies in Natural Resources and the Environment

**New Program, effective Fall 2013**

Natural Resources Management & Environmental Resources Department  
Bldg. 11, Room 217  
Phone: 805.756.2702

Coordinators:

Priya Verma, Natural Resources Management and Environmental Sciences  
805.756.2773; [pverma@calpoly.edu](mailto:pverma@calpoly.edu)

Kate Martin, Ethnic Studies  
805.756.2827; [kmartin@calpoly.edu](mailto:kmartin@calpoly.edu)

This interdisciplinary minor is sponsored by the Natural Resources Management and Environmental Sciences department in the College of Agriculture, Food and Environmental Sciences and the Ethnic Studies department in the College of Liberal Arts. The minor consists of innovative coursework and provides research opportunities that incorporate indigenous ecological knowledge in areas such as conservation biology, environmental biology, wildlife and fisheries sciences, forest resources management, environmental studies and environmental sciences: as well as agriculture, ethnic studies, geography, biology, and recreation, parks and tourism.

The Indigenous Studies in Natural Resources Management and the Environment minor aims to bring together principles of both Indigenous knowledge and Western science. Instruction in these two approaches will provide students with the necessary skills, practical research methods and critical thinking abilities for addressing complex environmental and health issues, and resource management problems facing both Indigenous and non-Indigenous communities around the world. Contact the minor coordinator for more details.

## Water Science

An interdisciplinary minor sponsored by the departments of BioResource and Agricultural Engineering, and Natural Resources Management, that emphasizes one of three areas of study: irrigation, water policy, or watershed management. For more information, see the College of Agriculture, Food and Environmental Sciences (<http://>

[catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences)) section.

The department also participates in offering minors in Land Rehabilitation, Rangeland Resources, Anthropology-Geography, and Geology. Please see College of Agriculture, Food and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences>) , College of Liberal Arts (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts>) or the Physics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/physics>) page for additional information.

## Graduate Program

Cal Poly offers a Master of Science degree in Agriculture with a specialization in Soil Science. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>) section of the College of Agriculture, Food and Environmental Sciences.

## MS Forestry Sciences

The Master of Science degree program in Forestry Sciences offers advanced study in a range of forest science sub-disciplines or in preparation for study leading to the Ph.D. degree.

### Areas of Emphasis

Students may select one of the following emphasis areas that incorporate specific scientific and professional disciplines:

### Forest Resource Sciences

Offers advanced preparation in the forestry disciplines of watershed management and hydrology, biometrics, forest health, forest management, fire science, and urban and community forestry.

### Environmental Management

Offers advanced preparation in the disciplines that comprise the field of environmental management, including environmental assessment, planning, mitigation and policy formation relating to a wide range of landscapes and ecosystems.

### Prerequisites

For consideration as a graduate student, an applicant will have completed a bachelor's degree in forestry at an accredited forestry four-year college or a related B.S. degree area such as environmental sciences with a minimum grade point average of 2.75 in the last 90-quarter units. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing.

### Program of Study

Graduate students must file a formal study plan with their major professor, graduate committee, department, college and university graduate studies office no later than the end of the quarter in which the 12th unit of approved courses is completed.

The formal program of study must include a minimum of 45 units (at least 23 of which must be at the 500 level). The broad curriculum for the Master of Science degree in Forestry Sciences is:

a) 20 units in the required core;

b) 25 units in area of emphasis approved by the student's major professor and department head;

c) completion of a thesis or scholarly project, and an oral and written examination. At the discretion of the graduate committee, the written examination may consist of submitting an article for publication to a referred journal.

## BS Environmental Earth Science

### Program Learning Objectives

1. Demonstrate problem solving skills using traditional and nontraditional thinking,
2. Demonstrate a "can-do" attitude through sense of personal responsibility, dedication and loyalty to the profession,
3. Demonstrate the ability to integrate and apply technical knowledge,
4. Demonstrate understanding of professional and ethical responsibilities, including respect for diversity, and
5. Effectively communicate orally and in writing, as professionals in individual and team-based working environments.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, student must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

ERSC/SS 110	Orientation in Earth and Soil Sciences	1
or NR 140	Careers in Forestry and Environmental Management	
ERSC 144	Introduction to Earth Science	4
ERSC 223	Rocks and Minerals	4
ERSC/GEOG 250	Physical Geography	4
ERSC 323	Geomorphology	4
ERSC/GEOG 333	Human Impact on the Earth	4
ERSC/GEOG 414	Global and Regional Climatology	4
Select from the following:		4
ERSC 461 & ERSC 462	Senior Project I and Senior Project II	
SS 461 & SS 462	Senior Project I and Senior Project II	
ASTR 101	Introduction to the Solar System	4
BOT 121	General Botany (B2 & B4) <sup>1</sup>	4



BOT 326	Plant Ecology	4
BRAE 237	Introduction to Engineering Surveying	2
CHEM 127 & CHEM 128	General Chemistry for Agriculture and Life Science I and General Chemistry II (B3 & B4) <sup>1</sup>	8
GEOG 318	Applications in GIS	4
GEOG 328	Applications in Remote Sensing	4
GEOL 201	Physical Geology	3
GEOL 241	Physical Geology Laboratory	1
GEOL 415	Structural Geology	4
PSC 201	Physical Oceanography	4
SS 121	Introductory Soil Science	4
SS 321	Soil Morphology	4
STAT 218	Applied Statistics for the Life Sciences (B1) <sup>1</sup>	4
Concentration or Individualized Course of Study (see below; 4 units B1) <sup>1</sup>		41-42
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		56
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		180-181

<sup>1</sup> Required in Major; also satisfies GE

## Concentrations or Individualized Course of Study (Select one)

- Climate Change Studies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalearthscience/climatechangestudiesconcentration>)
- Environmental Interpretation and Assessment (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalearthscience/environmentalinterpretationandassessmentconcentration>)
- Geology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalearthscience/geologyconcentration>)
- Geosciences Teaching (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalearthscience/geoscienceteachingconcentration>)
- Land and Water Resources (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalearthscience/landandwaterresourcesconcentration>)
- Individualized Course of Study (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/>)

naturalresourcesmanagementenvironmentalsciences/  
individualizedcourseofstudyearthsciences)

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Major & Concentration) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (KINE 250 recommended for Geosciences Teaching Concentration)	4
D5	Upper-division elective (PSY 352 recommended for Environmental Interpretation and Assessment Concentration)	4
Area F	Technology	
F	Upper-division elective (BRAE 340 recommended for Geosciences Teaching Concentration)	4
Total units		56

<sup>1</sup> Required in Major; also satisfies GE

## Climate Change Studies Concentration

ERSC 463	Undergraduate Seminar	2
or SS 463	Undergraduate Seminar	
GEOG 325	Climate and Humanity	4
GEOG 415	Applied Meteorology and Climatology	4
MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
MATH 119	Precalculus Trigonometry	4



PHYS 121	College Physics I	4
SOC 218	International Political Economy	4
UNIV 350	The Global Environment	4

**Energy/Sustainability**

BRAE 348	Energy for a Sustainable Society	4
or PSC 320	Energy, Society and the Environment	

**Approved electives**<sup>2</sup>

Select from the following: 7-8

CRP 375	Technology and the Environment: A Seminar on Contemporary Issues	
CRP 438	Pollution Prevention and Control	
CRP/NR 404	Environmental Law	
EDES 406	Sustainable Environments	
ENVE 324	Introduction to Air Pollution	
GEOG 301	Geography of Resource Utilization	
GEOG 440	Advanced-Applications in GIS	
PHIL 340	Environmental Ethics	

Note: CRP 438 or ENVE 324 recommended

Total units 41-42

<sup>1</sup> Required in Major; also satisfies GE.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Environmental Interpretation and Assessment Concentration

ERSC 202	Soil Erosion and Water Conservation	4
ERSC/GEOG 325	Climate and Humanity	4
ERSC 463	Undergraduate Seminar	2
or SS 463	Undergraduate Seminar	
CRP 420	Land Use Law	4
GEOG 301	Geography of Resource Utilization	4
MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
MATH 119	Precalculus Trigonometry	4
PHYS 121	College Physics I	4

**Approved electives**<sup>2</sup>

Select from the following: 11

CRP 212	Introduction to Urban Planning	
CRP 336	Introduction to Environmental Planning	
CRP/NR 404	Environmental Law	
CRP/NR 408	Water Resource Law and Policy	
GEOG 440	Advanced-Applications in GIS	
NR 306	Natural Resource Ecology and Habitat Management	
NR 320	Watershed Management and Restoration	
NR/ES 406	Indigenous Peoples and International Law and Policy	
NR 416	Environmental Impact Analysis and Management	
NR 418	Applied GIS	
NR 425	Applied Resource Analysis and Assessment	

SS 339	Soil Science Internship <sup>3</sup>	
Total units		41

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>3</sup> No more than 4 units of SS 339 may be use.

## Geology Concentration

GEOL 206	Geologic Excursions	1
GEOL 305	Fundamentals of Seismology	4
GEOL 310	Igneous and Metamorphic Petrology	4
GEOL 330	Principles of Stratigraphy	4
GEOL/ERSC 401	Field-Geology Methods	4
GEOL/ERSC 402	Geologic Mapping	4
GEOL 420	Applied Geophysics	3
ERSC 463	Undergraduate Seminar	2
or SS 463	Undergraduate Seminar	
MATH 141	Calculus I	8
& MATH 142	and Calculus II (B1) <sup>1</sup>	
PHYS 141	General Physics IA	4
PHYS 132	General Physics II	4
Total units		42

<sup>1</sup> Required in Major; also satisfies GE

## Geosciences Teaching Concentration

ASTR 102	Introduction to the Stars and Galaxies	4
BIO 111	General Biology	4
EDUC 300	Historical, Philosophical, and Social Foundations of Public Education	3
GEOG 301	Geography of Resource Utilization	4
GEOG 325	Climate and Humanity	4
GEOL 203	Fossils and the History of Life	4
GEOL 204	Geologic History of California	3
MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
MATH 119	Precalculus Trigonometry	4
PHYS 121	College Physics I	4
PSC 424	Organizing and Teaching Science	4
Total units		42

<sup>1</sup> Required in Major; also satisfies GE

## Land and Water Resources Concentration

ERSC 202	Soil Erosion and Water Conservation	4
ERSC 463	Undergraduate Seminar	2

or SS 463	Undergraduate Seminar	
CHEM 129	General Chemistry III	4
MATH 141	Calculus I	8
& MATH 142	and Calculus II (B1) <sup>1</sup>	
PHYS 141	General Physics IA	8
& PHYS 132	and General Physics II	
SS 432	Soil Physics	5

**Approved Electives** <sup>2,3</sup>

Select from the following:		11
ANT 202	World Prehistory	
ANT 309	Elements of Archaeology	
ANT 310	Archeological Field Methods	
CRP/NR 408	Water Resource Law and Policy	
ERSC/GEOG 415	Applied Meteorology and Climatology	
ERSC/GEOL 401	Field-Geology Methods	
ERSC/GEOL 402	Geologic Mapping	
GEOG 440	Advanced-Applications in GIS	
NR 306	Natural Resource Ecology and Habitat Management	
NR 320	Watershed Management and Restoration	
NR 418	Applied GIS	
SS 339	Soil Science Internship <sup>4</sup>	
NR 432	Disaster Operations Planning	
Total units		42

<sup>1</sup> Required in Major; also satisfies GE<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.<sup>3</sup> Min 6 units 300-400 level.<sup>4</sup> No more than 4 units of SS 339 may be used.

## Individualized Course of Study - Earth Sciences

ERSC 463	Undergraduate Seminar	2
or SS 463	Undergraduate Seminar	
MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
MATH 119	Precalculus Trigonometry	4
PHYS 121	College Physics I	4
Approved electives		27
(Minimum 10 units 300-400 level)		
Total units		41

<sup>1</sup> Required in Major; also satisfies GE

## BS Environmental Management and Protection

### Program Learning Objectives

- Critical thinking/problem solving
- Communication, teamwork and leadership
- Technical knowledge
- Quantitative skills and information management
- Ethics and sustainability principles
- Engage in lifelong learning

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section for this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

NR 140	Careers in Forestry and Environmental Management	1
NR 142	Environmental Management	3
NR 215	Land and Resource Measurements	2
NR 311	Environmental Measurements and Interpretation	4
NR/LA 218	Applications in GIS	3
NR 326	Natural Resources Economics and Valuation	4
NR 335	Conflict Management in Natural Resources	4
NR 402	Forest Health <sup>1</sup>	4
or NR 320	Watershed Management and Restoration	
NR/CRP 404	Environmental Law	3
or NR/CRP 408	Water Resource Law and Policy	
NR 412	Senior Assessment Project	3
or NR 461	Senior Project I	
NR 416	Environmental Impact Analysis and Management	4
NR 425	Applied Resource Analysis and Assessment	4
NR 465	Ecosystem Management	4
ASCI 329	Principles of Range Management <sup>2, 5</sup>	4
or BIO 263	Introductory Ecology and Evolution	
or BIO 427	Wildlife Management	
BOT 121	General Botany (B2 & B4) <sup>3, 6</sup>	4
or BIO 111	General Biology	
or BIO 161	Introduction to Cell and Molecular Biology	
BIO 114	Plant Diversity and Ecology <sup>7</sup>	4
or BIO 162	Introduction to Organismal Form and Function	
or NR 208	Dendrology	

BIO 325	General Ecology	4
or NR 306	Natural Resource Ecology and Habitat Management	
Select from the following:		2-4
BRAE 237	Introduction to Engineering Surveying	
BRAE/NR 247	Forest Surveying	
BRAE 239	Engineering Surveying	
BRAE 348	Energy for a Sustainable Society (Area F) <sup>3</sup>	4
or ENVE 324	Introduction to Air Pollution	
CHEM 111	Survey of Chemistry (B3) <sup>3</sup>	4-5
or CHEM 127	General Chemistry for Agriculture and Life Science I	
CHEM 312	Survey of Organic Chemistry	5
GEOL 201	Physical Geology	3
MATH 161	Calculus for the Life Sciences I (B1) <sup>3,4</sup>	4
or MATH 221	Calculus for Business and Economics	
PHYS 121	College Physics I <sup>3</sup>	4
PSY 201	General Psychology (D4) <sup>3</sup>	4
or PSY 202	General Psychology	
SS 121	Introductory Soil Science	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>3</sup>	4
or STAT 218	Applied Statistics for the Life Sciences	
Concentration Courses or Individualized Course of Study		35
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		48
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		180-183

- Students following Track 1 of Watershed Management and Hydrology Concentration must take NR 320.
- Students following Track 1 of Watershed Management and Hydrology Concentration must take PHYS 122 as a substitute.
- Required in Major; also satisfies GE
- Students following Track 1 of Watershed Management and Hydrology Concentration must take MATH 161.
- Students in the Wildlife Biology concentration must take BIO 263.
- Students in the Wildlife Biology concentration must take BIO 161.
- Students in the Wildlife Biology concentration must take BIO 162.

## Concentrations or Individualized Course of Study (Select one)

- Environmental Impact Mitigation Strategies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalmanagementandprotection/environmentalimpactmitigationstrategiesconcentration>)
- Environmental Policy and Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/>)

- bsenvironmentalmanagementandprotection/environmentalpolicyandmanagementconcentration)
- Watershed Management and Hydrology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalmanagementandprotection/watershedmanagementandhydrologyconcentration>)
- Wildlife Biology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsenvironmentalmanagementandprotection/wildlifebiologyconcentration>)
- Individualized Course of Study (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/individualizedcourseofstudyenvironmentalmanagementandprotection>)

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective (4 units in Major) <sup>1</sup>	0
Total units		48

<sup>1</sup> Required in Major; also satisfies GE

## Environmental Impact Mitigation Strategies Concentration

BIO 427	Wildlife Management	4
CRP/NR 404	Environmental Law <sup>1</sup>	3
or CRP/NR 408	Water Resource Law and Policy	
NR 421	Wetlands	4
ZOO 329	Vertebrate Field Zoology	4

### Approved Electives <sup>2</sup>

Select from the following:	20
Any upper division BIO, CRP, LA, NR, SS or ZOO course	

Total units	35
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<sup>1</sup> Course meeting requirement in major cannot be double-counted in concentration.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Environmental Policy and Management Concentration

CRP 212	Introduction to Urban Planning	4
CRP 420	Land Use Law	4
or POLS 341	American Constitutional Law	
ECON 431	Environmental Economics	4
or POLS 230	Basic Concepts of Political Thought	
NR 435	Natural Resource Policy Analysis	4
NR/CRP 404	Environmental Law <sup>1</sup>	3
or NR/CRP 408	Water Resource Law and Policy	

### Approved Electives <sup>2</sup>

Select from the following:	16
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### Pre-Environmental Law

POLS 245	Judicial Process	
POLS 334	Jurisprudence	
POLS 343	Civil Rights in America	
POLS 344	Civil Liberties	
NR 339	Internship in Forest and Natural Resources	
NR 400	Special Problems for Advanced Undergraduates	

### Other

ECON 311	Intermediate Microeconomics I	
ECON 432	Economics of Energy and Resources	
ENVE 330	Environmental Quality Control	
NR 339	Internship in Forest and Natural Resources	
NR 400	Special Problems for Advanced Undergraduates	
NR/ES 406	Indigenous Peoples and International Law and Policy	
NR 420	Advanced Watershed Hydrology	
SS 433	Land Use Planning	
UNIV 330	Cal Poly Land: Nature, Technology, and Society	

Any CRP or POLS course

Total units	35
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<sup>1</sup> Course meeting requirement in major cannot be double-counted in concentration.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Watershed Management and Hydrology Concentration - Environmental Management and Protection

ERSC 323	Geomorphology	4
GEOL 241	Physical Geology Laboratory	1
NR 420	Advanced Watershed Hydrology	4
SS 321	Soil Morphology	4
SS 440	Forest and Range Soils	4

### Approved electives <sup>1</sup>

Select one track:	18
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### Track 1 <sup>2</sup>

(a) Select 4 units from the following:

MATH 162	Calculus for the Life Sciences II	
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(b) Select 14 units from the following:

BRAE 345	Aerial Photogrammetry and Remote Sensing	
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NR/BIO/SS 421	Wetlands	
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NR/HNRS 475	Sustainable Forest and Environmental Practices (9 units allowed)	
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PHYS 107	Introduction to Meteorology	
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SS 440	Forest and Range Soils	
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SS 442	Soil Vadose Zone and Groundwater Processes	
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### Track 2

Select 18 units from the following:

BRAE 435	Drainage	
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MATH 162	Calculus for the Life Sciences II	
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NR 260	Forest Practices and Environmental Protection	
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NR 339	Internship in Forest and Natural Resources	
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NR 418	Applied GIS	
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NR/BIO/SS 421	Wetlands	
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NR/CRP 408	Water Resource Law and Policy	
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NR/HNRS 475	Sustainable Forest and Environmental Practices (8 units allowed)	
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PHYS 107	Introduction to Meteorology	
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PHYS 122	College Physics II	
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STAT 313	Applied Experimental Design and Regression Models	
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Total units	35
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<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

- <sup>2</sup> This track is designed to prepare students to become eligible for hydrology positions and meets the criteria for employment eligibility in the federal government (GS 1315).

## Wildlife Biology Concentration - Environmental Management and Protection

BIO 327	Wildlife Ecology	4
BIO 427	Wildlife Management	4
BIO 444	Population Ecology	3-4
or BIO 401	Conservation Biology	
BOT 313	Taxonomy of Vascular Plants	4
BOT 433	Field Botany	4
ZOO 321	Mammalogy	4
ZOO 323	Ornithology	4

### Approved Electives

Select from the following: 7-8

BIO 160	Diversity and History of Life
BIO 325	General Ecology
BIO 328	Marine Ecology
BIO 330	Extended Field Biology Activity
BIO 400	Special Problems for Advanced Undergraduates
BIO 401	Conservation Biology
BIO 415	Biogeography
BIO 419	Ecological Methodology
BIO 427	Wildlife Management
BIO 434	Environmental Physiology
BIO 439	Fisheries Science and Resource Management
BIO 442	Behavioral Ecology
BIO 444	Population Ecology
BOT 326	Plant Ecology
BOT 437	Marine Plants
ZOO 322	Ichthyology
ZOO 329	Vertebrate Field Zoology
ZOO 335	General Entomology
ZOO 336	Invertebrate Zoology
ZOO 341	Herpetology
ZOO 425	Parasitology

Total units 35

## Individualized Course of Study - Environmental Management and Protection

Select from the following: 35

NR 339	Internship in Forest and Natural Resources (1-12)
Any course used in minor(s)	

Total units 35

## BS Environmental Soil Science

### Program Learning Objectives

1. Demonstrate problem solving skills using traditional and nontraditional thinking,
2. Demonstrate a "can-do" attitude through sense of personal responsibility, dedication and loyalty to the profession,
3. Demonstrate the ability to integrate and apply technical knowledge,
4. Demonstrate understanding of professional and ethical responsibilities, including respect for diversity, and
5. Effectively communicate orally and in writing, as professionals in individual and team-based working environments.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

SS 110	Orientation in Earth and Soil Sciences	1
or NR 140	Careers in Forestry and Environmental Management	
SS 121	Introductory Soil Science	4
ERSC 202	Soil Erosion and Water Conservation	4
SS 221	Fertilizers and Plant Nutrition	4
ERSC 223	Rocks and Minerals	4
SS 321	Soil Morphology	4
SS 322	Soil Plant Relationships	4
ERSC 323	Geomorphology	4
SS 422	Soil Microbiology and Biochemistry	4
SS 423	Soil and Water Chemistry	5
SS 431	Soil Resource Inventory	4
SS 432	Soil Physics	5
SS 461	Senior Project I	1
or ERSC 461	Senior Project I	
SS 462	Senior Project II	3
or ERSC 462	Senior Project II	
SS 463	Undergraduate Seminar	2
or ERSC 463	Undergraduate Seminar	
Concentration courses (see below)		27-28

### SUPPORT COURSES

BOT 121	General Botany (B2 & B4) <sup>1</sup>	4
BRAE 340	Irrigation Water Management (Area F) <sup>1</sup>	4



CHEM 127	General Chemistry for Agriculture and Life Science I (B3 & B4) <sup>1</sup>	4
CHEM 128	General Chemistry II	4
CHEM 129	General Chemistry III	4
CHEM 313	Survey of Biochemistry and Biotechnology	5
GEOL 201	Physical Geology	3
MATH 118	Precalculus Algebra (B1) <sup>1, 2</sup>	4
or MATH 141	Calculus I	
NR/LA 218	Applications in GIS	3
MATH 119	Precalculus Trigonometry (B1) <sup>1, 2</sup>	4
or MATH 142	Calculus II	
PHYS 121	College Physics I <sup>3</sup>	4
or PHYS 141	General Physics IA	
STAT 218	Applied Statistics for the Life Sciences	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		52
<b>FREE ELECTIVES</b>		
Free Electives		0-1
<b>Total units</b>		180

<sup>1</sup> Required in Support; also satisfies GE.

<sup>2</sup> Students in the Environmental Science and Technology concentration take MATH 141 and MATH 142.

<sup>3</sup> Students in the Environmental Science and Technology concentration take PHYS 141.

## Concentrations (Select one):

- Environmental Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsevironmental soils science/environmentalmanagementconcentration>)
- Environmental Science and Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsevironmental soils science/environmentalscienceandtechnologyconcentration>)
- Land Resources (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsevironmental soils science/landresourcesconcentration>)

## General Education (GE) Requirements

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4

<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective (4 units in Support) <sup>1</sup>	0
<b>Total units</b>		52

<sup>1</sup> Required in Support; also satisfies GE

## Environmental Management Concentration

CHEM 312	Survey of Organic Chemistry <sup>1</sup>	5
CRSC 411	Experimental Techniques and Analysis	4
or STAT 313	Applied Experimental Design and Regression Models	
GEOG 440	Advanced-Applications in GIS	4

### Approved electives <sup>2</sup>

Select from the following: 15

CHEM 341	Environmental Chemistry: Water Pollution	
CRP 212	Introduction to Urban Planning	
CRP 336	Introduction to Environmental Planning	
CRP/NR 404	Environmental Law	
CRP/NR 408	Water Resource Law and Policy	
NR 142	Environmental Management	
NR 306	Natural Resource Ecology and Habitat Management	
NR 311	Environmental Measurements and Interpretation	
NR 320	Watershed Management and Restoration	
NR 335	Conflict Management in Natural Resources	
NR/ES 406	Indigenous Peoples and International Law and Policy	
NR 416	Environmental Impact Analysis and Management	
NR 418	Applied GIS	
NR 425	Applied Resource Analysis and Assessment	
PHIL 340	Environmental Ethics	

RPTA 302	Environmental and Wilderness Education	
SS 339	Soil Science Internship <sup>3</sup>	
SS 402	Soil, Compost, and Water Testing Enterprise	
SS 440	Forest and Range Soils	
SS 444	Soil Judging	
SS 453	Tropical Soils	

Total units 28

- <sup>1</sup> Transfer equivalent CHEM 212
- <sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>3</sup> No more than 4 units of SS 339 may be used

## Environmental Science and Technology Concentration

CHEM 216 & CHEM 217	Organic Chemistry for Life Sciences I and Organic Chemistry for Life Sciences II	9
Select from the following:		8
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 231	Quantitative Analysis	
or CHEM 331	Quantitative Analysis	
CHEM 319	Advanced Organic Chemistry Laboratory	
CHEM 341	Environmental Chemistry: Water Pollution	
CHEM 481	Inorganic Chemistry	
Select from the following:		6
ENVE 325	Air Quality Engineering	
ENVE 330	Environmental Quality Control	
ENVE 434	Water Chemistry and Water Quality Measurements	
ENVE 439	Solid Waste Management	
SS 442	Soil Vadose Zone and Groundwater Processes	
STAT 313	Applied Experimental Design and Regression Models	4
or CRSC 411	Experimental Techniques and Analysis	
Total units		27

## Land Resources Concentration

CHEM 312	Survey of Organic Chemistry <sup>1</sup>	5
CRSC 411	Experimental Techniques and Analysis	4

### Approved Electives <sup>2</sup>

Select 19 units from any one minor or any of the following courses below: <sup>3</sup>

AG 450	Applied Holistic Management	
AGB 321	Farm Records	
AGB 370	World Food Economy	
AGED 404	Agricultural Leadership	
ANT 310	Archeological Field Methods	
ARCH 202	Creative Problem Solving	
ASCI 220	Introductory Animal Nutrition and Feeding	
ASCI 221	Introduction to Beef Production	

ASCI 222	Systems of Swine Production	
ASCI 223	Systems of Sheep Management	
ASCI 329	Principles of Range Management	
ASCI 420	Animal Metabolism and Nutrition	
BIO 112	Environmental Biology and Conservation	
BIO 114	Plant Diversity and Ecology	
BIO 161	Introduction to Cell and Molecular Biology	
BIO 162	Introduction to Organismal Form and Function	
BIO 325	General Ecology	
BIO 415	Biogeography	
BIO 427	Wildlife Management	
BIO 435	Plant Physiology	
BOT 238	Central Coast Flora and Vegetation	
BOT 323	Plant Pathology	
BOT 433	Field Botany	
BRAE 340	Irrigation Water Management	
BRAE 348	Energy for a Sustainable Society	
BRAE 405	Chemigation	
BRAE 435	Drainage	
BRAE 440	Agricultural Irrigation Systems	
BRAE 448	Bioconversion	
CHEM 216	Organic Chemistry for Life Sciences I	
CHEM 217	Organic Chemistry for Life Sciences II	
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 319	Advanced Organic Chemistry Laboratory	
CHEM 341	Environmental Chemistry: Water Pollution	
CHEM 481	Inorganic Chemistry	
COMS 212	Interpersonal Communication	
CRP 212	Introduction to Urban Planning	
CRP 214	Land Use and Transportation Studies	
CRSC 203	Organic Farming Enterprise Project	
CRSC 333	Greenhouse Vegetable Production	
CRSC 445	Cropping Systems	
DSCI 121	Elements of Dairying	
DSCI 201	Introduction to Dairy Nutrition and Feed Ingredients	
DSCI 230	General Dairy Husbandry	
EHS 343	Turfgrass Management	
ENVE 325	Air Quality Engineering	
ENVE 330	Environmental Quality Control	
ENVE 434	Water Chemistry and Water Quality Measurements	
ENVE 436	Introduction to Solid and Hazardous Waste Management	
ENVE 439	Solid Waste Management	
ERSC/GEOG 250	Physical Geography	
ERSC/GEOG 325	Climate and Humanity	
ERSC/GEOG 333	Human Impact on the Earth	
FRSC 132	Pomology I	
FRSC 133	Pomology II	

FRSC 230	California Fruit Growing	
FRSC 231	Viticulture I	
FRSC 342	Citrus and Avocado Fruit Production	
FSN 121	Fundamentals of Food	
FSN 125	Introduction to Food Science	
FSN 341	Wines and Fermented Foods	
GEOG 150	Introduction to Cultural Geography	
GEOG 300	Geography of United States	
GEOG 301	Geography of Resource Utilization	
GEOG 308	Global Geography	
GEOG 340	Geography of California	
GEOL 204	Geologic History of California	
HUM 302	Human Values in Agriculture	
JOUR 205	Agricultural Communications	
LA 551	Regional Landscape Assessment I	
MCRO 221	Microbiology	
NR 141	Introduction to Forest Ecosystem Management	
NR 142	Environmental Management	
NR 208	Dendrology	
NR 306	Natural Resource Ecology and Habitat Management	
NR 311	Environmental Measurements and Interpretation	
NR/ES 406	Indigenous Peoples and International Law and Policy	
NR 420	Advanced Watershed Hydrology	
PHIL 321	Philosophy of Science	
PHIL 331	Ethics	
PHIL 337	Business Ethics	
PHIL 340	Environmental Ethics	
PPSC 311	Agricultural Entomology	
PPSC 321	Weed Biology and Management	
PPSC 327	Vertebrate Pest Management	
PPSC 431	Insect Pest Management	
PPSC 441	Biological Control for Pest Management	
PSY 301	Psychology of Personal Development	
PSY 302	Behavior in Organizations	
RPTA 302	Environmental and Wilderness Education	
SOC 309	The World System and Its Problems	
SS 301	Earth Sciences/Soils Science Practicum	
SS 339	Soil Science Internship <sup>4</sup>	
SS 402	Soil, Compost, and Water Testing Enterprise	
SS 433	Land Use Planning	
SS 440	Forest and Range Soils	
SS 442	Soil Vadose Zone and Groundwater Processes	
SS 444	Soil Judging	
SS 453	Tropical Soils	
VGSC 230	Introduction to Vegetable Science	
Total units		28

<sup>1</sup> Transfer equivalent CHEM 212.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>3</sup> Note: The prerequisite courses are not listed - check the catalog.

<sup>4</sup> No more than 4 units of SS 339 may be used.

## BS Forestry and Natural Resources

### Program Learning Objectives

- Critical thinking/problem solving
- Communication, teamwork and leadership
- Technical knowledge
- Quantitative skills and information management
- Ethics and sustainability principles
- Engage in lifelong learning

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, student must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

NR 140	Careers in Forestry and Environmental Management	1
NR 141	Introduction to Forest Ecosystem Management	3
NR 208	Dendrology	4
NR 215	Land and Resource Measurements	2
NR 260	Forest Practices and Environmental Protection	4
NR 306	Natural Resource Ecology and Habitat Management	4
NR 307	Fire Ecology	3
NR 315	Measurements and Sampling in Forested Environments	4
NR/LA 218	Applications in GIS	3
NR 320	Watershed Management and Restoration	4
NR 326	Natural Resources Economics and Valuation	4
NR 335	Conflict Management in Natural Resources	4
NR 365	Silviculture and Vegetation Management	4
NR 402	Forest Health	4
NR 412	Senior Assessment Project	3
or NR 461	Senior Project I	
NR 414	Sustainable Forest Management <sup>1</sup>	4
NR 416	Environmental Impact Analysis and Management	4
NR 435	Natural Resource Policy Analysis	4
NR 465	Ecosystem Management	4
Concentration and individualized course of study courses (see below)		27-28

**SUPPORT COURSES**

ASCI 329	Principles of Range Management <sup>2, 6</sup>	4
or BIO 427	Wildlife Management	
BOT 121	General Botany (B2 & B4) <sup>3</sup>	4
BRAE/NR 247	Forest Surveying	2
BRAE 345	Aerial Photogrammetry and Remote Sensing <sup>8</sup>	3
CHEM 111	Survey of Chemistry (B3) <sup>3</sup>	5
MATH 161	Calculus for the Life Sciences I (B1) <sup>3, 4</sup>	4
or MATH 221	Calculus for Business and Economics	
SS 121	Introductory Soil Science	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>3</sup>	4
or STAT 218	Applied Statistics for the Life Sciences	
Approved science course <sup>5</sup>		
BOT 313	Taxonomy of Vascular Plants <sup>7</sup>	4-5
or CHEM 312	Survey of Organic Chemistry	
or PHYS 121	College Physics I	
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		56
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		184-186

- 1 Students following Track 1 of Watershed Management and Hydrology Concentration must take CHEM 312 as a substitute.
- 2 Students following Track 1 of Watershed Management and Hydrology Concentration must take PHYS 122 as a substitute.
- 3 Required in Support; also satisfies GE
- 4 Students following Track 1 of Watershed Management and Hydrology Concentration must take MATH 161.
- 5 Students following Track 1 of Watershed Management and Hydrology Concentration must take PHYS 121.
- 6 Students in the Wildlife Biology concentration must take BIO 427.
- 7 Students in the Wildlife Biology concentration must take BOT 313.
- 8 Students in the Wildlife Biology concentration may substitute BIO 162 to prepare for ZOO 322 (one of the courses that satisfies the Approved Electives requirement in the concentration).

## Concentrations or Individualized Course of Study (Select one)

- Environmental Planning and Assessment (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/environmentalplanningandassessmentconcentration>)
- Forest and Environmental Practices (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/forestandenvironmentalpracticesconcentration>)
- Urban Forestry (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/>)

[collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/urbanforestryconcentration](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/urbanforestryconcentration))

- Watershed Management and Hydrology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/watershedmanagementandhydrologyconcentrationforestryandnaturalresources>)
- Wildlife Biology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/wildlifebiologyconcentration>)
- Wildland Fire and Fuels Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/wildlandfireandfuelsmanagementconcentration>)
- Individualized Course of Study (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/bsforestryandnaturalresources/individualizedcourseofstudyforestryandnaturalresources>)

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

### Area A Communication

A1 Expository Writing	4
A2 Oral Communication	4
A3 Reasoning, Argumentation and Writing	4

### Area B Science and Mathematics

B1 Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2 Life Science (4 units in Support) <sup>1</sup>	0
B3 Physical Science (4 units in Support) <sup>1</sup>	0
B4 One lab taken with either a B2 or B3 course	

### Area C Arts and Humanities

C1 Literature	4
C2 Philosophy	4
C3 Fine/Performing Arts	4
C4 Upper-division elective (no NR course, except ES/NR 360)	4
Area C elective (Choose one course from C1-C5)	4

### Area D/E Society and the Individual

D1 The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2 Political Economy	4
D3 Comparative Social Institutions	4
D4 Self Development (CSU Area E)	4
D5 Upper-division elective (no NR course, except ES/NR 308)	4

**Area F Technology**

F Upper-division elective	4
Total units	56

<sup>1</sup> Required in Support; also satisfies GE

## Environmental Planning and Assessment Concentration

CRP 212	Introduction to Urban Planning	4
NR 311	Environmental Measurements and Interpretation	4
NR/CRP 404	Environmental Law	3
or NR/CRP 408	Water Resource Law and Policy	
NR 425	Applied Resource Analysis and Assessment	4

**Approved Electives <sup>1</sup>**

Select from the following:		13
CRP 334	Cities in a Global World	
CRP 420	Land Use Law	
ENVE 434	Water Chemistry and Water Quality Measurements	
GEOG 301	Geography of Resource Utilization	
GEOG 414	Global and Regional Climatology	
GEOG 415	Applied Meteorology and Climatology	
NR 339	Internship in Forest and Natural Resources	
NR 400	Special Problems for Advanced Undergraduates	
NR/ES 406	Indigenous Peoples and International Law and Policy	
NR 418	Applied GIS	
NR 420	Advanced Watershed Hydrology	
SS 321	Soil Morphology	
SS 440	Forest and Range Soils	
SS 433	Land Use Planning	
Total units		28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Forest and Environmental Practices Concentration

NR 475	Sustainable Forest and Environmental Practices	12
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**Approved electives <sup>1, 2</sup>**

Select from the following:		16
AG 360	Holistic Management	
AGB 315	Land Economics	
BIO 435	Plant Physiology	
BOT 238	Central Coast Flora and Vegetation	
BRAE 133	Introduction to Engineering Design Graphics	
BRAE 151	CAD for Agricultural Engineering	
BRAE 340	Irrigation Water Management	
CRP 212	Introduction to Urban Planning	
CRP 336	Introduction to Environmental Planning	

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CRP 420	Land Use Law	
EHS 382	Restoration Horticulture	
EHS 421	Arboriculture	
JOUR 203	News Reporting and Writing	
JOUR 205	Agricultural Communications	
MCRO 436	Environmental Microbiology	
NR 204	Wildland Fire Control	
NR/ES 308	Fire and Society	
NR 312	Technology of Wildland Fire Management	
NR 339	Internship in Forest and Natural Resources	
NR 340	Wildland Fire Management	
NR 350	Urban Forestry	
NR/ES 360	Ethnicity and the Land	
NR 400	Special Problems for Advanced Undergraduates	
NR/CRP 404	Environmental Law	
NR 408	Water Resource Law and Policy	
NR 418	Applied GIS	
NR 420	Advanced Watershed Hydrology	
NR/BIO/SS 421	Wetlands	
NR 434	Wood Properties, Products and Sustainable Uses	
NR 450	Community Forestry	
NR 455	Wildland-Urban Fire Protection	
SS 221	Fertilizers and Plant Nutrition	
SS 321	Soil Morphology	
SS 433	Land Use Planning	
SS 440	Forest and Range Soils	
PPSC 321	Weed Biology and Management	
PPSC 327	Vertebrate Pest Management	
Any upper division BIO, BOT, ZOO, MCRO, CHEM, COMS, or JOUR course		
Any DMHS course		
Total units		28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> At least 2 units must be upper division

## Individualized Course of Study - Forestry and Natural Resources

4 units of NR coursework	4
Select any course used in minor(s)	24
Total units	28

## Urban Forestry Concentration

CRP 212	Introduction to Urban Planning	4
EHS 421	Arboriculture	4
NR 350	Urban Forestry	3
NR 450	Community Forestry	3

**Approved electives <sup>1</sup>**



Select from the following:	14
EHS 230 Environmental Horticulture	
EHS 381 Native Plants for California Landscapes	
HCS 327 Abiotic Plant Problems	
NR 204 Wildland Fire Control	
NR 311 Environmental Measurements and Interpretation	
NR 339 Internship in Forest and Natural Resources	
NR 340 Wildland Fire Management	
NR 400 Special Problems for Advanced Undergraduates	
NR/ES 406 Indigenous Peoples and International Law and Policy	
NR 418 Applied GIS	
NR 455 Wildland-Urban Fire Protection	
NR/CRP 404 Environmental Law	
SS 433 Land Use Planning	
Total units	28

- <sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Watershed Management and Hydrology Concentration - Forestry and Natural Resources

NR 420 Advanced Watershed Hydrology	4
SS 321 Soil Morphology	4
SS 440 Forest and Range Soils <sup>2</sup>	4
or ERSC 323 Geomorphology	

### Approved electives <sup>1, 2</sup>

Select one track 16

#### Track 1 <sup>3</sup>

(a) Select 4 units from the following:

NR 418 Applied GIS & NR 400 and Special Problems for Advanced Undergraduates	
NR/BIO/SS 421 Wetlands	
or NR/HNRS 475 Sustainable Forest and Environmental Practices	

(b) Select 8 units from the following:

BRAE 435 Drainage	
ERSC 323 Geomorphology	
GEOL 201 Physical Geology & GEOL 241 and Physical Geology Laboratory	
NR/HNRS 475 Sustainable Forest and Environmental Practices	
PHYS 107 Introduction to Meteorology	
SS 440 Forest and Range Soils	

(c) Select the following:

MATH 162 Calculus for the Life Sciences II	
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#### Track 2

Select 16 units from the following:

BRAE 435 Drainage	
CHEM 312 Survey of Organic Chemistry	
NR 339 Internship in Forest and Natural Resources	
NR/BIO/SS 421 Wetlands	
NR/HNRS 475 Sustainable Forest and Environmental Practices	
PHYS 107 Introduction to Meteorology	
PHYS 121 College Physics I	
STAT 313 Applied Experimental Design and Regression Models	
Total units	28

- <sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>2</sup> If a course is taken to meet a requirement, it cannot be double-counted as an approved elective for the concentration.
- <sup>3</sup> This track is designed to prepare students to become eligible for hydrology positions and meets the criteria for employment eligibility in the federal government (GS 1315).

## Wildland Fire and Fuels Management Concentration

NR 204 Wildland Fire Control	3
NR 340 Wildland Fire Management	3
NR 455 Wildland-Urban Fire Protection	4

### Approved electives <sup>1</sup>

Select from the following: 18

BOT 326 Plant Ecology	
BOT 433 Field Botany	
CRP 212 Introduction to Urban Planning	
CRP 336 Introduction to Environmental Planning	
CRP 342 Environmental Planning Methods	
CRP 458 Local Hazard Mitigation Planning and Design	
CRP/NR 404 Environmental Law	
CRP/NR 408 Water Resource Law and Policy	
EHS 230 Environmental Horticulture	
EHS 381 Native Plants for California Landscapes	
EHS 421 Arboriculture	
ERSC 415 Applied Meteorology and Climatology	
LA 221 California Plants and Plant Communities	
NR 203 Resource Law Enforcement	
NR/ES 308 Fire and Society	
NR 312 Technology of Wildland Fire Management	
NR 339 Internship in Forest and Natural Resources	
NR 350 Urban Forestry	
NR/ES 406 Indigenous Peoples and International Law and Policy	
NR 418 Applied GIS	
NR 420 Advanced Watershed Hydrology	
NR 425 Applied Resource Analysis and Assessment	
NR 450 Community Forestry	

NR/HNRS 475	Sustainable Forest and Environmental Practices	
PHYS 107	Introduction to Meteorology	
SS 321	Soil Morphology	
SS 440	Forest and Range Soils	
UNIV 339		
Any DMHS course		
Any CSU-transferable course recognized by Cal Regional Fire Academy		
Any CSU-transferable fire technology course		
Any CSU-transferable emergency medical technician course		
Total units		28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Wildlife Biology Concentration - Forestry and Natural Resources

BIO 161	Introduction to Cell and Molecular Biology	4
BIO 327	Wildlife Ecology	4
BIO 401	Conservation Biology	3-4
or BIO 444	Population Ecology	
BOT 433	Field Botany	4
ZOO 321	Mammalogy	4
ZOO 323	Ornithology	4

### Approved Electives

Select from the following:		4
BIO 160	Diversity and History of Life	
BIO 325	General Ecology	
BIO 328	Marine Ecology	
BIO 330	Extended Field Biology Activity	
BIO 400	Special Problems for Advanced Undergraduates	
BIO 401	Conservation Biology	
BIO 415	Biogeography	
BIO 419	Ecological Methodology	
BIO 427	Wildlife Management	
BIO 434	Environmental Physiology	
BIO 439	Fisheries Science and Resource Management	
BIO 442	Behavioral Ecology	
BIO 444	Population Ecology	
BOT 326	Plant Ecology	
BOT 437	Marine Plants	
ZOO 322	Ichthyology	
ZOO 329	Vertebrate Field Zoology	
ZOO 335	General Entomology	
ZOO 336	Invertebrate Zoology	
ZOO 341	Herpetology	
ZOO 425	Parasitology	

Total units 27-28

## Disaster Management and Homeland Security Minor

**NOTE: Applications to the Disaster Management and Homeland Security minor are not currently being accepted. Contact the Natural Resources Management and Environmental Sciences Department for further information.**

### Required Courses

CRP 339	Disaster-Resistant Sustainable Communities (Area F)	4
CRP 458	Local Hazard Mitigation Planning and Design	4
NR 455	Wildland-Urban Fire Protection	4
DMHS/NR/CRP 351	Introduction to Emergency Management in California	3
DMHS/NR 353	Introduction to Crisis Communications and the Media	3
DMHS/NR/CRP 401	Disaster Recovery	3

### Approved Electives

Select from the following:		10
CRP 212	Introduction to Urban Planning	
DMHS/NR 352	Terrorism: Understanding the Threat	
DMHS/NR 405	Managing Sustained Operations	
NR 312	Technology of Wildland Fire Management (Area F)	
NR 418	Applied GIS	

Total units 31

## Soil Science Minor

### Required Courses

SS 121	Introductory Soil Science (B5)	4
ERSC 202	Soil Erosion and Water Conservation	4
SS 221	Fertilizers and Plant Nutrition	4
or ERSC 223	Rocks and Minerals	
SS 321	Soil Morphology	4

### Approved Electives

Select from the following:		11-14
ERSC 323	Geomorphology	
BIO/NR/SS 421	Wetlands	
SS 322	Soil Plant Relationships	
SS 422	Soil Microbiology and Biochemistry	
SS 423	Soil and Water Chemistry	
SS 431	Soil Resource Inventory	
SS 432	Soil Physics	
SS 433	Land Use Planning	
SS 440	Forest and Range Soils	
SS 442	Soil Vadose Zone and Groundwater Processes	
SS 453	Tropical Soils	

Total units 27-30

## MS Forestry Sciences

### Program Learning Objectives

1. Technical competency in discipline
2. Effective communication skills
3. Awareness of impact of technology on society
4. Understanding ethics and professional conduct
5. Strong interpersonal and teamwork skills
6. Leadership/planning/decision making skills
7. Critical thinking/complex problem-solving skills

#### Required Courses

SS 501	Research Planning	4
NR 532	Applications in Biometrics and Econometrics	4
NR 581	Graduate Seminar in Forestry and Environmental Sciences	3
NR 599	Thesis	9

#### Area of Emphasis

Determined by the student's graduate committee from forestry subdisciplines (400–500 level). 25

At least half of all units required by the committee as reflected on the formal study plan must be at the 500 level.

Total units 45

## Recreation, Parks, & Tourism Administration

Agricultural Sciences Bldg. (11), Room 262  
Phone: 805.756.1288  
www.rpta.calpoly.edu

Department Head: William W. Hendricks

### ACADEMIC PROGRAMS

Program name	Program type
Recreation, Parks, & Tourism Administration	BS

Recreation, parks, and tourism are mainstays of the American culture and a foundation of the United States economy, with an estimated \$2.5 trillion spent annually on leisure pursuits. U.S. households spend seven to eight percent of their income on recreation. The United States has been ranked as the top tourism earner in the world and generates over \$100 billion from international tourism. Although recreation, parks, and tourism provide activities for people from all walks of life, these industries also provide numerous jobs, both in this country and abroad.

Students are prepared for professional employment in public, non-profit, private, and commercial recreation, parks, and tourism organizations. Students select a concentration in hospitality and tourism management; outdoor, adventure, and resource recreation; event planning and management; and sport management. In addition, students may select a course of study in community services management.

To prepare students for their professional careers, the major includes a 400-hour required internship (one quarter) with a recreation, parks, tourism, sport, or special even-related organization. Graduates qualify for diverse positions including recreation supervisors, wedding planners, hotel general managers, sport managing directors, park and

recreation administrators, ecotourism guides, environmental educators, concert and festival organizers, recreation-related business owners, athletic directors, adventure program planners, camp directors, convention and visitor bureau directors, meeting planners, youth sports coordinators, winery event managers, wilderness educators, and campus recreation directors.

Graduates employed nationally and internationally plan, organize, implement and evaluate recreation, parks, and tourism programs and services. Management skills developed through coursework and through practical hands-on applications, allow for career progress into executive management positions within the recreation, parks, and tourism industries.

Students develop those competencies through a myriad of partnerships developed by the department with local, state, national, and international organizations. These partnerships allow students, both in and out of the classroom, to gain valuable experience designing, implementing, and evaluation various recreation-related programs and experiences for diverse clientele.

### Undergraduate Program

#### BS Recreation, Parks, and Tourism Administration

The Recreation, Parks, and Tourism Administration (RPTA) department is dedicated to excellence in teaching, developing professionals, and fostering dynamic and effective leaders. The major is accredited by the Council on Accreditation of Parks, Recreation, Tourism and Related Professions (COAPRT).

In addition to major requirements, the curriculum provides a full range of general education and support courses. These courses are designed to fully educate and prepare students for cultural diversity, community engagement, and international understanding in a global society.

### Concentrations

#### Event Planning and Management

Prepares students for employment for a professional career in event planning, leadership, and management for a variety of event genres including festivals, celebrations, meetings, and expositions, social life-cycle events, mega and hallmark events, sporting, international and non-profit events. Courses focus on a sustained and measurable approach to designing, planning and implementing and managing events.

#### Hospitality and Tourism Management

Emphasizes preparation for employment in organizations that provide leisure products or services for national and international tourists. Students may choose to emphasize in areas such as: hospitality, tourism planning, tourism marketing, tour operation, resort management, and business opportunities.

#### Outdoor, Adventure, and Resource Recreation

Prepares students for leadership positions in a variety of organizations and settings including outdoor and adventure recreation, camp leadership, parks and protected areas management, challenge course management, wilderness education, and adventure travel. Areas of study include the planning, development, leadership, and management of outdoor recreation opportunities.

## Sport Management

Prepares students for management positions with sport entities ranging from youth and high school sport to professional sports. Areas of study include sport marketing and promotion, sport ethics, sport structure and governance, sports-based youth development, and sport event management.

## Graduate Program

Cal Poly offers a Master of Science degree in Agriculture with a specialization in Recreation, Parks, and Tourism Management. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>) section of the College of Agriculture, Food and Environmental Sciences.

## BS Recreation, Parks, and Tourism Administration

### Program Learning Objectives

1. RPTA graduates should be able to understand the field of Recreation, Parks, and Tourism Administration in relation to the larger world.
2. RPTA graduates should be able to communicate effectively, both orally and in writing.
3. RPTA graduates should be able to use their knowledge and skills in the field of Recreation, Parks, and Tourism Administration to make a positive contribution to society.
4. RPTA graduates should be able to work effectively and productively as individuals and in groups.
5. RPTA graduates will be committed to lifelong learning.
6. RPTA graduates shall be able to demonstrate the following entry-level knowledge: a) the nature and scope of the relevant park, recreation, tourism or related professions and their associated industries; b) techniques and processes used by professionals and workers in those industries; and c) the foundations of the profession in history, science, and philosophy (COAPRT Standard 7.01).
7. RPTA graduates shall be able to demonstrate the ability to design, implement, and evaluate services that facilitate targeted human experiences and that embrace personal and cultural dimensions of diversity (COAPRT Standard 7.02).
8. RPTA graduates shall be able to demonstrate entry-level knowledge about operations and strategic management/administration in parks, recreation, tourism and/or related professions (COAPRT Standard 7.03).
9. RPTA graduates will demonstrate, through a comprehensive internship of not less than 400 clock hours and no fewer than 10 weeks, the potential to succeed as professionals at supervisory or higher levels in park, recreation, tourism, or related organizations. (COAPRT Standard 7.04).

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/>)

generalrequirementsbachelorsdegree/#generaleducationtext) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

RPTA 101	Introduction to Recreation, Parks and Tourism	4
RPTA 110	Career Planning in Recreation, Parks and Tourism	1
RPTA 210 or RPTA 260	Introduction to Program Design Recreational Sport Programming	4
RPTA 221	Professionalism and Customer Service	4
RPTA 257	Leadership and Diverse Groups	4
RPTA 313	Sustainability in Recreation, Parks, and Tourism	4
RPTA 342	Risk Management for Recreation, Parks and Tourism	4
RPTA 360	Assessment and Evaluation of Recreation, Parks and Tourism	4
RPTA 370	Experiential Marketing Strategies for Recreation, Parks, and Tourism Services	4
RPTA 405	Recreation, Parks and Tourism Management	4
RPTA 424	Financing Recreation, Parks and Tourism Services	4
RPTA 460	Senior Project in Recreation, Parks, and Tourism	4
RPTA 463	Pre-Internship Seminar	1
RPTA 465	Internship	6
Concentration or individualized course of study courses (see below)		28

### SUPPORT COURSES

BUS 212	Financial Accounting for Nonbusiness Majors	4
BUS 346	Principles of Marketing	4
ENGL 310	Corporate Communication	4
JOUR 312	Public Relations	4
MATH 118	Precalculus Algebra (B1) <sup>1, 2</sup>	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 64

### FREE ELECTIVES

Free Electives	12
Total units	180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> MATH 116 & MATH 117 substitute.

## Concentrations (Select one)

- Event Planning and Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/recreationparktourismadministration/>)

- bsrecreationparksandtourismadministration/  
eventplanningandmanagementconcentration)
- Hospitality and Tourism Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/recreationparkstourismadministration/bsrecreationparksandtourismadministration/hospitalityandtourismmanagement>)
  - Outdoor, Adventure, and Resource Recreation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/recreationparkstourismadministration/bsrecreationparksandtourismadministration/outdooradventureandresourcecreationconcentration>)
  - Sport Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/recreationparkstourismadministration/bsrecreationparksandtourismadministration/sportmanagementconcentration>)

## Individualized Course of Study

A minimum of 28 units of coursework are selected by the student and approved by the student's academic advisor.

## General Education (GE) Requirements

- 72 units required, 8 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	

F	Upper-division elective	4
Total units		64

<sup>1</sup> Required in Support; also satisfies GE

## Event Planning and Management Concentration

RPTA 214	Introduction to Hospitality and Travel	4
RPTA 317	Hospitality, Convention and Meeting Management	4
RPTA 320	Special Event Planning	4
RPTA 420	Festival and Event Management	4

### Approved electives <sup>1</sup>

Select from the following, with a minimum of 6 units upper division: 12

AGB 314	Fair and Fair Facility Management
AGB 455	Advanced Fair Management Seminar
BUS 207	Legal Responsibilities of Business
BUS 387	Organizational Behavior
BUS 418	Listening to the Customer
COMS 212	Interpersonal Communication
COMS 301	Business and Professional Communication
COMS 419	Media Effects
EHS 215	Floral Design I
EHS 225	Floral Design II
FSN 250	Food and Nutrition: Customs and Culture (D4) (USCP)
FSN 275	Elements of Food Safety
GRC 377	Web and Print Publishing (Area F)
JOUR 331	Contemporary Advertising
JOUR 342	Public Relations Writing and Editing
KINE 181	First Aid/CPR/AED
PSY 319	Motivation and Emotion
RPTA 316	Resort and Lodging Operations
RPTA 321	Visitor Services in Recreation, Parks and Tourism
RPTA 330	Directed Field Experience
RPTA 400	Special Problems for Advanced Undergraduates
RPTA 412	Tourism and Outdoor Applications Seminar
RPTA 414	Commercial Recreation Enterprise
RPTA 450	Resource and Grant Development
TH 230	Stagecraft I
or TH 330	Stagecraft II
TH 250	Costume Construction
TH 270	Stage Make-Up

Total units		28
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<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.



## Hospitality and Tourism Management Concentration

RPTA 214	Introduction to Hospitality and Travel	4
RPTA 314	Sustainable Travel and Tourism Planning	4
RPTA 316	Resort and Lodging Operations	4
RPTA 317	Hospitality, Convention and Meeting Management	4

### Approved electives<sup>1</sup>

Select from the following, with a minimum of 6 units upper division: 12

BUS 207	Legal Responsibilities of Business	
BUS 302	International and Cross Cultural Management	
BUS 310	Introduction to Entrepreneurship	
BUS 387	Organizational Behavior	
BUS 418	Listening to the Customer	
BUS 446	International Marketing	
COMS 201	Advanced Public Speaking	
CRP 212	Introduction to Urban Planning	
CRP 214	Land Use and Transportation Studies	
CRP 215	Planning for and with Multiple Publics	
CRP 334	Cities in a Global World	
CRP 427	Local Economic Development Planning	
ECON 221	Microeconomics	
ECON 222	Macroeconomics	
FSN 250	Food and Nutrition: Customs and Culture (D4)	
GEOG 301	Geography of Resource Utilization (D5)	
GEOG 308	Global Geography (D5)	
JOUR 331	Contemporary Advertising	
JOUR 342	Public Relations Writing and Editing	
PSY 252	Social Psychology	
PSY 319	Motivation and Emotion	
PSY 351	Group Dynamics	
RPTA 316	Resort and Lodging Operations	
RPTA 320	Special Event Planning	
RPTA 321	Visitor Services in Recreation, Parks and Tourism	
RPTA 330	Directed Field Experience	
RPTA 400	Special Problems for Advanced Undergraduates	
RPTA 412	Tourism and Outdoor Applications Seminar	
RPTA 414	Commercial Recreation Enterprise	
RPTA 415	Adventure Programming and Planning	
RPTA 420	Festival and Event Management	
RPTA 450	Resource and Grant Development	

Total units 28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Outdoor, Adventure, and Resource Recreation Concentration

RPTA 112	Parks and Outdoor Recreation	4
RPTA 302	Environmental and Wilderness Education	4
RPTA 325	Outdoor and Adventure Leadership	4

Approved electives<sup>1</sup> 16

Select from the following, with a minimum of 6 units upper division:

BIO 227	Wildlife Conservation Biology	
BIO 263	Introductory Ecology and Evolution	
BIO 307	World Aquaculture: Applications, Methodologies and Trends	
BIO 325	General Ecology	
BIO 401	Conservation Biology	
BIO 427	Wildlife Management	
BUS 207	Legal Responsibilities of Business	
BUS 310	Introduction to Entrepreneurship	
BUS 382	Organizations, People, and Technology	
BUS 387	Organizational Behavior	
BUS 418	Listening to the Customer	
BUS 446	International Marketing	
COMS 322	Persuasion	
EHS 437	Park and Public Space Management	
NR/ES 360	Ethnicity and the Land (C4) (USCP)	
GEOG 308	Global Geography (D5)	
JOUR 331	Contemporary Advertising	
JOUR 342	Public Relations Writing and Editing	
LA 363	Recreation Plan and Design	
MSL 111	Orienteering	
NR 141	Introduction to Forest Ecosystem Management	
NR 142	Environmental Management	
NR 204	Wildland Fire Control	
NR 208	Dendrology	
NR 218	Applications in GIS	
NR 306	Natural Resource Ecology and Habitat Management	
NR 350	Urban Forestry	
NR 360	Ethnicity and the Land (C4) (USCP)	
NR 416	Environmental Impact Analysis and Management	
PSY 311	Environmental Psychology (D5)	
RPTA 203	Resource Law Enforcement	
RPTA 214	Introduction to Hospitality and Travel	
RPTA 275	Challenge Course Facilitation	
RPTA 314	Sustainable Travel and Tourism Planning	
RPTA 321	Visitor Services in Recreation, Parks and Tourism	
RPTA 330	Directed Field Experience	
RPTA 400	Special Problems for Advanced Undergraduates	
RPTA 410	Resource Recreation Management	
RPTA 412	Tourism and Outdoor Applications Seminar	

RPTA 414	Commercial Recreation Enterprise	
RPTA 450	Resource and Grant Development	
Total units		28

- <sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Sport Management Concentration

RPTA 160	Introduction to Sport Management	4
RPTA 320	Special Event Planning	4
or RPTA 420	Festival and Event Management	

### Approved electives <sup>1</sup>

Select from the following, with a minimum of 6 units upper division: 20

BUS 207	Legal Responsibilities of Business
BUS 387	Organizational Behavior
BUS 407	Managing People in Global Markets
BUS 418	Listening to the Customer
COMS 213	Organizational Communication
COMS 301	Business and Professional Communication
ECON 221	Microeconomics
GRC 377	Web and Print Publishing (Area F)
JOUR 331	Contemporary Advertising
JOUR 342	Public Relations Writing and Editing
KINE 266	Introduction to Psycho/Social Aspects of Physical Activity
KINE 323	Sport and Gender (D5) (USCP)
KINE 324	Sports, Media and American Popular Culture (D5) (USCP)
PSY 256	Developmental Psychology
RPTA 214	Introduction to Hospitality and Travel
RPTA 321	Visitor Services in Recreation, Parks and Tourism
RPTA 330	Directed Field Experience
RPTA 400	Special Problems for Advanced Undergraduates
RPTA 420	Festival and Event Management
RPTA 450	Resource and Grant Development

Total units	28
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- <sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Wine and Viticulture

Agricultural Sciences Bldg. (11), Room 224  
Phone: 805.756.7308; Fax: 805.756.1335  
<http://www.wvit.calpoly.edu/>

Department Chair: Marianne Wolf

### Academic Programs

Program name	Program type
Wine and Viticulture	BS, Minor

Professional positions within the grape and wine industry are multi-dimensional, where winemakers and winegrape-growers work together with wine marketing and sales personnel. To develop successful strategies, management teams need to understand all aspects of wine.

The WVIT major provides a unique interdisciplinary learning experience, combining a solid foundation in winegrape production, winemaking, and wine business with a concentration in enology, viticulture or wine business. With a campus located in the heart of California's Central Coast wine country, Cal Poly students have the added benefit of gaining hands-on experience at one of more than 400 local vineyards and wineries. The WVIT major is based on fundamental and applied sciences, modern agribusiness principles, and appropriate social sciences. The curriculum encompasses winegrape cultivation, enology, sensory science, and wine business and fosters an academic alliance among production agriculture, food-science, and agricultural business interests to provide an academic understanding of the "vine to glass" philosophy.

Cal Poly has a 14-acre campus vineyard and pilot winery that provide students the opportunity to practice our "learn-by-doing" method of education.

### Undergraduate Program

#### BS Wine and Viticulture

The major is based on fundamental and applied sciences, modern agribusiness principles, and appropriate social sciences. The curriculum encompasses winegrape cultivation, enology, and wine business and fosters an academic alliance among production agriculture, food science, and agricultural business interests to provide an academic understanding of the "vine to glass".

#### Concentrations

##### Enology

The science of winemaking and its creative and practical application. Students monitor and assess wines and winemaking choices using sensory, chemical and microbiological analyses. Graduates are able to make creative winemaking decisions, manage a winery and provide successful solutions to winemaking challenges.

##### Viticulture

Intensive training in all aspects of quality wine grape production. Students learn site evaluation and vine-yard development, disease and pest management, sustain-ability, and state-of-the-art cultural practices. Graduates typically become vineyard managers, pest control advisors, or vineyard owners.

### Wine Business

Students learn financial management, principles of vineyard and winery operations, strategic planning, branded wine marketing, packaging, wine consumer behavior, and government compliance. Graduates are prepared for a variety of wine industry careers, with many planning to operate vineyards or wineries of their own.

### Wine and Viticulture Minor

The goals of the minor are to educate students in the various aspects of wine and viticulture management, addressing knowledge of viticulture, enology, and marketing with skill areas of growing practices, wine making and wine marketing.

Contact the minor advisor for requirements for being admitted into the Wine and Viticulture minor.

### Graduate Program

Cal Poly offers a Master of Science degree in Agriculture in which students can choose a thesis topic in enology, viticulture or wine business. Please refer to the MS Agriculture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduate>) section of the College of Agriculture, Food and Environmental Sciences.

## BS Wine and Viticulture

### Program Learning Objectives

1. An understanding of the fundamental principles of wine grape growing, winemaking, and wine business, both domestically and globally, with in-depth knowledge in a chosen sub-discipline (viticulture, enology, or wine business).
2. Development of the ability to think critically and creatively, analyze and interpret data, and make reasoned and informed decisions.
3. Development of effective leadership skills, and strong written and oral communication skills.
4. An understanding of legal and environmental issues, and sustainability principles, within the wine industry.
5. A high commitment and respect for cultural diversity.
6. Strong interpersonal skills and an ability to collaborate with other wine industry professionals.
7. Create the desire to engage in lifelong learning.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units upper division
- GWR
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

WVIT 101	Orientation to Wine and Viticulture	1
WVIT 102	Global Wine and Viticulture	4

WVIT 202	Fundamentals of Enology	4
WVIT 210	Viticultural Practices	2
WVIT 231	Viticulture I	4
WVIT 331	Viticulture II	4
WVIT 343	Branded Wine Marketing	4
WVIT 339	Internship Wine and Viticulture	4
WVIT 442	Sensory Evaluation of Wine	4
WVIT 423	Wine Law and Compliance	4
WVIT 463	Issues, Trends and Careers in the Wine Industry	2
AGB 214	Agribusiness Financial Accounting	4
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations (USCP)	4
BRAE 340	Irrigation Water Management (Area F) <sup>1</sup>	4
CHEM 111	Survey of Chemistry (B3 & B4) <sup>1</sup>	5
SS 121	Introductory Soil Science	4
MATH 118	Precalculus Algebra (B1)	4
or MATH 161	Calculus for the Life Sciences I	
or MATH 221	Calculus for Business and Economics	
STAT 218	Applied Statistics for the Life Sciences (B1)	4
Concentration courses (see below)		55
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		48
<b>FREE ELECTIVES</b>		
Free Electives		11
Total units		180

<sup>1</sup> Required in Major; also satisfies GE

## Concentrations (select one)

- Enology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/wineandviticulture/bswineandviticulture/enologyconcentration>)
- Viticulture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/wineandviticulture/bswineandviticulture/viticultureconcentration>)
- Wine Business (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/wineandviticulture/bswineandviticulture/winebusinessconcentration>)

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics (no additional units required)</b>	

B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Concentration) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Concentration) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective (4 units in Major) <sup>1</sup>	0
Total units		48

<sup>1</sup> Required in Major/Concentration; also satisfies GE

## Enology Concentration

CHEM 312	Survey of Organic Chemistry	5
CHEM 313	Survey of Biochemistry and Biotechnology	5
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
MCRO 221	Microbiology (B2) <sup>1</sup>	4
WVIT 203	The Anatomy of a Wine <sup>5</sup>	2
WVIT 301	Wine Microbiology	4
WVIT 365	Wine Analysis and Amelioration	4
WVIT 404	Winemaking I	4
WVIT 405	Winemaking II	4
WVIT 406	Winemaking III	4
WVIT 461	Senior Project I - Enology and Viticulture	4
& WVIT 462	and Senior Project II - Enology and Viticulture	

### Approved electives <sup>2</sup>

Select from the following:		11
AGB 212	Agricultural Economics	
AGB 310	Agribusiness Credit and Finance	
AGB 318	Global Agricultural Marketing and Trade	
AGB 322	Principles of Agribusiness Management	
AGB 323	Agribusiness Managerial Accounting	
BIO 111	General Biology	
BIO 161	Introduction to Cell and Molecular Biology	
BIO 303	Survey of Genetics	
BIO 435	Plant Physiology	
BOT 121	General Botany	
BOT 323	Plant Pathology	
BRAE 348	Energy for a Sustainable Society	

BRAE 439	Vineyard Water Management
CHEM 128	General Chemistry II
CHEM 129	General Chemistry III
CHEM 216	Organic Chemistry for Life Sciences I
CHEM 217	Organic Chemistry for Life Sciences II
CHEM 316	Organic Chemistry I
CHEM 317	Organic Chemistry II
CHEM 401	Advanced Undergraduate Research
ECON 222	Macroeconomics <sup>3</sup>
FSN 230	Elements of Food Processing
FSN 285	Certified Organic Food Processing
FSN 354	Packaging Function in Food Processing
FSN 370	Food Plant Sanitation and Prerequisite Programs
FSN 374	Food Laws and Regulations
HCS 421	Postharvest Technology of Horticultural Crops
IT 311	Industrial Safety and Quality Program Leadership
IT 330	Packaging Fundamentals
IT 435	Packaging Development
MCRO 342	Sanitary Microbiology
MCRO 421	Food Microbiology
PPSC 311	Agricultural Entomology
PPSC 321	Weed Biology and Management
PPSC 421	Plant-Pest Interactions
RPTA 214	Introduction to Hospitality and Travel
RPTA 314	Sustainable Travel and Tourism Planning
RPTA 320	Special Event Planning
RPTA 321	Visitor Services in Recreation, Parks and Tourism
RPTA 412	Tourism and Outdoor Applications Seminar
RPTA 420	Festival and Event Management
SPAN 101	Elementary Spanish I <sup>4</sup>
or FR 101	Elementary French I
or GER 101	Elementary German I
or ITAL 101	Elementary Italian I
SPAN 102	Elementary Spanish II <sup>4</sup>
or FR 102	Elementary French II
or GER 102	Elementary German II
or ITAL 102	Elementary Italian II
SPAN 103	Elementary Spanish III <sup>4</sup>
or FR 103	Elementary French III
or GER 103	Elementary German III
or ITAL 103	Elementary Italian III
SPAN 201	Intermediate Spanish I <sup>4</sup>
or FR 201	Intermediate French I
or GER 201	Intermediate German I
or ITAL 201	Intermediate Italian I
SPAN 202	Intermediate Spanish II <sup>4</sup>
or FR 202	Intermediate French II
or GER 202	Intermediate German II
SS 221	Fertilizers and Plant Nutrition

WVIT 339	Internship Wine and Viticulture (limited to 2 units)
WVIT 400	Special Problems for Advanced Undergraduates
WVIT 414	Grape Pest Management
WVIT 415	Grapevine Physiology
WVIT 424	Winegrape Growing: Fall
WVIT 425	Winegrape Growing: Winter
WVIT 426	Winegrape Growing: Spring
WVIT 427	Winegrape Growing: Summer
WVIT 433	Wine Sales and E-Commerce
WVIT 444	Wine Marketing Research and Market Analysis
WVIT 450	Wine Business Strategies
WVIT 470	Selected Advanced Topics
WVIT 471	Selected Advanced Laboratory
<hr/>	
Total units	55

- <sup>1</sup> Required in Major; also satisfies GE
- <sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>3</sup> ECON 201 must be taken first, as it is not open to students with ECON 222 credit.
- <sup>4</sup> A maximum of 8 units of foreign language may be counted toward approved electives.
- <sup>5</sup> May substitute an additional 2 units of free electives.

## Viticulture Concentration

BOT 121	General Botany (B2) <sup>1</sup>	4
BOT 323	Plant Pathology	4
CHEM 312	Survey of Organic Chemistry	5
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
PPSC 311	Agricultural Entomology	4
PPSC 321	Weed Biology and Management	4
SS 221	Fertilizers and Plant Nutrition	4
WVIT 302	Wine Fermentation Laboratory	2
WVIT 414	Grape Pest Management	4
WVIT 415	Grapevine Physiology	4
Select from the following:		6
WVIT 424	Winegrape Growing: Fall	
WVIT 425	Winegrape Growing: Winter	
WVIT 426	Winegrape Growing: Spring	
WVIT 427	Winegrape Growing: Summer	
WVIT 461	Senior Project I - Enology and Viticulture	4
& WVIT 462	and Senior Project II - Enology and Viticulture	

### Approved electives <sup>2</sup>

Select from the following:		6
AG 315	Organic Agriculture	
AG 360	Holistic Management	
AG 450	Applied Holistic Management	
AG 452	Issues Affecting California Agriculture	
AGB 212	Agricultural Economics	
AGB 310	Agribusiness Credit and Finance	
AGB 321	Farm Records	



BIO 435	Plant Physiology
BOT 326	Plant Ecology
BOT 431	Advanced Plant Pathology
BRAE 438	Drip/Micro Irrigation
BRAE 439	Vineyard Water Management
CRSC 244	Precision Farming
GEOG 318	Applications in GIS
GEOG 328	Applications in Remote Sensing
FRSC 342	Citrus and Avocado Fruit Production
MCRO 221	Microbiology
PPSC 327	Vertebrate Pest Management
PPSC 405	Advanced Weed Management
PPSC 421	Plant-Pest Interactions
PPSC 431	Insect Pest Management
PPSC 441	Biological Control for Pest Management
SPAN 101	Elementary Spanish I <sup>4</sup>
or FR 101	Elementary French I
or GER 101	Elementary German I
or ITAL 101	Elementary Italian I
SPAN 102	Elementary Spanish II <sup>4</sup>
or FR 102	Elementary French II
or GER 102	Elementary German II
or ITAL 102	Elementary Italian II
SPAN 103	Elementary Spanish III <sup>4</sup>
or FR 103	Elementary French III
or GER 103	Elementary German III
or ITAL 103	Elementary Italian III
SPAN 201	Intermediate Spanish I <sup>4</sup>
or FR 201	Intermediate French I
or GER 201	Intermediate German I
or ITAL 201	Intermediate Italian I
SPAN 202	Intermediate Spanish II <sup>4</sup>
or FR 202	Intermediate French II
or GER 202	Intermediate German II
SS 321	Soil Morphology
SS 322	Soil Plant Relationships
WVIT 203	The Anatomy of a Wine
WVIT 301	Wine Microbiology
WVIT 339	Internship Wine and Viticulture (Limited to 2 units)
WVIT 365	Wine Analysis and Amelioration
WVIT 400	Special Problems for Advanced Undergraduates
WVIT 404	Winemaking I
WVIT 405	Winemaking II
WVIT 406	Winemaking III
WVIT 424	Winegrape Growing: Fall <sup>3</sup>
WVIT 425	Winegrape Growing: Winter <sup>3</sup>
WVIT 426	Winegrape Growing: Spring <sup>3</sup>
WVIT 427	Winegrape Growing: Summer <sup>3</sup>
WVIT 433	Wine Sales and E-Commerce

WVIT 444	Wine Marketing Research and Market Analysis
WVIT 450	Wine Business Strategies
WVIT 470	Selected Advanced Topics
WVIT 471	Selected Advanced Laboratory
<hr/>	
Total units	55

- <sup>1</sup> Required in Major; also satisfies GE
- <sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>3</sup> Only if course was not used to complete non-elective viticulture concentration requirements.
- <sup>4</sup> A maximum of 8 units of foreign language may be counted toward approved electives.

## Wine Business Concentration

AGB 212	Agricultural Economics	4
AGB 310	Agribusiness Credit and Finance	4
AGB 323	Agribusiness Managerial Accounting	4
AGB 422	Logistics in Global Agribusiness	4
BIO 111	General Biology (B2) <sup>1</sup>	4
ECON 222	Macroeconomics (D2) <sup>1</sup>	4
WVIT 302	Wine Fermentation Laboratory	2
WVIT 433	Wine Sales and E-Commerce	4
WVIT 444	Wine Marketing Research and Market Analysis	4
WVIT 450	Wine Business Strategies	4
WVIT 460	Senior Project - Wine Business	4

### Approved electives <sup>2</sup>

Select from the following:		13
AGB 312	Agricultural Policy	
AGB 315	Land Economics	
AGB 318	Global Agricultural Marketing and Trade	
AGB 324	Agricultural Property Management and Sales	
AGB 326	Rural Property Appraisal	
AGB 404	Food Retail Management	
AGB 452	Agricultural Market Structure and Strategy	
BRAE 348	Energy for a Sustainable Society	
BRAE 438	Drip/Micro Irrigation	
BRAE 439	Vineyard Water Management	
FSN 230	Elements of Food Processing	
FSN 285	Certified Organic Food Processing	
FSN 354	Packaging Function in Food Processing	
FSN 370	Food Plant Sanitation and Prerequisite Programs	
FSN 374	Food Laws and Regulations	
HCS 421	Postharvest Technology of Horticultural Crops	
IT 311	Industrial Safety and Quality Program Leadership	
IT 330	Packaging Fundamentals	
IT 435	Packaging Development	
JOUR 203	News Reporting and Writing	
JOUR 285	Intro to Multimedia Journalism	
JOUR 312	Public Relations	

JOUR 331	Contemporary Advertising
JOUR 342	Public Relations Writing and Editing
PPSC 311	Agricultural Entomology
PPSC 321	Weed Biology and Management
PPSC 421	Plant-Pest Interactions
RPTA 214	Introduction to Hospitality and Travel
RPTA 314	Sustainable Travel and Tourism Planning
RPTA 320	Special Event Planning
RPTA 321	Visitor Services in Recreation, Parks and Tourism
RPTA 412	Tourism and Outdoor Applications Seminar
RPTA 420	Festival and Event Management
SPAN 101	Elementary Spanish I <sup>3</sup>
or FR 101	Elementary French I
or GER 101	Elementary German I
or ITAL 101	Elementary Italian I
SPAN 102	Elementary Spanish II <sup>3</sup>
or FR 102	Elementary French II
or GER 102	Elementary German II
or ITAL 102	Elementary Italian II
SPAN 103	Elementary Spanish III <sup>3</sup>
or FR 103	Elementary French III
or GER 103	Elementary German III
or ITAL 103	Elementary Italian III
SPAN 201	Intermediate Spanish I <sup>3</sup>
or FR 201	Intermediate French I
or GER 201	Intermediate German I
or ITAL 201	Intermediate Italian I
SPAN 202	Intermediate Spanish II <sup>3</sup>
or FR 202	Intermediate French II
or GER 202	Intermediate German II
SS 221	Fertilizers and Plant Nutrition
WVIT 203	The Anatomy of a Wine
WVIT 301	Wine Microbiology
WVIT 365	Wine Analysis and Amelioration
WVIT 400	Special Problems for Advanced Undergraduates
WVIT 404	Winemaking I
WVIT 405	Winemaking II
WVIT 406	Winemaking III
WVIT 339	Internship Wine and Viticulture (limited to 2 units)
WVIT 414	Grape Pest Management
WVIT 415	Grapevine Physiology
WVIT 424	Winegrape Growing: Fall
WVIT 425	Winegrape Growing: Winter
WVIT 426	Winegrape Growing: Spring
WVIT 427	Winegrape Growing: Summer
WVIT 470	Selected Advanced Topics
WVIT 471	Selected Advanced Laboratory

Total units

55

<sup>1</sup> Required in Major; also satisfies GE<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.<sup>3</sup> A maximum of 8 units of foreign language may be counted toward approved electives.

## Wine and Viticulture Minor

### Required Courses

WVIT 102	Global Wine and Viticulture	4
WVIT 202	Fundamentals of Enology	4
WVIT 210	Viticultural Practices	2
WVIT 311	Survey of Viticulture	4
WVIT 339	Internship Wine and Viticulture	4
WVIT 433	Wine Sales and E-Commerce	4
or WVIT 343	Branded Wine Marketing	
WVIT 463	Issues, Trends and Careers in the Wine Industry	2
Total units		24

## College of Architecture and Environmental Design

Architecture and Environmental Design Bldg. (05), Room 212  
Phone: 805.756.1321  
<http://www.caed.calpoly.edu/>

Dean: Christine Theodoropoulos  
Associate Dean: Michael Lucas

### Academic Programs

Program name	Program type
Architectural Engineering	BS, Minor
Architecture	BArch, MS
City and Regional Planning	BS, MCRP, Minor
Construction Management	BS, Minor
Integrated Project Delivery	Minor
Landscape Architecture	BLA
Real Property Development	Minor
Sustainable Environments	Minor
Transportation Planning	MRCP/MS Engineering

### Graduate Certificate Program

Program name	Program type
Facilities Management and Operations	Certificate

The five undergraduate programs share the common objective of betterment of the human physical environment through the effective application of natural and cultural systems knowledge in planning, design and construction. They are all nationally accredited by their respective external review organizations.

The masters degree programs are designed for students interested in advanced professional studies. Included under the MS Architecture are specializations in structural engineering, environmental design and professional practice. The college also offers the Master of City and Regional Planning (MCRP). The joint MCRP/MS Engineering with a specialization in Transportation Planning is an interdisciplinary program. It is a cooperative effort between the colleges of Engineering and Architecture and Environmental Design.

The well-equipped college facilities include design laboratories, grading presentation galleries, soils laboratory, stress laboratory, construction shop, project yard, instructional resource center, computer laboratories, and photo presentation laboratory. An outlying area of 12 acres known as the "Canyon" is available for experimental construction.

The location of the campus between the population centers of San Francisco and Los Angeles is ideal for community and environmental studies in a variety of contexts and scales. An active visiting lecturer program joins with faculty in all departments in providing excellent student instruction. Course field trips to varying destinations are offered in each of the majors. Students have the opportunity to participate in national and international exchange programs. The college offers several opportunities through departmentally sponsored programs for directed foreign study. Students also regularly participate in the California State University's International Programs in Denmark and Italy.

In addition to individual faculty representation in a wide range of professional associations, departments are members of their respective educators associations: the Association of Collegiate Schools of Architecture (ACSA); the Council of Educators in Landscape Architecture (CELA); the Association of Collegiate Schools of Planning (ACSP); and the Associated Schools of Construction Management (ASCM).

Likewise, students maintain active chapters of the professional organizations of the American Institute of Architects (AIA), the American Society of Landscape Architects (ASLA), the Associated General Contractors (AGC), the Structural Engineers Association of California (SEAOC), the American Planning Association (APA), and the National Society of Architectural Engineers (NSAE).

Opportunities for interdisciplinary interaction within the college are made available through coursework, annual forums, participation in district and national student competitions, student council activities and community service projects. Students are exposed to viable economic and ecological alternatives to conventional planning, design and construction through faculty applied research in such areas as passive solar building, post-disaster community rebuilding, sustainable design and construction technologies, earthquake-resistant building systems, project delivery methodologies, and daylighting and electrical lighting integration.

The college has various enhanced computing capabilities including Geographic Information System Technology, Computer-Aided Design and Immersive Visualization (virtual reality).

Students interested in pursuing one of the five undergraduate program offerings within the college should familiarize themselves with the appropriate curriculum flow chart, available online and through the College Advising Center, Architecture and Environmental Design Bldg. (05), Room 221, and departments. Special attention is directed to the sequencing of courses and prerequisite requirements. Students who plan to transfer from a California community college should schedule classes to maximize transfer units. Current admission requirements may be found at the Cal Poly website ([www.calpoly.edu](http://www.calpoly.edu)).

As a consequence of the periodic review and accreditation requirements of its programs, the college reserves the right to keep selected student projects for its archives. These projects are returned to students at the discretion of their respective department faculty.

Additional information about the college and its programs may be found at its website, <http://www.caed.calpoly.edu/>.

### CAED Advising Center

Ellen Notermann, Director  
Bldg. (05), Room 210  
Phone: 805.756.1325  
[www.calpoly.edu/~caed/the\\_CAED/Advising\\_Center/](http://www.calpoly.edu/~caed/the_CAED/Advising_Center/)

The College of Architecture and Environmental Design (CAED) Advising Center provides academic advising services to all students within the CAED, in conjunction with each student's departmental faculty advisor. These services include providing information relative to curriculum requirements for all majors within the college, General Education requirements, transfer and evaluation credit and articulation, academic probation advising, University, College and department policies and procedures, change of major policies and procedures, tutoring, special academic programs, and referral of students to other campus resources.

The Advising Center processes most student-related forms including those for curriculum substitution, course withdrawal, change of major and other forms. Curriculum sheets, flowcharts, information on CAED minors, jobs, scholarships and competitions are located in the Advising Center.

## Integrated Project Delivery Minor

Construction Management Department (186), Room A100  
Phone: 805.756.1323

Barbara J. Jackson, Minor Advisor  
bjackson@calpoly.edu

This minor is offered by the Construction Management Department, and is specific and intentional in its design. It is intended to provide an "interdisciplinary" understanding of the design and construction process. It is designed to serve students who will be engaged in the Architecture/ Engineering/Construction (A/E/C) industry and be involved in integrated services project delivery.

### Prerequisite

Upper division standing; and thus students are presumed to have completed the majority of their General Education courses, support, and/or major courses.

## Real Property Development Minor

Construction Management Department (186), Room A100  
Phone: 805.756.1323

Scott Kelting, Minor Advisor  
skelting@calpoly.edu

This minor is designed for students who are interested in the built environment, and want to expand their knowledge of how projects get initiated, move through the development process, and then how they are managed after construction.

The program is designed to prepare students for entry-level employment with professionals engaged in real property development. Courses include aspects of practitioners' real world experiences and knowledge of state-of-the-art practices, techniques, and challenges.

Students learn about the economic, design, environmental, and regulatory factors that influence housing, office, industrial, and commercial projects. They gain a clearer understanding of how these factors impact green development, urban sprawl, place-making, and transit oriented development.

## Sustainable Environments Minor

Architecture Department (05), Room 212  
Phone: 805.756.1298

Margot McDonald, Minor Advisor  
mmcdonal@calpoly.edu

This minor educates students within the University in the principles and various aspects of sustainable environmental design with global, regional and local perspectives and concepts. It provides students with the knowledge and abilities needed to integrate concerns for ecology, social equity and economics within the context of human and natural resource systems and the built environment.

## Environmental Studies Minor

Students who complete the Environmental Studies Minor, coordinated through the College of Science and Mathematics (see the College of Science and Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/#text>) catalog section for additional information), are able to:

- Analyze, explain, and evaluate environmental issues from both scientific/technical and social/political/economic perspectives.
- Integrate and synthesize knowledge from multiple disciplines.
- Explain and apply the methodologies and approaches that different disciplines bring to bear on complex problems.
- Work productively and effectively with students from other disciplines and with other points of view.
- Confront real issues of contemporary significance; issues that affect them and their future.
- Gain employment or pursue further study that emphasizes interdisciplinary knowledge and skills.

The College of Architecture and Environmental Design offers the following course options as a part of this minor:

- EDES 406 Sustainable Environments
- CRP 336 Introduction to Environmental Decision Making
- CRP 404 Environmental Law

## Integrated Project Delivery Minor

### Required Courses

COMS 301	Business and Professional Communication	4
CM 415	Integrated Project Delivery	4
CM/EDES 430	Collaborative Process	3
CM 432	Design-Build Project Management	3
CM 433	Integrated Project Delivery	2

### Approved Electives

Select from the following: 8

Construction Management students must complete advisor approved design courses (ARCE, ARCH, CRP or LA prefix)

Other CAED students must complete Construction Management courses

Non-CAED students must complete advisor approved design and/or CM courses

Total units 24

## Real Property Development Minor

### Required Courses

CM 475	Real Property Development Principles	4
CRP 212	Introduction to Urban Planning	4
CRP 315	Fiscal and Project Feasibility	3-4
or CM 232	Evaluation of Cost Alternatives	

### Planning/Design

Select from the following: 3-4

ARCH 445 Urban Design in Architecture

ARCH 472 Housing Design Concepts

CRP 412 Plan Implementation

CRP 430 Professional Planning Practice

Any advisor approved planning or design courses at the 400 or 500 level

### Approved Electives

Select two or more courses from the following to complete a minimum of 24 units. 9-10

BUS 434 Real Estate Finance

CM 214 Residential Construction Management

CM 313 Commercial Construction Management

CM 413 Jobsite Construction Management

CM 480 Preconstruction Integration and Planning

CRP 336 Introduction to Environmental Planning

CRP 420 Land Use Law

CRP 442 Housing and Planning

CRP 446 Development Review and Entitlement

CRP 458 Local Hazard Mitigation Planning and Design

CRP 470 Selected Advanced Topics

ECON 434 Urban Economics

ECON 435 Economics of Land and Water

LA 470 Selected Advanced Topics

Total units 24-25

## Sustainable Environments Minor

### Required Courses

EDES 406	Sustainable Environments	4
EDES 408	Implementing Sustainable Principles	4

### Approved Electives

Select from the following: 16

At least 4 units must be upper division (300-400 level)

AG 450 Applied Holistic Management

ANT 201 Cultural Anthropology <sup>1</sup>

ANT 360 Human Cultural Adaptations <sup>2</sup>

ARCH 445 Urban Design in Architecture

ARCH 472 Housing Design Concepts

BIO 112 Environmental Biology and Conservation

BIO 227 Wildlife Conservation Biology

BIO 325 General Ecology <sup>3</sup>

BOT 238 Central Coast Flora and Vegetation

BRAE 348 Energy for a Sustainable Society

CRP 211 Cities: Form, Culture and Evolution <sup>4</sup>

CRP 212 Introduction to Urban Planning <sup>4</sup>

CRP 214 Land Use and Transportation Studies <sup>4</sup>

CRP/ES 215 Planning for and with Multiple Publics

CRP 334 Cities in a Global World

CRP 336 Introduction to Environmental Planning <sup>4</sup>

CRP 339 Disaster-Resistant Sustainable Communities

CRP 342 Environmental Planning Methods <sup>4</sup>

CRP 436 Collaborative Planning <sup>4</sup>

CRP 438 Pollution Prevention and Control

ECON/HNRS 303 Economics of Poverty, Discrimination and Immigration

EDES 410 Advanced Implementation of Sustainable Principles

EDES 420 Historic Preservation and Adaptive Reuse in the Built Environment

ENGL 380 Literary Themes (Eco-Lit)

ES/ARCH 326 Native American Architecture and Place

ES 360 Ethnicity and the Land

GEOG 150 Introduction to Cultural Geography <sup>1</sup>

GEOG/ERSC 325 Climate and Humanity

GEOG/ERSC 333 Human Impact on the Earth

HUM 303/ HNRS 304 Values and Technology

LA 482 Evaluating Social and Behavioral Factors for Open Space Design

NR 306 Natural Resource Ecology and Habitat Management <sup>3</sup>

NR 320 Watershed Management and Restoration

NR 321 Water Systems Technology, Issues and Impacts



NR 323	Human Dimensions in Natural Resources Management
NR 414	Sustainable Forest Management
NR 434	Wood Properties, Products and Sustainable Uses
NR/CRP 404	Environmental Law
NR/ES 360	Ethnicity and the Land
NR/HNRS 475	Sustainable Forest and Environmental Practices
NR/LA 218	Applications in GIS <sup>3</sup>
PHIL 340	Environmental Ethics
PHYS 310	Physics of Energy
PSC 320	Energy, Society and the Environment
PSY 311	Environmental Psychology
SOC 313	Urban Sociology
UNIV/AG/HUM 330	Cal Poly Land: Nature, Technology, and Society
UNIV 333	World Food Systems
UNIV 350	The Global Environment
UNIV 391	Appropriate Technology for the World's People: Development
UNIV 392	Appropriate Technology for the World's People: Design
UNIV 492	Appropriate Technology for the World's People: Design
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Total units	24

<sup>1</sup> ANT 201 and GEOG 150 do not count for Sociology, Social Sciences, and Anthropology and Geography majors.

<sup>2</sup> ANT 360 does not count for Anthropology and Geography majors.

<sup>3</sup> BIO 325, LA 218 / NR 218, and NR 306 do not count for Environmental Management and Protection majors.

<sup>4</sup> CRP 211, CRP 212, CRP 214, CRP 336, CRP 342 and CRP 436 do not count for City and Regional Planning majors.

## Architectural Engineering

Engineering West (21), Room 110

Phone: 805.756.1314

<http://www.arce.calpoly.edu/>

Department Head: Allen C. Estes

### Academic Programs

Program name	Program type
Architectural Engineering	BS, Minor

The Architectural Engineering Department is an integral part of the College of Architecture and Environmental Design, and it shares and supports the mission of the College. The department has several overall program objectives, which are: to advance in a career path primarily in structural engineering or a building industry field, attain a graduate degree, engage in lifelong learning, and meet increasing professional demands to communicate effectively.

To eventually attain these overall program objectives, the following student learning outcomes must be satisfied. At the time of graduation, we expect our graduates to be able to: apply knowledge of mathematics, science and engineering to building structures; design and conduct experiments, as well as to analyze and interpret data; design a building system, component, or process to meet desired needs within realistic constraints such as regulatory, economic, environmental, social, political, ethical, health and safety, constructability, and sustainability; function in interdisciplinary teams for the design and construction of buildings; identify, formulate and solve structural engineering problems; understand professional and ethical responsibility; communicate effectively; have the broad education necessary to understand the impact of engineering solutions in a global and societal context; have a recognition of the need for and an ability to engage in life-long learning; have a knowledge of how the built environment is related to contemporary issues; use the techniques, skills and tools necessary for structural engineering practice; and apply construction and constructability issues in buildings. To attain these outcomes, the program provides a balance of theoretical (analytical) and experimental courses.

The Architectural Engineering program carefully addresses architectural design, constructability issues, life safety and economy of construction. In addition, course projects address realistic design criteria, such as economic implications and environmental, social, ethical and sustainability issues. Using integrated design projects, modern technological tools, and the latest design codes to address these goals, the department emphasizes the advantages of a close, interdisciplinary team-based approach to design and construction.

The use of interdisciplinary projects allows students to hone their communication, critical thinking, and project management skills by working in multi-disciplinary teams. As students learn more about building design, they become cognizant of the ethical implications of design, specifically of how political and societal issues affect the engineering of the built environment, both on a local scale and on a broader international scale. These larger societal issues motivate students to engage in life-long learning, allowing them to use their skills in professional structural engineering practice.

The department's learn-by-doing philosophy is part of a pedagogy which emphasizes design-centered laboratories, integrating theory and design, culminating in a senior project capstone design experience.

The Architectural Engineering Program is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

### Undergraduate Programs

#### B S Architectural Engineering

Cal Poly's Department of Architectural Engineering's (ARCE) curriculum focuses on the structural engineering of buildings. By focusing on building design students are able to take many more structural engineering courses than is possible in a traditional civil engineering program. Beyond structural engineering courses, students take several architecture and construction management, giving them an appreciation for these disciplines.

#### Architectural Engineering Minor

The minor is designed for students wishing to pursue a more in-depth education in structures. The coursework exposes students to analytical, design, and construction issues relevant to the structural design process. Students select a sequence of courses that focus on either structural design or structural analysis. The program is tailored for students majoring in architecture, construction management, and civil engineering. Enrollment is limited and acceptance into the program is dependent upon the student's performance in structures-related courses. Contact the department for additional information.

#### Integrated Project Delivery Minor

The department also participates in offering an interdisciplinary minor in Integrated Project Delivery. Please see the College of Architecture and Environmental Design (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign>) for more information.

### Graduate Program

Cal Poly offers the MS in Architecture with a Specialization in Architectural Engineering. Please see the Architecture Department's (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/architecture>) catalog section for more information.

## BS Architectural Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science and engineering to building structures.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to design a building system, component, or process to meet desired needs within realistic constraints such as regulatory, economic, environmental, social, political, ethical, health and safety, constructability, and sustainability.
4. An ability to function in interdisciplinary teams for the design and construction of buildings.
5. An ability to identify, formulate and solve structural engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.

8. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
9. A recognition of the need for and an ability to engage in life-long learning.
- 10A knowledge of how the built environment relates to contemporary issues.
- 11 An ability to use the techniques, skills and tools necessary for structural engineering practice.
- 12A basic proficiency in construction and constructability issues in buildings.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

All ARCE majors must obtain a grade of C- or better in ARCE courses that are prerequisites for other ARCE courses.

### MAJOR COURSES

ARCE 106	Introduction to Building Systems	2
or CM 113	Construction Materials and Assemblies	
ARCE 211	Structures I	3
ARCE 212	Structures II	3
ARCE 223	Mechanics of Structural Members	3
ARCE 224	Mechanics of Structural Members Laboratory	1
ARCE 225	Dynamics	3
or ME 212	Engineering Dynamics	
ARCE 227	Structures III	2
ARCE 257	Structural CAD for Building Design	2
ARCE 302	Structural Analysis	4
ARCE 303	Steel Design I	3
ARCE 304	Timber Design	3
ARCE 305	Masonry Design	2
ARCE 306	Matrix Analysis of Structures	3
ARCE 351	Structural Computing Analysis I	3
& ARCE 352	and Structural Computing Analysis II	
& ARCE 353	and Structural Computing Analysis III	
ARCE 354	Numerical Analysis Laboratory	1
ARCE 371	Structural Systems Laboratory	3
ARCE 372	Steel Structures Design Laboratory	3
ARCE 412	Dynamics of Framed Structures	3
ARCE 421	Soil Mechanics	3
ARCE 422	Foundation Design	3
ARCE 444	Reinforced Concrete Laboratory	3
ARCE 451	Timber and Masonry Structures Design and Constructability Laboratory	3

ARCE 452	Concrete Structures Design and Constructability Laboratory	3
ARCE 483	Seismic Analysis and Design	4

### Advanced Structural Electives

Select from the following: 6-7

ARCE 403	Advanced Steel Structures Laboratory	
ARCE 414	Precast Concrete	
ARCE 423	Advanced Foundation Design	
ARCE 445	Prestressed Concrete Design Laboratory	
ARCE 446	Advanced Structural Systems Laboratory	
ARCE 447	Advanced Reinforced Concrete Laboratory	
ARCE 448	Seismic Rehabilitation Laboratory	
ARCE 449	Cold Formed Steel Design Laboratory	
ARCE 475	Civil Infrastructure and Building Systems	
ARCE 501	Advanced Structural Mechanics	

### Interdisciplinary Senior Project

ARCE 415	Interdisciplinary Capstone Project	4
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### SUPPORT COURSES

ARCH 131	Design and Visual Communication 1.1	12
& ARCH 132	and Design and Visual Communication 1.2	
& ARCH 133	and Design and Visual Communication 1.3	
ARCH 217	History of World Architecture: Prehistory - Middle Ages (C3) <sup>1</sup>	4
or ARCH 218	History of World Architecture: Middle Ages - 18th Century	
or ARCH 219	History of World Architecture: 18th Century - Present	
or ARCE 260	History of Structures	
BRAE 237	Introduction to Engineering Surveying	2
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
CM 115	Fundamentals of Construction Management	6
CM 232	Evaluation of Cost Alternatives	3
or IME 314	Engineering Economics	
CSC 231	Programming for Engineering Students	2
EDES 101	Introduction to Architecture and Environmental Design	2
EE 201	Electric Circuit Theory	3
GEOL 201	Physical Geology	3
MATH 141	Calculus I	8
& MATH 142	and Calculus II (B1) <sup>1</sup>	
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 302	Thermodynamics I	3
ME 341	Fluid Mechanics I	3
PHYS 141	General Physics IA (Add'l Area B) <sup>1</sup>	4
PHYS 132	General Physics II	8
& PHYS 133	and General Physics III	
STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
or STAT 321	Probability and Statistics for Engineers and Scientists	

### GENERAL EDUCATION (GE)

(See GE program requirements below.)	44
<b>FREE ELECTIVES</b>	
Free Electives	0
Total units	203-204

<sup>1</sup> Required in Support; also satisfies GE

## General Education (GE) Requirements

- 72 units required, 28 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 8 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts (4 units in Support) <sup>1</sup>	0
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		44

<sup>1</sup> Required in Support; also satisfies GE

## Architectural Engineering Minor

### Required Courses

ARCE 211	Structures I	6
& ARCE 212	and Structures II	
ARCE 223	Mechanics of Structural Members	3
ARCE 226	Structural Systems	3
ARCE 315	Small Scale Structures	4
ARCE 316	Large Scale Structures	4
Select either Analysis or Design Option:		8-9
<b>Analysis Option</b>		
ARCE 227	Structures III	
ARCE 302	Structural Analysis	
Select one of the following:		

Last updated: 04/22/15

ARCE 303	Steel Design I
ARCE 304	Timber Design
ARCE 305	Masonry Design
<b>Design Option</b>	
ARCE 303	Steel Design I
ARCE 304	Timber Design
ARCE 305	Masonry Design

Total units 28-29

## Architecture

Architecture & Environmental Design Bldg. (05), Rm 212  
Phone: 805.756.1316; Fax 805.756.1500  
<http://www.arch.calpoly.edu/>

Interim Department Head: Margot McDonald

Associate Department Head: Michael Lucas

### Academic Programs

Program name	Program type
Architecture	BArch
Architecture	MS; MS with Specialization in Architectural Engineering
Architecture Planning Track	MCRP

The objective of the five-year Bachelor of Architecture degree program is to develop design and related skills necessary for entry into the professional field of architecture. Preparation for architecture spans several disciplines and requires a range of aptitudes. As the architect has a responsibility for solving problems of the built environment involving people, an understanding and sensitivity to human needs is required. Therefore, programs in architecture are broad in nature. With careful selection of elective work, areas of specialization can be included.

The Bachelor of Architecture degree is accredited by the National Architectural Accrediting Board.

"In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit US professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Doctor of Architecture and Master of Architecture degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree."

California Polytechnic State University, San Luis Obispo, CA, College of Architecture and Environmental Design, Department of Architecture offers the following NAAB-accredited degree program:

B.Arch. (225 undergraduate credits)

Next accreditation visit for program: 2017"

### Transfer Students

Transfer applicants into Architecture are ranked by Admissions in accordance to the formula outlined on the Admissions Web Site. The Architecture Department then invites the top ranked candidates to submit a portfolio of their work for final selection by the Architecture Department faculty.

### Laptop Requirement

The department has a requirement that all freshmen or transfer students have a notebook computer when they enter the program. In the profession of architecture, computing is an integral component, and developing the ability to critically integrate hand and digital tools is a fundamental aspect of architectural education. A notebook computer is the key to having computing capabilities available at all times and all locations. Financial aid may be available to cover the cost of the notebook computer (contact the Financial Aid Office (<http://financialaid.calpoly.edu>) for more information).

### Off-Campus Architecture Programs

Off-campus study opportunities for fourth year Architecture students are offered in a variety of formats and locations. Programs from one quarter to a full year are available abroad and in the United States. There is a third year student general information session each fall quarter to present the department-sponsored programs offered for the following year. Applications from third year students for all programs are due in the winter quarter.

### CSU International Programs

There are two CSU-sponsored organized studio programs for Architecture majors, one in Copenhagen, Denmark, and one in Florence, Italy. The concept of the studio organization is similar to Cal Poly. Credit for major design courses, some professional electives, some general education courses and free electives are handled through approved overseas study centers.

### San Francisco Urban Design Internship Program

San Francisco Urban Design Internship Program offers fourth year students the opportunity to live and study in San Francisco for one quarter (fall and spring). Each class utilizes real projects with the participation of talented, award-winning architectural offices and urban designers to introduce students to urban design and architectural practice.

### Washington Alexandria Architecture Consortium

The Consortium, comprised of several universities including Cal Poly, is organized to offer a challenging and stimulating one-year option. The Center functions as an extension of the College of Architecture of Virginia Polytechnic Institute and State University (VPI) in the Washington DC Metropolitan Area. The Consortium seeks to explore and expand design pedagogues and processes and establish collaboration with national and international institutions.

### Other Programs

The Architecture Department offers a changing variety of off-campus programs throughout the world. Contact the Architecture Department for current information.

### Cooperative Education (Co-op)

In addition to traditional classroom study experiences and instructor-led field trips, students have the opportunity to work for professional architecture firms and receive professional elective credits. To find out more about Cooperative Education opportunities, visit the Architecture Department or Career Services. Applications and opportunities for Co-op credit are available year-round.



## Undergraduate Program

### Bachelor of Architecture

The objective of the five-year Bachelor of Architecture degree program is to develop design and related skills necessary for entry into the professional field of architecture.

## Graduate Programs

Graduate Coordinator: Thomas Fowler

### Master of Science in Architecture

The Master of Science in Architecture is a post-professional degree in the broad field of architecture with an emphasis on environmental planning and design in an information society. Common core studies aim to establish a framework for advanced study and research, while specialization areas and directed electives provide for the development of in-depth study chosen by candidates.

### Professional Practice Specialization

Designed for applicants holding an accredited architecture degree wishing to pursue advanced studies with a strong professional practice orientation.

### Environmental Design Specialization

Designed for applicants holding a degree in one of the several cognate environmental design disciplines, engineering, or computer science, wishing to pursue advanced studies with a strong inter-professional orientation. This is a post-professional specialized degree in the inter-professional field of environmental design, with special reference to its three primary contributory disciplines of Architecture, City and Regional Planning, and Landscape Architecture. The common core curriculum aims to establish a central focus for advanced study and research, while sub-core studies and directed electives provide for in-depth study in one of the contributory disciplines of Architecture, City and Regional Planning, Architectural Engineering, Landscape Architecture and Construction Management.

### Graduate Study Areas

The graduate study topics are challenging. Each is of critical importance to the architecture, engineering, and construction industry. The knowledge and experience students bring to the program are fully employed. At the same time new practices and new knowledge are acquired. These study areas are:

- *Computer-Aided Design.* Focusing on the development and utilization of computer systems in the architectural process, with particular emphasis on design information representation and management, the development and utilization of knowledge bases, and expert design assistants. Students are encouraged to participate in the research projects undertaken by the CAD Research Center of the College of Architecture and Environmental Design.
- *Architectural Science.* Focusing on the increasingly complex performance and technical aspects of architectural design and the knowledge and skills needed when designers deal with the challenges associated with such topics as energy responsive architecture, acoustics, lighting, and wind-effects phenomena.
- *Facilities Management.* Stresses the practice of coordinating the physical workplace with the people and work of an organization. It integrates the principles of business administration, architecture,

and behavioral and engineering sciences. Facilities management is concerned with the design, construction, maintenance, and management of physical environments. Facility managers usually work as generalists managing teams of specialists such as architects, interior architects, interior designers, engineers, construction personnel, communication technicians, etc.

- *Structural Engineering.* For students holding an accredited degree in architectural engineering or civil engineering. To prepare students in meeting the demands for practice in the structural engineering profession.

## MS Architecture, Specialization in Architectural Engineering

The Architectural Engineering specialization is designed for students holding an accredited degree in architectural engineering or civil engineering who wish to pursue advanced studies in structural engineering. For students within the Cal Poly Architectural Engineering undergraduate program, a blended BS + MS option is available. The program is developed to better prepare students in meeting the demands for practice in the structural engineering profession. Core curriculum courses expose students to emerging topics in structures, advanced methodologies to predict and analyze structural behavior, and cutting edge design procedures. Additionally, related topics in architecture and construction management are integrated into the curriculum to create a unique masters level education. Elective courses allow individuals to concentrate in an area of interest related to environmental design or technology. Individuals conclude their educational experience through a series of project oriented laboratories designed to increase the student's awareness of building design issues using projects, reports, or experimentation, and culminating in a report and oral presentation. Additionally, candidates should refer to the "General Policies Governing Graduate Studies (<http://catalog.calpoly.edu/graduateeducation/#generalpoliciesgoverninggraduatestudies>)" section for supplemental University requirements.

Two program options are available:

**Design project.** 36 units of advisor-approved coursework, 9 units of design project, and an oral project defense examination.

**Comprehensive examination.** 45 units of advisor-approved coursework and a comprehensive examination.

## MBA, Architectural Management Track

This track is available only to those students who are enrolled in Cal Poly's Bachelor of Architecture (BArch) program. During the fifth/final year of the architecture program, students may request permission to enroll in MBA courses. The request, along with all supporting documents, must be submitted to the Orfalea College of Business – Graduate Programs Office. Permission to participate in the courses is competitive and based upon the student's previous academic performance and GMAT/GRE results.

Upon completion of the BArch degree, students are eligible to formally apply to the University for admission to the MBA program. Students who fulfill all the requirements first receive the BArch and then the MBA.

## Blended BS Architectural Engineering + MS Architecture

For motivated students a blended program, also referred to as a 4+1 program, is available. The blended program allows students to simultaneously complete both a bachelor in Architectural Engineering and a Masters in Architecture with a Specialization in Architectural Engineering. The blended program offers promising individuals an opportunity to continue their studies in architectural engineering in a collaborative learning environment.

### Eligibility for the Blended Program

Architectural Engineering (ARCE) students wishing to pursue a Masters of Science in Architecture with a Specialization in Architectural Engineering may apply after completing all 300-level Architectural Engineering courses and 180 units. The ARCE Graduate Committee reviews all applications and selects individuals with records that demonstrate success at the undergraduate level as well as potential to succeed at the graduate level. Candidates shall meet the University requirements, as a minimum, stated in "Blended BS+MS Programs (<http://catalog.calpoly.edu/graduateeducation/#generalpoliciesgoverninggraduatestudies>)" in the Graduate Programs section. Contact the Architectural Engineering Department for additional information.

## Bachelor of Architecture

### Program Learning Objectives

1. Think critically and creatively.
2. Communicate effectively.
3. Demonstrate expertise in the integration of building systems.
4. Demonstrate expertise in the development of a project design.
5. Demonstrate expertise in the maintenance of an architectural practice.
6. Understand architecture in relation to the larger world of knowledge.
7. Work productively in groups.
8. Use architectural knowledge and skills to make a positive contribution to society.
9. Make reasonable decisions informed by shared values.
10. Engage in lifelong learning.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

#### MAJOR COURSES

ARCH 101	Survey of Architectural Education and Practice	3
	(1, 1, 1) <sup>4</sup>	

ARCH 131 & ARCH 132 & ARCH 133	Design and Visual Communication 1.1 and Design and Visual Communication 1.2 and Design and Visual Communication 1.3	12
ARCH 207	Environmental Control Systems I	4
ARCH 217	History of World Architecture: Prehistory - Middle Ages (C3) <sup>1</sup>	4
ARCH 218	History of World Architecture: Middle Ages - 18th Century (Area C) <sup>1</sup>	4
ARCH 219	History of World Architecture: 18th Century - Present	4
ARCH 241 & ARCH 242	Architectural Practice 2.1 and Architectural Practice 2.2	8
ARCH 251 & ARCH 252 & ARCH 253	Architectural Design 2.1 and Architectural Design 2.2 and Architectural Design 2.3	15
ARCH 307	Environmental Control Systems 2	4
ARCH 341 & ARCH 342	Architectural Practice 3.1 and Architectural Practice 3.2	8
ARCH 351 & ARCH 352 & ARCH 353	Architectural Design 3.1 and Architectural Design 3.2 and Architectural Design 3.3	15
ARCH 420	Seminar in Architectural History, Theory and Criticism	4
or ARCH 320	Topics in Architectural History	
ARCH 443	Issues in Contemporary Professional Practice	4
ARCH 451 & ARCH 452 & ARCH 453	Architectural Design 4.1 and Architectural Design 4.2 and Architectural Design 4.3	15
ARCH 481	Senior Architectural Design Project (5, 5, 5)	15
ARCH 492	Senior Design Thesis	3
<b>SUPPORT COURSES</b>		
ARCE 211	Structures I	3
ARCE 212	Structures II	3
ARCE 226	Structural Systems	3
ARCE 315	Small Scale Structures	4
ARCE 316	Large Scale Structures	4
EDES 101	Introduction to Architecture and Environmental Design	2
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 182	Calculus for Architecture and Construction Management (B1) <sup>1,2</sup>	4
PHYS 121	College Physics I (B3) <sup>1,3</sup>	4
or PHYS 141	General Physics IA	
PHYS 122	College Physics II	4
or PHYS 132	General Physics II	
Professional Electives		16
May include: Any EDES, ARCH, ARCE, CM, CRP, LA or ART course. Any course included in any College of Architecture and Environmental Design minor, or the ART minor.		

#### GENERAL EDUCATION (GE)

(See GE program requirements below.) 52

#### FREE ELECTIVES

Free Electives	0
Total units	225

- <sup>1</sup> Required in Major/Support; also satisfies GE
- <sup>2</sup> MATH 142 Calculus II substitutes
- <sup>3</sup> PHYS 121 has a lab (B4). If PHYS 141 is taken, then take a B2 Life Science course with a lab (B4).
- <sup>4</sup> Transfer students may substitute ARCH 400-02. Contact the department for details.

## General Education (GE) Requirements

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in major) <sup>1</sup>	0
B2	Life Science <sup>3</sup>	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course <sup>3</sup>	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts (4 units in major) <sup>1</sup>	0
C4	Upper-division elective (no ARCH course, except ARCH 326)	4
Area C elective	(Choose one course from C1-C5) (4 units in major) <sup>1</sup>	0
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		52

- <sup>1</sup> Required in Major/Support; also satisfies GE
- <sup>2</sup> PHYS 121 has a lab (B4). If PHYS 141 is taken, then take a B2 Life Science course with a lab (B4).
- <sup>3</sup> One lab taken in either PHYS 121 (see Support) or a B2 course with lab component

## Master of Science in Architecture

### Required Courses

ARCH 519	Theory of Architecture	3
ARCH 551	Architectural Design (5, 5, 5)	15
ARCH 561	Advanced Design (3, 3, 3)	9
ARCH 598	Master's Design Project (3, 3, 3)	9

### Directed Electives

Advisor approved elective courses are included in a student's formal program of study	9
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Total units	45
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## MS Architecture, Specialization in Architectural Engineering

### Required Courses

ARCE 501	Advanced Structural Mechanics	3
ARCE 502	Nonlinear Structural Behavior I	3
ARCE 503	Nonlinear Structural Behavior II	3
ARCE 504	Finite Element Method for Building Structures	3
ARCE 511	Structural Systems Behavior	3
ARCH 551	Architectural Design	5

Select from the following	9
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ARCH 598 Master's Design Project  
or 9 units of approved electives and a comprehensive examination

### Approved Electives

Advisor approved elective courses shall be included in a student's Formal Study Plan	11
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Total units	45
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For additional information contact the Architectural Engineering Department or the Architecture Department Graduate Program Coordinator.

## MBA Architectural Management Track

### MBA Common Required Courses

GSB 511	Accounting for Managers	4
GSB 512	Quantitative Analysis	4
GSB 513	Organizational Behavior	4
GSB 523	Managerial Economics	4
GSB 524	Marketing Management	4
GSB 531	Managerial Finance	4
GSB 533	Aggregate Economics Analysis and Policy	4
GSB 534	Lean Operations Management	4

Select one of the following:	4
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GSB 562 Seminar in General Management and Strategy  
or other approved culminating experience

Approved electives	24
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One elective must satisfy the Orfalea College of Business'  
international course requirement

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Total units	60
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## City and Regional Planning

Architecture & Environmental Design Bldg. (05), Room 313  
Phone: 805.756.1315  
<http://planning.calpoly.edu/>

Department Head: Hemalata Dandekar

### Academic Programs

Program name	Program type
City and Regional Planning	BS, Minor, Master of
Transportation Planning	MSCR/MS Engineering

The profession of city and regional planning involves helping people and communities manage growth and change in their physical, social, and economic environments. The focus is on understanding how cities and towns (human settlements) function and how to make them better places for people to live, work and play. City planning has its roots in engineering, architecture, landscape architecture, law, social welfare and government reform. The practice of city and regional planning is both science and art. It involves technical competence, creativity, hard-headed pragmatism and the ability to develop a vision of the future and to build on that vision. Contemporary planners combine design, quantitative, and people skills to assist communities and society. Both the undergraduate (BSCR) and the graduate (MCRP) programs are accredited by the national Planning Accreditation Board.

The degree programs prepare students for professional careers in the design of human settlements in harmony with the natural environment and the needs of society. Practicing planners work in public agencies, non-profit organizations, and private consulting firms, preparing comprehensive plans for projects, neighborhoods, cities, and entire regions. The plans address the use of land, housing, transportation, public facilities, and open space. In addition, they are responsible for finding the means to make their plans become a reality by budgeting for public projects and programs and by reviewing and regulating private development.

The curriculum leading to the Bachelor of Science in City and Regional Planning provides a broad, interdisciplinary education as well as competency in physical planning with an emphasis on urban design and development. The Master of City and Regional Planning degree builds on a general undergraduate preparation in the humanities, architecture, landscape architecture, social sciences or natural sciences, and offers four areas of specialized study: Urban Design, Environment and Sustainability, Transportation and, Housing, Economic, and Community Development.

### Undergraduate Programs

#### BS City and Regional Planning

The BSCR program cultivates creativity and problem solving in the management of urban change. Technical design and analytic skills for professional practice are taught utilizing field-based experiences.

The BSCR program is one of the most studio/lab intensive, four-year undergraduate planning degree in the United States. Beginning in year two and continuing through year four, students must take at least seven studio courses. In addition, students take the foundation courses necessary to be able to fulfill the studio expectations and learn from the studio experience. These foundation courses include urban design,

computer skill, planning theory, plan implementation methods and land use law.

The BSCR degree curriculum is a total of 180 quarter units, composed of three parts:

1. Required CRP major courses
2. Required Support courses; and
3. Required General Education courses

The Support courses are designed to provide core knowledge in the areas of ecology, natural science/geology, political science, and statistics. These skills provide the scientific, policy and analytical tools necessary for community planning.

All BSCR students are required to do an Internship. They must take an internship seminar course that contextualizes the practice experience and allow professional reflection.

In addition, all students prepare a "Senior Project" or they can meet this requirement by completing the Senior Project-Professional Practice studio.

### City and Regional Planning Minor

The minor provides students with an interdisciplinary understanding of the science and the art of city planning and its relationship with other environmental design professionals. The student is provided with an understanding of how growth and change affect the physical, social and economic aspects of the city, including the relationships among land use, transportation, housing and the environment. Courses that build skills in the preparation of plan documents, land use studies and environmental studies are combined with laboratory courses providing opportunities for involvement in community building and plan-making projects.

The minor is excellent preparation for creating visions of the future, participation in government and community organizations. It enhances skills in disciplines that have linkages with cities and the built and natural environments. It provides the student with the knowledge, skills and values that help people build better communities and cities.

### Additional Minors

The department also participates in offering interdisciplinary minors in Real Property Development, and Sustainable Environments. See the College of Architecture and Environmental Design (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign>) page for further information.

### Graduate Programs

#### Master of City and Regional Planning

##### General Characteristics

The Master of City and Regional Planning degree (MCRP) is an applied, comprehensive, and professionally-based program. It is open to students from any undergraduate major, with high standards of academic achievement who wish to pursue careers in city and regional planning. It is structured to prepare graduates to function in a general context of city planning, as well as in an area of special emphasis. The core courses cover planning theory and history, methods, law, community-based studios, and formulation and implementation of plans and policies.



Students may choose to pursue specialized studies in four areas:

- Urban Design
- Environment and Sustainability
- Transportation
- Housing, Economic, and Community Development

In addition, skill building in all aspects of planning communications (visual, verbal, written) is stressed. The City and Regional Planning Department jointly offers the MCRP degree with the Master of Science in Engineering with a specialization in transportation planning.

The program is six quarters (two years) in duration and consists of 72 approved units (not including courses necessary to compensate for deficiencies). Because of the sequencing of courses, students admitted to the program are generally expected to begin their studies in the fall quarter. Students with prerequisite coursework deficiencies and those with backgrounds allowing waivers of first-year core courses may be admitted in other quarters. The degree culminates in a thesis (CRP 599), professional project (CRP 596), or a community planning studio (CRP 556).

Students have an opportunity to develop a close working relationship with the planning faculty. Self-directed study, tailored to the student's interests and needs, is also encouraged.

## Prerequisites

Students entering the MCRP program are required to have a basic working knowledge of word processing, spreadsheets and presentation software.

Applicants for admission to the Master of City and Regional Planning program are expected to:

1. Have earned a bachelor's degree from an accredited university or college.
2. Demonstrated academic excellence by earning at least a 3.0 (out of 4.0) grade point average in the last 90 quarter (60 semester) units of undergraduate work, and in cases of borderline grade point average, by earning qualifying scores on the Graduate Record Examination (GRE).
3. Show evidence of motivation, maturity, work ethic, academic excellence, and intellectual ability through references (3 letters required), work experience, and other life experiences.
4. Submit a representative example of a self-authored paper or project to demonstrate writing ability.
5. Demonstrate understanding of, and areas of interest in, city and regional planning from the perspective of their career and educational objectives, through the statement of purpose.

Applicants lacking prerequisites or other background requirements for classified standing requirements may be admitted on a conditionally classified basis, depending on the results of an individual analysis of their applications.

## Joint MCRP/MS Engineering with Specialization in Transportation Planning

The MCRP/MS Engineering with Specialization in Transportation Planning (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mcrpmsengineeringtransportationplanning>) is a joint interdisciplinary program between the College of Engineering and the City and

Regional Planning Department of the College of Architecture and Environmental Design. Participation in the program requires enrollment in both Colleges. Participants successfully completing the program are awarded both the MCRP and the MS in Engineering, each with a Specialization in Transportation Planning.

## MCRP Advising Track (5+1) for BLA & BARCH Students

Students may pursue an accelerated route to a graduate professional degree through enrollment in MCRP courses during their fourth and fifth years of undergraduate study and an additional year of graduate study after completion of their undergraduate degree. Contact the Graduate Coordinator, City and Regional Planning Department, for additional information.

## Blended Program - Bachelor of Landscape Architecture/Master of City and Regional Planning (BLA/MCRP)

The blended BLA/MCRP Program is an accelerated route to the graduate professional degree in City and Regional Planning. Under this program a student can simultaneously graduate with a BLA and MCRP. Contact the Graduate Coordinator, City and Regional Planning Department, for additional information.

## MCRP, Architecture Planning Track

This track is available only to students who are enrolled in Cal Poly's Bachelor of Architecture (BArch) program. Students may request permission to enroll in Master of City and Regional Planning (MCRP) graduate level courses during their fourth and fifth years of study. Upon completion of the BArch degree, students are eligible to formally apply for graduate student status in the MCRP program. Students who fulfill all the requirements first receive the BArch and then the MCRP. Contact the Graduate Coordinator, City and Regional Planning Department for additional information.

## BS City and Regional Planning

### Program Learning Objectives

After successfully completing the BSCR program, students will be able to:

#### Foundational skills

1. Demonstrate an understanding of the historical, theoretical, legal, and methodological foundations of planning
2. Effectively represent and communicate planning and urban design information

#### Methodology

1. Gather, organize, analyze and present planning information
2. Transform data and information into knowledge for action

#### Integrative skills

1. Integrate and apply the necessary skills and knowledge to address complex planning problems
2. Implement a planning process
3. Work with a variety of audiences: multiple publics, officials, and decision-makers

**Professional skills**

1. Reflect upon, critique, and evolve the practice of planning
2. Address issues of sustainability, diversity, and environmental and social justice
3. Practice in accordance with the AICP Code of Ethics

**Degree Requirements and Curriculum**

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

**MAJOR COURSES**

CRP 201	Basic Graphic Skills	4
CRP 202	Urban Design Studio I	4
CRP 203	Urban Design Studio II	4
CRP 204	Theories and Methods of Urban Design	3
CRP 211	Cities: Form, Culture and Evolution	4
CRP 212	Introduction to Urban Planning	4
CRP 213	Population, Housing and Economic Applications	4
CRP 214	Land Use and Transportation Studies	4
CRP 215	Planning for and with Multiple Publics (USCP)	4
CRP 216	Computer Applications for Planning	2
CRP 314	Planning Theory	4
CRP 315	Fiscal and Project Feasibility	4
CRP 336	Introduction to Environmental Planning	4
CRP 341	Urban Design Studio III	4
CRP 342	Environmental Planning Methods	4
CRP 409	Planning Internship	2
CRP 410	Community Planning Laboratory I	4
CRP 411	Community Planning Lab II	4
CRP 412	Plan Implementation	4
CRP 420	Land Use Law	4
CRP 430	Professional Planning Practice	3
CRP 457	GIS Applications in Planning	3
Select from the following:		4
CRP 461	Senior Project I	
& CRP 462	and Senior Project II (2, 2)	
CRP 463	Senior Project Professional Practice (4)	
Approved Electives <sup>2, 3</sup>		
Select from the following:		13
AG 350	The Global Environment (Area F)	
AGB 315	Land Economics	
ANT 360	Human Cultural Adaptations (D5)	
ARCH 401	Toward a Barrier-Free Environment	
ARCH 445	Urban Design in Architecture	

ARCH 460	Computer Graphics Applications III
ARCH 461	Advanced Computer-Aided Fabrication in Architecture
BIO 325	General Ecology
BIO 415	Biogeography
BUS 382	Organizations, People, and Technology
BUS 384	Human Resources Management
BUS 387	Organizational Behavior
BUS 404	Governmental and Social Influences on Business
BUS 435	Real Estate Investment
BUS 477	Managing Change and Development
CE 421	Traffic Engineering
CE 424	Public Transportation
CE 523	Transportation Systems Planning
CE 525	Airport Planning and Design
CM 430	Collaborative Process
CM 475	Real Property Development Principles
CRP 334	Cities in a Global World (D5)
CRP 338	Digital Cities (Area F)
CRP 375	Technology and the Environment: A Seminar on Contemporary Issues
CRP 400	Special Problems for Advanced Undergraduates
CRP 402	Contemporary Urban Design
CRP 404	Environmental Law
CRP 408	Water Resource Law and Policy
CRP 424	Reflections of Planning in Cinema
CRP 435	Transportation Theory
CRP 436	Collaborative Planning
CRP 440	Climate Action Planning
CRP 442	Housing and Planning
CRP 444	Infrastructure and Planning Management
CRP 445	Planning and Urban Ecology
CRP 446	Development Review and Entitlement
CRP 452	Community Design Methods
CRP 458	Local Hazard Mitigation Planning and Design
CRP 470	Selected Advanced Topics
CRP 471	Selected Advanced Laboratory
CRP 472	Planning Colloquium
CRP 483	Special Studies in City and Regional Planning
CRP 500	Individual Study
CRP 505	Principles Regional Plan
CRP 513	Planning Research and Analysis
CRP 516	Demographic and Analytic Tools
CRP 520	Feasibility Studies
CRP 525	Plan Implementation
CRP 545	Principles of Environmental Planning
CRP 548	Principles of Urban Design
CRP 553	Project Planning and Design Studio
ECON 325	Economics of Development and Growth
ECON 410	Public Finance and Cost-Benefit Analysis
ECON 431	Environmental Economics
ECON 432	Economics of Energy and Resources

ECON 434	Urban Economics	NR 317	The World of Spatial Data and Geographic Information Technology (Area F)
ECON 435	Economics of Land and Water	NR 323	Human Dimensions in Natural Resources Management (D5)
EDES 350	The Global Environment (Area F)	NR 326	Natural Resources Economics and Valuation
EDES 406	Sustainable Environments	NR 335	Conflict Management in Natural Resources
EDES 408	Implementing Sustainable Principles	NR 404	Environmental Law
EDES 410	Advanced Implementation of Sustainable Principles	NR 408	Water Resource Law and Policy
EDES 420	Historic Preservation and Adaptive Reuse in the Built Environment	NR 416	Environmental Impact Analysis and Management
ENGL 310	Corporate Communication	NR 420	Advanced Watershed Hydrology
ENGL 317	Technical Editing	NR 425	Applied Resource Analysis and Assessment
ENGR 350	The Global Environment (Area F)	NR 435	Natural Resource Policy Analysis
ENVE 324	Introduction to Air Pollution (Area F)	NR 455	Wildland-Urban Fire Protection
ENVE 330	Environmental Quality Control	NR 465	Ecosystem Management
ENVE 434	Water Chemistry and Water Quality Measurements	PHIL 333	Political Philosophy (C4)
ENVE 439	Solid Waste Management	PHIL 334	Philosophy of Law (C4)
ENVE 450	Industrial Pollution Prevention	PHIL 335	Social Ethics (C4, USCP)
ERSC 323	Geomorphology	PHIL 336	Feminist Ethics, Gender and Society (C4, USCP)
ERSC 325	Climate and Humanity	PHIL 337	Business Ethics (C4)
ERSC 333	Human Impact on the Earth	PHIL 340	Environmental Ethics (C4)
GEOG 308	Global Geography (D5)	PHIL 350	Aesthetics (C4)
GEOG 317	The World of Spatial Data and Geographic Information Technology (Area F)	POLS 310	Politics of Ethnicity and Gender (USCP)
GEOG 318	Applications in GIS	POLS 316	Political Participation
GEOG 328	Applications in Remote Sensing	POLS 325	Global Political Issues (D5)
GEOG 414	Global and Regional Climatology	POLS 328	Politics of Developing Areas
HNRS 303	Economics of Poverty, Discrimination and Immigration (D5, USCP)	POLS 330	Modern Political Thought
HNRS 319	Natural Resource Ecology, Theories and Applications (B5)	POLS 333	World Food Systems (Area F)
HNRS 475	Sustainable Forest and Environmental Practices	POLS 338	Critical Issues in American Politics (D5)
HUM 350	The Global Environment (Area F)	POLS 351	Public Administration
IT 454	Facilities Development	POLS 375	California Politics
JOUR 312	Public Relations	POLS 419	Social Movements and Political Protest
JOUR 413	Public Relations Campaigns	POLS 451	Technology and Public Policy
KINE 265	Introduction to Community and Public Health	POLS 456	Politics and Economic Policy
KINE 434	Health Promotion Program Planning I	POLS 459	The Politics of Poverty
LA 218	Applications in GIS	POLS 471	Urban Politics
LA 320	Design Theory for Landscape Architects	POLS 515	Public Policy
LA 330	Cultural Landscapes: People, Places and Ethical Decisions	POLS 516	Public Finance
LA 363	Recreation Plan and Design	POLS 517	Organizational Theory
LA 411	Regional Landscape History	POLS 518	Public Policy Analysis
LA 481	Visual Resource Methods	PSC 320	Energy, Society and the Environment (Area F)
LA 482	Evaluating Social and Behavioral Factors for Open Space Design	PSY 302	Behavior in Organizations
LA 551	Regional Landscape Assessment I	PSY 303	Intergroup Dialogues
LA 552	Regional Landscape Assessment II	PSY 311	Environmental Psychology (D5)
NR 218	Applications in GIS	PSY 350	Teamwork
NR 306	Natural Resource Ecology and Habitat Management	PSY 351	Group Dynamics
NR 311	Environmental Measurements and Interpretation	PSY 352	Conflict Resolution: Violent and Nonviolent (D5)
		PSY 360	Applied Social Psychology
		RPTA 450	Resource and Grant Development
		SCM 350	The Global Environment (Area F)
		SOC 301	Social Work and Social Welfare Institutions
		SOC 309	The World System and Its Problems
		SOC 313	Urban Sociology

SOC 315	Global Race and Ethnic Relations (D5)	
SOC 316	American Ethnic Minorities (USCP)	
SOC 323	Social Stratification	
SOC 355	Quantitative Research Methods	
SOC 395	Sociology of Complex Organizations	
SOC 413	Methods of Social Work	
SOC 421	Social Theory	
SS 321	Soil Morphology	
SS 345	Soil Interpretations and Management	
SS 421	Wetlands	
SS 431	Soil Resource Inventory	
SS 433	Land Use Planning	
SS 440	Forest and Range Soils	
SS 442	Soil Vadose Zone and Groundwater Processes	
SS 508	Environmental Assessment for Erosion Control	
STAT 313	Applied Experimental Design and Regression Models (B1)	
STAT 321	Probability and Statistics for Engineers and Scientists (B6)	
UNIV 350	The Global Environment (Area F)	
<b>SUPPORT COURSES</b>		
EDES 101	Introduction to Architecture and Environmental Design	2
Select from the following:		4
NR 306	Natural Resource Ecology and Habitat Management	
NR 319	Natural Resource Ecology, Theories and Applications	
BIO 112	Environmental Biology and Conservation	
Select from the following:		4
GEOL 102	Introduction to Geology (B3) <sup>1</sup>	
GEOL 205	Earthquakes (B3) <sup>1</sup>	
CHEM 110	World of Chemistry (B3 & B4) <sup>1</sup>	
MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
Select from the following:		4
POLS 316	Political Participation	
POLS 340	American Judicial Politics	
POLS 349	Contemporary American Political Thought	
POLS 375	California Politics	
POLS 471	Urban Politics	
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		60
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		180

<sup>1</sup> Required in Support; also satisfies GE<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.<sup>3</sup> If any of these courses is taken to meet a major, support, or general education requirement in the degree, it cannot be double-counted as an approved elective.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A Communication</b>		
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B Science and Mathematics</b>		
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C Arts and Humanities</b>		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E Society and the Individual</b>		
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no CRP course)	4
<b>Area F Technology</b>		
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Support; also satisfies GE

## City and Regional Planning Minor

### Required Courses

CRP 212	Introduction to Urban Planning	4
Select from the following:		4
CRP 211	Cities: Form, Culture and Evolution	
CRP 213	Population, Housing and Economic Applications	
CRP 214	Land Use and Transportation Studies	

### Approved Electives

Select from the following:		19-20
CRP 215	Planning for and with Multiple Publics	
CRP 314	Planning Theory	
CRP 334	Cities in a Global World (D5) <sup>1</sup>	

CRP 338	Digital Cities (F) <sup>1</sup>	
CRP 375	Technology and the Environment: A Seminar on Contemporary Issues	
CRP 402	Contemporary Urban Design	
CRP 404	Environmental Law	
CRP 408	Water Resource Law and Policy	
CRP 412	Plan Implementation	
CRP 420	Land Use Law	
CRP 424	Reflections of Planning in Cinema	
CRP 430	Professional Planning Practice	
CRP 435	Transportation Theory	
CRP 440	Climate Action Planning	
CRP 444	Infrastructure and Planning Management	
CRP 445	Planning and Urban Ecology	
CRP 446	Development Review and Entitlement	
CRP 452	Community Design Methods	
CRP 458	Local Hazard Mitigation Planning and Design	
CRP 545	Principles of Environmental Planning	
CRP 548	Principles of Urban Design	
Total units		27-28

<sup>1</sup> Required in Support; also satisfies GE

## Master of City and Regional Planning

### Program Learning Objectives

After successfully completing the MCRP program, students will be able to:

#### Foundational skills

1. Demonstrate an understanding of the historical, theoretical, legal, and methodological foundations of planning
2. Effectively represent and communicate planning information

#### Methodology

1. Gather, organize, analyze and present planning information
2. Transform data and information into knowledge for action
3. Critically assess and apply scientific research

#### Integrative skills

1. Integrate and apply the necessary skills and knowledge to address complex planning problems
2. Develop and manage a planning process
3. Work with a variety of audiences: multiple publics, officials, and decision-makers

#### Professional skills

1. Reflect upon, critique, and evolve the practice of planning
2. Address issues of sustainability, diversity, and environmental and social justice
3. Practice in accordance with the AICP Code of Ethics

#### Required Courses

First Year		
CRP 501	Foundations of Cities and Planning	4

CRP 504	Sustainable Communities	4
CRP 510	Planning Theory	4
CRP 512	Introduction to Visual Communication and GIS	4
CRP 513	Planning Research and Analysis	4
CRP 516	Demographic and Analytic Tools	4
CRP 525	Plan Implementation	4
CRP 553	Project Planning and Design Studio	4

#### Second Year

CRP 518	Policy Development	4
CRP 530	Planning Agency Management	4
CRP 535	Land Use and Planning Law	4
CRP 552	Community and Regional Planning Studio I	4
CRP 554	Community and Regional Planning Studio II	4

Select one of the following options: 4-6

CRP 596	Professional Project (2, 2, 2)	
CRP 599	Thesis (2, 2, 2)	
CRP 556	Community and Regional Planning Studio III (4)	

#### Emphasis Area (select one)

Select Advisor Approved Electives in one of the following areas: 12

Urban Design	
Environment and Sustainability	
Transportation	
Housing, Economic, and Community Development	
Open Emphasis	

#### Advisor Approved Electives

Electives 2-4

**Total units** 72



# Construction Management

Building 186, Room A100  
Phone: 805.756.1323

Department Head: Allan J. Hauck

## Academic Programs

Program name	Program type
Construction Management	BS, Minor

## Graduate Certificate Program

Program name	Program type
Facilities Management and Operations	Certificate

The professional constructor plays the central role in building and maintaining the infrastructure of this country and in markets around the world, making significant contributions throughout the planning, design, construction, and facilities management phases of major projects. The curriculum of the Construction Management program is specifically designed to prepare young men and women to fill this essential role. Building on a solid foundation in architecture, engineering, and business, the curriculum introduces students to construction methods and materials; to the techniques used to manage budgets, schedules, quality, and safety; to the varied contracting approaches used to deliver today's complex construction projects; and to the leadership and teamwork skills demanded by this profession. This curricular content is delivered in a unique, project-based environment that explores how these management principles are applied in each of the construction sectors, such as, commercial building, residential, heavy/civil, industrial, and specialty.

The mission of the department is to "provide innovative educational challenges focused on preparing construction professionals committed to excellence." To attain this mission and to support the interdisciplinary goals of the College of Architecture and Environmental Design, the department has established the following program goals:

### The Cal Poly CM department will produce graduates who:

1. Demonstrate a readiness and ability to perform in the construction industry.
2. Demonstrate an ability to apply problem solving skills and integrate technical knowledge.
3. Demonstrate an ability to participate successfully within an interdisciplinary team environment.
4. Demonstrate an understanding of professional behavior, standards, and leadership attributes.
5. Demonstrate an ability to communicate effectively, both orally and written, and professionally present ideas.
6. Demonstrate a propensity for life long learning and service to the industry and community at large.

### The Cal Poly CM faculty will:

1. Work closely with the architecture, engineering, and construction (AEC) industry and maintain currency and participation with industry practice.
2. Bring the AEC professions into the classroom and engage students in innovative learning experiences.

3. Engage in the scholarship of teaching, discovery, application, and integration.
4. Engage in life-long learning endeavors.

### The Cal Poly CM administration will:

1. Secure, develop, and maintain professional relationships with the construction industry.
2. Create opportunities for faculty professional development.
3. Create a rich and challenging learning environment by providing the staff, faculty, space, equipment and supplies required.
4. Encourage and support innovative endeavors and approaches to teaching, learning, and the engagement of students.

Due to the department's close association with practitioners in the industry, many professional development opportunities are provided for our students. Over 100 companies per year recruit for internships, co-ops, and permanent job placements directly through the department. Through our Professional Advancement for Construction Students (PACS) program, students are systematically introduced to and encouraged to participate with the major associations and societies representing this industry. These opportunities include participation in the Associated Students of Construction Management (ASCM) club as well as student chapters of AGC, ABC, DBIA, MCAA, NECA, Emerging Green Builders, and Sigma Lambda Chi, the national honorary society for construction students. Extensive interaction with industry brings practicing professionals into the classroom and students out to the jobsites of projects throughout the region. Finally, student participation in regional and national project management competitions gives our students the opportunity to test their knowledge and management skills against teams of students from other universities.

For both first time Freshmen and transfer students from community colleges, the Construction Management faculty and staff are committed to providing the best education possible for the future generation of leaders in the construction profession. These future constructors are educated in modern, state-of-the-art facilities utilizing the technology typical of the companies for whom they will work. They benefit from a unique, interdisciplinary program that has been accredited by the American Council for Construction Education (ACCE) since 1978. The program at Cal Poly remains one of the largest and most respected Construction Management programs in the western United States.

## Transfer Students

Transfer students are welcome in the Construction Management program and should contact the department for advising help with efficiently scheduling their graduation requirements. Most lower division courses may be completed at most California Community Colleges. Full time students who have successfully completed these lower division courses prior to transferring into the department can usually anticipate graduating in six or seven quarters. Transfer students should work closely with their assigned advisors before registering for classes every quarter to ensure efficient progress to degree.

## Laptop Requirement

The department has a requirement that all students have a laptop computer. Most Construction Management classes emphasize cooperative projects/assignments, and a laptop computer provides the required mobility to facilitate collaboration. In today's construction environment, computing is an integral component with the computer being the standard tool. A laptop computer is the key to having

computing capability available at all times and all locations. Financial aid may be available to help cover the cost of the computer laptop (contact the Financial Aid Office (<http://financialaid.calpoly.edu>) for more information).

## Undergraduate Program

### BS Construction Management

The Construction Management Department is the only one of its kind housed in a college that includes all of the other planning and design professions that define the built environment: Architecture, Architectural Engineering, Landscape Architecture, and City and Regional Planning.

### Minors

The department offers a Construction Management Minor for students in other programs and also participates in offering interdisciplinary minors in Integrated Project Delivery, and Real Property Development. Please see the College of Architecture and Environmental Design (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign>) for more information.

### Construction Management Minor

The Construction Management Minor provides students an introduction to the body of knowledge expected of persons pursuing careers in the construction industry. This minor gives a student a competitive edge when applying for certain jobs, by providing concepts, tools and skills which enhance one's progress in a career in one of the professions involved in the built environment.

The Construction Management Minor is recommended for majors in architecture, architectural engineering, business, civil engineering, mechanical engineering and electrical engineering. Contact the department for more information.

## Graduate Certificate Program

### Facilities Management and Operations

#### *New Program, effective Fall 2013*

#### General Characteristics

The Graduate Certificate in Facility Management and Operations (FM/O) at Cal Poly is designed for working Facilities Management professionals at every career level who want to expand their awareness and capabilities. It is also designed for individuals in the fields of construction, engineering, architecture, real estate, building operations and maintenance, property management, energy management or sustainability, interior design, plant management and engineering, business administration or anyone with an interest in the field of Facility Management.

The FM/O Graduate Certificate addresses the core competencies associated with facility management and operations including communication, emergency preparedness and business continuity, environmental stewardship and sustainability, finance and business, human factors, leadership and strategy, operations and maintenance, project management, quality, real estate and property management, and technology.

## Program Goals

Upon completing the requirements for the graduate certificate, students should be able to:

1. Describe the facility management profession and identify the primary core competencies associated with it, as well as define all of the common functions associated with the facility management task, and how they strategically relate to the bigger mission of the business enterprise.
2. Manage and oversee the financial risks of the facility organization including budget development, financial report analysis and interpretation, project management, contract administration, and procurement procedures.
3. Manage and oversee the real estate, design, and construction services and activities related to capital improvements, renovations, and relocations, including the maintenance of budgets, lease agreements, quality and safety standards, and schedules.
4. Manage and oversee the facility operations and maintenance activities including building systems (structural, mechanical, electrical, interior, exterior, and grounds), operational requirements (temperature control, lighting, tech services, equipment, energy management, etc.), and occupant services (parking, janitorial services, food services, safety, and security).
5. Manage and oversee the creation and application of operational procedures and protocol, quality standards, and improvement of work processes.
6. Evaluate various techniques associated with facility conditions assessment, building automation, and systems integration and apply those that offer the best return on investment for improving building function, operational performance, occupant comfort, and security of people and property.
7. Manage and oversee the development, financial analysis, and implementation of a comprehensive facility sustainability initiative that aligns with the overall goals of the business enterprise.
8. Manage and oversee initiatives to assure proper compliance with various employment, environmental, health and safety, occupancy, and building codes, regulations, and laws and develop a facility emergency preparedness and business continuity program.

## Admission Requirements

Successful applicants to the FM/O Certificate Program will have a bachelor's degree in construction management, engineering, facilities management, real estate, architecture, business, or relevant field of study (minimum 2.5 GPA) from an accredited institution. At the discretion of the program, work experience and/or the *Certified Facility Manager (CFM®)* credential may substitute for the relevancy of the bachelor's degree or GPA requirement.

## Tuition and Fees

As a special session programs through Extended Education, the Facilities Management and Operation graduate certificate is administratively and academically completely self-supporting. As such, the program carries a separate tuition and fee schedule.

# BS Construction Management

## Program Learning Objectives

1. Demonstrate a readiness and ability to perform in the construction industry.
2. Demonstrate an ability to apply problem solving skills and integrate technical knowledge.
3. Demonstrate an ability to participate successfully within an interdisciplinary team environment.
4. Demonstrate an understanding of professional behavior, ethical standards, and leadership attributes.
5. Demonstrate an ability to communicate effectively, both orally and written, and professionally present ideas.
6. Demonstrate a propensity for life long learning and service to the industry and community at large.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

CM 102	Introduction to Construction Management	2
CM 113	Construction Materials and Assemblies	2
CM 114	Construction Materials and Assemblies Lab	2
CM 115	Fundamentals of Construction Management	6
CM 214	Residential Construction Management	5
CM 232	Evaluation of Cost Alternatives	3
CM 313	Commercial Construction Management	5
CM 314	Heavy Civil Construction Management	5
CM 317	Sustainability and the Built Environment (Area F)	4 <sup>3</sup>
CM 334	Construction Law	2
CM 335	Construction Accounting	2
CM 411	Specialty Contracting Construction Management	5
CM 413	Jobsite Construction Management	5
CM 415	Integrated Project Delivery	4
CM 443	Management of the Construction Firm	3
Select from the following		3
CM 461 & CM 462 or CM 463	Senior Project I and Senior Project II Senior Project: Professional Practice for Constructors	
CM 480	Preconstruction Integration and Planning	2
Technical Electives		
Select from the following CM Topic Courses:		8

CM 420	Service / Experiential Learning	
CM 421	Emerging Trends	
CM 422	Professional Preparation	
CM 423	Construction Materials / Assemblies	
CM 424	Construction Technology	
CM 425	Sustainability and Environment	
CM 426	International Construction Studies	

### SUPPORT COURSES

Select from the following:		6
ARCE 211 & ARCE 212	Structures I and Structures II (3, 3)	
ME 211 & CE 204	Engineering Statics and Mechanics of Materials I (3, 3)	
ARCE 226	Structural Systems	3
ARCE 315	Small Scale Structures	4
ARCE 421	Soil Mechanics	3
BRAE 239 or CM 239	Engineering Surveying Construction Surveying	4
BUS 207	Legal Responsibilities of Business	4
BUS 212	Financial Accounting for Nonbusiness Majors	4
BUS 215	Managerial Accounting	4
ECON 221	Microeconomics	4
ECON 222	Macroeconomics (D2) <sup>1</sup>	4
ECON 303	Economics of Poverty, Discrimination and Immigration (D5) (USCP) <sup>1</sup>	4
EDES 101	Introduction to Architecture and Environmental Design	2
ENGL 310	Corporate Communication (GWR)	4
GEOL 201	Physical Geology	3
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 182	Calculus for Architecture and Construction Management <sup>2</sup>	4
PHYS 141	General Physics IA	4
Select from the following:		4
PHYS 132	General Physics II (B3 & B4) <sup>1</sup>	
CHEM 124	General Chemistry for the Engineering Disciplines I (B3 & B4) <sup>1</sup>	
CHEM 127	General Chemistry for Agriculture and Life Science I (B3 & B4) <sup>1</sup>	
STAT 251	Statistical Inference for Management I (B1) <sup>1</sup>	4

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 48

### FREE ELECTIVES

Free Electives	0
Total units	189

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> MATH 142 Calculus II substitutes.

<sup>3</sup> Required in Major; also satisfies GE

## General Education (GE) Requirements

- 72 units required, 24 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (4 units in Support) <sup>1</sup>	0
Area F	Technology	
F	Upper-division elective (4 units in Major) <sup>1</sup>	0
Total units		48

<sup>1</sup> Required in Major/Support; also satisfies GE

## Construction Management Minor

### Required Courses

CM 102	Introduction to Construction Management	2
CM 113	Construction Materials and Assemblies	2
CM 212	Construction Management Principles	3
CM 480	Preconstruction Integration and Planning	2

### Methods Courses

Select from the following: <sup>1</sup>		10
CM 214	Residential Construction Management	
CM 313	Commercial Construction Management	
CM 314	Heavy Civil Construction Management	
CM 411	Specialty Contracting Construction Management	
CM 413	Jobsite Construction Management	

### Project-Based Courses

Select from the following:		6
CM 415	Integrated Project Delivery	

And 2 units of CM 420, CM 421, CM 422, CM 423, CM 424, CM 425, CM 426, CM 470 or CM 471

Or

CM 463 Senior Project: Professional Practice for Constructors

And 3 units of CM 420, CM 421, CM 422, CM 423, CM 424, CM 425, CM 426, CM 470 or CM 471

Total units 25

<sup>1</sup> One course must be CM 214 Residential Construction Management, CM 313 Commercial Construction Management, or CM 314 Heavy Civil Construction Management.

## Facilities Management and Operations Graduate Certificate

CM 510	Principles of Integrated Facility Management <sup>1</sup>	4
CM 511	Facility Risk Analysis and Project Management	4
CM 512	Facility Maintenance and Operation Strategies	4
CM 513	Facility Systems Assessment and Integration	4
CM 514	Sustainable Facility Management	4
CM 515	Environmental Health and Safety Management for Facilities	4
Total units		24

<sup>1</sup> International Facilities Management Association's (IFMA) the *Certified Facility Manager (CFM®)* credential may substitute for CM 510 Principles of Integrated Facility Management. Individuals possessing this credential are only required to complete 5 courses.

## Landscape Architecture

Dexter Bldg.(34), Room 251  
Phone: 805.756.1319

Interim Department Chair: David J. Watts

### Academic Program

Program name	Program type
Landscape Architecture	BLA, MBA, BLA/MCRP

The profession of landscape architecture is primarily involved with the design, planning, and protection of the natural and developed environments. The five-year program in landscape architecture is accredited by the Landscape Architectural Accreditation Board and recognized by the Landscape Architects Technical Committee of the California Board of Architectural Examiners.

An emphasis is placed on a process oriented approach to design and planning while developing an awareness and sensitivity to community and human values as they relate to environmental conditions. Students majoring in landscape architecture acquire technical competencies and creative design skills through a range of projects which represent the breadth of the profession.

Graduates of the program are prepared for positions in private practice, consulting, governmental agencies at the national, state or local levels, industry and construction firms. Graduate study is encouraged for those students interested in pursuing advanced studies or academic positions.

Majors who are in their last two years of study and have at least a 3.2 grade point average may have the opportunity to join Theta Chapter of Sigma Lambda Alpha, the national scholastic honor society for landscape architecture.

### Laptop Requirement

The department has a requirement that all freshmen or transfer students have a notebook computer when they enter the program. In the profession of landscape architecture, computing is an integral component, and developing the ability to critically integrate hand and digital tools is a fundamental aspect of landscape architecture education. A notebook computer is the key to having computing capabilities available at all times and all locations. Financial aid may be available to cover the cost of the notebook computer (contact the Financial Aid Office (<http://financialaid.calpoly.edu>) for more information).

### Undergraduate Program

#### Bachelor of Landscape Architecture

The five-year program in landscape architecture is accredited by the Landscape Architectural Accreditation Board and recognized by the Landscape Architects Technical Committee of the California Board of Architectural Examiners. The program offers transfer students an accelerated curriculum to speed their time to graduation while fulfilling degree requirements. Contact the department for more information.

### Graduate Programs

#### MBA – Landscape Architecture Management Track

This program is available only to those students who are currently enrolled in Cal Poly's Bachelor of Landscape Architecture (BLA) program. During the fifth/final year of the landscape architecture program, students may request permission to enroll in MBA courses. The request, along with all supporting documents, must be submitted to the Orfalea College of Business (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness>) – Graduate Programs Office. Permission to participate in the courses is competitive and based upon the student's previous academic performance and GMAT/GRE results.

Upon completion of the BLA degree, students are eligible to formally apply to the University for admission to the MBA program. Students who fulfill all the requirements first receive the BLA and then the MBA.

#### Blended Program-Bachelor of Landscape Architecture/Master of City and Regional Planning (BLA/MCRP)

The blended BLA/MCRP Program is an accelerated route to the graduate professional degree in City and Regional Planning. Under this program a student can simultaneously graduate with a BLA and MCRP. Students shall meet the minimum eligibility requirements for a blended degree set down in the university catalog, complete a planning internship and the required MCRP classes. An updated list pertaining to which courses can be counted in the program is available from the City and Regional Planning Department. Students choosing this program shall make a request for admission to the CRP department head or graduate coordinator, who determines eligibility.

MCRP courses for the blended program include:

CRP 420	Land Use Law	4
CRP 510	Planning Theory	4
CRP 516	Demographic and Analytic Tools	4
CRP 518	Policy Development	4
or CRP 513	Planning Research and Analysis	
CRP 520	Feasibility Studies	4
CRP 525	Plan Implementation	4
CRP 530	Planning Agency Management	4
CRP 552	Community and Regional Planning Studio I	4
CRP 554	Community and Regional Planning Studio II	4

See the City and Regional Planning (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/cityregionalplanning/#text>) section for further information.

### Bachelor of Landscape Architecture

#### Program Learning Objectives

1. Integrate natural and cultural systems at the project, community, regional and global levels.



2. Incorporate a sense of place, environmental ethics, responsible use of resources and other sustainable practices throughout the design, planning and implementation process.
3. Comprehend and demonstrate relationships among analysis, design concept, development and implementation.
4. Demonstrate a passion for creativity and the process of analytical problem solving.
5. Apply the knowledge of theory, history and contemporary philosophies of landscape architecture.
6. Apply critical thinking to make cogent decisions in a professional context.
7. Demonstrate employable skills, and a mind open to learning in a professional setting.
8. Demonstrate the ability and confidence to work in interdisciplinary settings and work environments.
9. Comprehend the leadership role that landscape architecture plays in the design, planning and implementation process.
10. Apply written, oral, graphic and digital skills throughout the design process.
11. Apply professional standards, ethics and practices.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

LA 101	Introduction to Landscape Architecture	4
LA 170	Principles of Design Communication	4
LA 171	Principles of Digital Communication	4
LA 202	Design Fundamentals I	4
LA 203	Design Fundamentals II	4
LA 204	Design Fundamentals III	4
LA 211	History of Landscape Architecture: Ancient Civilizations through Colonial America (C3) <sup>1</sup>	4
LA 212	History of Modern and Contemporary Landscape Architecture (Area C elective) <sup>1</sup>	4
LA 220	Landscape Ecology: Concepts, Issues and Interrelationships	4
LA 221	California Plants and Plant Communities	4
LA 241	Site Engineering Techniques and Applications	4
LA 242	Implementation Strategies	4
LA 243	Materials and Techniques of Landscape Construction	4
LA 320	Design Theory for Landscape Architects	4
LA 330	Cultural Landscapes: People, Places and Ethical Decisions	4

LA 349	Advanced Planting Design	4
LA 370	Professional Practice	4
LA 371	Internship	3
LA 401	Research Project	2
LA 402	Design Theory and Exploration Focus Studio	4
LA 403	Natural Environments Design Focus Studio	4
LA 404	Cultural Environments Design Focus Studio	4
LA 405	Project Design and Implementation Focus Studio	4
Select from the following:		4

LA 402	Design Theory and Exploration Focus Studio
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LA 403	Natural Environments Design Focus Studio
--------	--

LA 404	Cultural Environments Design Focus Studio
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LA 405	Project Design and Implementation Focus Studio
--------	--

### Integrated Learning Course (ILC) topics

Select from the following: <sup>2</sup>	20
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LA 431	CAD and Digital Media Communications (ILC)
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LA 432	Landscape Ecology Applications (ILC)
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LA 433	Cultural Environments (ILC)
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LA 434	Project Design and Implementation (ILC)
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LA 435	Professional Practice (ILC)
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LA 436	Traditional and Digital Media Communications (ILC)
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LA 437	3D Digital Design Communications (ILC)
--------	--

LA 438	GIS Application to Design Projects (ILC)
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LA 439	Planting Design (ILC)
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LA 461	Senior Design Project Focus Studio	8
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Upper Division LA Electives <sup>3</sup>	4
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### SUPPORT COURSES

BOT 121	General Botany (B2&B4) <sup>1</sup>	4
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or BIO 114	Plant Diversity and Ecology
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CRP 212	Introduction to Urban Planning	4
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EDES 101	Introduction to Architecture and Environmental Design	2
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EHS 231	Plant Materials I	4
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EHS 232	Plant Materials II	4
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MATH 118	Precalculus Algebra (B1) <sup>1</sup>	4
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MATH 119	Precalculus Trigonometry (B1) <sup>1</sup>	4
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Select from the following:	8
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BIO 227	Wildlife Conservation Biology
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BRAE 337	Landscape Irrigation
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SS 121	Introductory Soil Science
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STAT 217	Introduction to Statistical Concepts and Methods
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or STAT 218	Applied Statistics for the Life Sciences
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Professional Electives: <sup>4</sup>	8
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### GENERAL EDUCATION (GE)

(See GE program requirements below.)	52
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### FREE ELECTIVES

Free Electives	0
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Total units	219
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- <sup>1</sup> Required in Major or Support; also satisfies GE
- At least three (3) different ILCs must be chosen. (ILCs are repeatable to 12 units)
- Any 300 or 400-level LA course, or EDES 333.
- May include any course in: College of Architecture and Environmental Design; Art and Design Department; TH 330; any minor in the College of Architecture and Environmental Design.

## General Education (GE) Requirements

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts (4 units in Major) <sup>1</sup>	0
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5) (4 units in Major) <sup>1</sup>	0
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		52

<sup>1</sup> Required in Major or Support.

## MBA Landscape Architecture Management

### MBA Common Required Courses

GSB 511	Accounting for Managers	4
GSB 512	Quantitative Analysis	4
GSB 513	Organizational Behavior	4
GSB 523	Managerial Economics	4
GSB 524	Marketing Management	4

GSB 531	Managerial Finance	4
GSB 533	Aggregate Economics Analysis and Policy	4
GSB 534	Lean Operations Management	4
Select from the following:		4

GSB 562 Seminar in General Management and Strategy  
or other approved culminating experience

### Advisor approved electives

Advisor Approved Electives <sup>1</sup>	24
Total units	60

<sup>1</sup> One elective must satisfy the Orfalea College of Business' international course requirement

## Orfalea College of Business

Business Bldg. (03), Room 455  
Phone: 805.756.2704

Dean: Scott Dawson  
Interim Associate Dean: Rosemary Wild  
Associate Dean: Bradford P. Anderson  
Assistant Dean: Kris McKinlay  
Advancement Director: Tina Guerrero

## Academic Programs

Program name	Program type
Accounting	MS
Business Administration	BS, MBA
Business and Technology	MS
Economics	BS, Minor, MS
Engineering	MBA, MS
Industrial Technology	BS, Minor

## Mission Statement

We are an engaged learning community that contributes to business and society through discovery and application.

### Amplifications of our Mission Statement

- We strive to contribute to the well being of our students and the communities to which they belong by instilling in them a love and an ability for learning and discovery that will serve them for the rest of their lives. We reinforce this by cultivating that love and ability for learning and discovery within ourselves.
- We embrace the principles in the 1940 AAUP Statement of Academic Freedom.
- We treat one another with respect and integrity, communicate honestly, and consult with one another when making important decisions that affect our learning community.
- We value research that is theoretical, applied and interdisciplinary, rooted in both our academic disciplines and the scholarship of teaching and learning.
- We are committed to providing our academically talented students with hands-on experiences and opportunities for discovery.
- Members of our community are ready to contribute to one another, to our organizations, and to the world.
- We challenge students, faculty and staff to assume responsibility for lifelong learning.

- We are committed to earning external accreditation of our college and its programs.

The BS degree program and the graduate programs in Business Administration are accredited by the AACSB—The International Association to Advance Collegiate Schools of Business. The BS degree program in Industrial Technology is accredited by the Association of Technology, Management, and Applied Engineering (ATMAE). The objective of accreditation is to foster high quality educational programs.

The college is organized into seven areas: Accounting, Economics, Finance, Industrial Technology, Marketing Management and Graduate Management Programs. This organizational structure allows for programs of study that blend broad-based knowledge of the functional disciplines of Business and Economics with an in-depth study of particular discipline(s).

The college's educational philosophy follows the Cal Poly tradition—that of enlisting maximum student involvement in the learning process through case analysis, special projects, internships, computer simulations and other learn-by-doing exercises. The college has state-of-the-art computer facilities which are available to students to meet their coursework needs. Educational programs are designed to challenge highly motivated students to become tomorrow's socially responsible business leaders through a learn-by-doing technology oriented education. The curricula include general education requirements and specialized studies in the student's major field. Optional areas of concentration within each major enable the student to select the program most closely suited to the chosen career field.

## Business Honor Society

Beta Gamma Sigma is the honor society serving business programs accredited by AACSB International – The Association to Advance Collegiate Schools of Business. Membership in Beta Gamma Sigma is the highest recognition a business student anywhere in the world can receive in a business program accredited by AACSB International. Only 7% of the junior class and 10% of the senior class are invited to join. The mission of Beta Gamma Sigma is to encourage and honor academic achievement in the study of business and to foster personal and professional excellence among its members. For further information, please contact the Dean's Office, 805.756.2705.

## Advising Center

Business Bldg. (03), Room 100  
Phone: 805.756.2601  
[www.cob.calpoly.edu/advising](http://www.cob.calpoly.edu/advising)

## The Advising Center Mission Statement

The Orfalea College of Business Advising Center serves as a peer-driven resource for students seeking academic guidance. Trained and knowledgeable staff provide all students of the Orfalea College of Business community to achieve their unique educational goals by providing timely and effective support in a professional, welcoming environment. We give students the resources needed to successfully negotiate the curriculum they select and empower them to make educated decisions.

## The Peer Advising Model

The Orfalea College of Business Advising Center utilizes a student-to-student advising structure, which has been proven as a key factor to successful graduation rates. It is beneficial for students to meet with peer advisors, who are extensively trained on all college and university

policies, expectations, curriculum and resources for advising students in their major.

Peer advisors take part in a quarter-long highly specialized training program to meet the needs of all Business, Economics, and Industrial Technology students. They update and review students' files before an advising session and are prepared to answer any questions or concerns the students may have about the curriculum and/or policies. Two professional academic advisors are involved with direct supervision and specialty student concerns; their appointments involve career/internship advising and serving students with special concerns, assisting students having academic difficulty. Faculty advisors within the college provide further information on course content, career planning, and clarification on concentration areas. Faculty advisors are assigned by the student's area office or by the student's concentration.

## Areas of Specialty

- Academic advising and planning courses towards graduation
- Assist students with strategies for success in their academics
- Advising students on academic probation
- Interpretation of curriculum sheets and flowcharts, articulation agreements, requirements towards degree, and online advising tools
- Change of major advising
- Study abroad advising
- College and university policies and procedures
- Process forms related to student's degree progress
- Quarterly advising workshops and programs

## Transfer Students

Transfer students to the Orfalea College of Business should refer to the curricula listed for the appropriate major. Please note that all lower division courses may be completed at most California Community Colleges. Full time students who have successfully completed all lower division courses prior to transferring to the College of Business can usually anticipate graduating in six quarters. Admitted transfer students should seek immediate advising assistance from the Advising Center.

## Undergraduate Programs

### BS Business Administration

The undergraduate business program provides students with the knowledge and the analytical skills essential for employment in all sectors of business, industry, governmental and non-profit organizations. Graduates of the business program will understand the fundamentals of how a successful enterprise operates, and will have sufficient depth in an area of study to begin a successful career by providing immediate value to an organization.

The Orfalea College of Business engages in a comprehensive assessment plan to ensure student achievement of these objectives.

The Business Administration degree program consists of five components: Major, Concentration, Support, General Education, and Electives.

## Concentrations

Concentrations are provided for students preparing for careers in Accounting, Financial Management, Management, Information

Systems, Marketing Management, Entrepreneurship, and Consumer Packaging Solutions.

The Quantitative concentration and the Real Estate concentration offered under the BS Economics, are also available to Business Administration majors.

Choose from:

- Accounting Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/accountingconcentration>)
- Entrepreneurship Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/entrepreneurshipconcentration>)
- Financial Management Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/financialmanagementconcentration>)
- Management and Human Resources (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/managementandhumanresourcesconcentration>)
- Marketing Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/marketingmanagementconcentration>)
- Information Systems (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/informationssystemconcentration>)
- Consumer Packaging Solutions (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/consumerpackagingsolutionsconcentration>)
- Quantitative Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics/quantitativeconcentration>)
- Real Estate Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics/realestateconcentration>)

## Accounting and Business Law Area

Business Bldg. (03), Room 403  
Phone: 805.756.2084

Area Chair: James Kaney

Accounting provides information for making informed business decisions by decision makers both external and internal to the firm. The Accounting Area works closely with the accounting profession to help ensure curriculum relevancy and technical competency. The accounting program offers a Masters of Science (see Graduate Programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/#graduatetext>)). The Masters of Science along with the concentration in accounting allows the student to meet the academic requirements for licensure as a Certified Public Accountant (CPA).

Last updated: 04/22/15

## Economics Area

Business Bldg. (03), Room 407  
Phone: 805.756.2555

Area Chair: Steve Hamilton

## BS Economics

The mission of the economics program is to educate students in the models and problem solving tools of economics. The degree program:

- instructs students on the analytical tools of economics and the application of these tools to business and social problems,
- instructs students on the economic structure of our society and its interdependence with the global marketplace,
- instructs students about the economic forces that affect business, the natural environment, technology and political decision-making,
- instructs students on the role of business, government and households in our economy,
- prepares students for successful careers in business, government and non-profit organizations, and
- prepares students for graduate studies in business, economics, law and public administration.

## Concentrations

Economics majors do not need to choose a concentration but they can if they choose. Students may develop their own program of study by selecting one of the following: 1) an economics concentration; or 2) a business concentration.

Choose from:

- Accounting Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/accountingconcentration>)
- Entrepreneurship Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/entrepreneurshipconcentration>)
- Financial Management Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/financialmanagementconcentration>)
- Management and Human Resources (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/managementandhumanresourcesconcentration>)
- Marketing Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/marketingmanagementconcentration>)
- Information Systems (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/informationssystemconcentration>)
- Consumer Packaging Solutions (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/consumerpackagingsolutionsconcentration>)



- Quantitative Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics/quantitativeconcentration>)
- Real Estate Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics/realestateconcentration>)

For the requirements of each concentration, please check the information listed under the Business major.

## Economics Minor

Business Bldg. (03), Room 407  
Phone: 805.756.2555

This minor is designed to give students from other majors a general competency in economics. Students are encouraged to meet with the advisor of the Economics Minor to develop a course of study that complements their major curriculum. For more information, contact the Economics Area office.

## Finance Area

Business Bldg. (03), Room 407  
Phone: 805.756.1168

Area Chair: Cyrus Ramezani

The Financial Management (FM) concentration provides a rigorous, coherent, real-world-based, and up-to-date curriculum which prepares students for rewarding careers. The FM students gain in-depth knowledge of Fixed Income Securities (Bond Markets), Security Analysis and Portfolio Management (Equity and Derivative Markets), Corporate Finance (Mergers and Acquisitions and Initial Public Offerings), Alternative Investments (Foreign Exchange, Commodities and Real Estate), and Quantitative Methods.

Finance classes are taught in the **Financial Analysis Resource Center**, a special-purpose classroom with data terminals, and real time display of stock prices. The computers are equipped with financial data and software, which permits students to work on real-world problems - individually and in teams.

Finance students have outstanding internship and senior project opportunities, including the ability to pursue the Chartered Financial Analyst (CFA) designation; the ability to participate in the Student Managed Portfolio Project, where they assume an active role in investing Cal Poly Corporation endowment funds; and the opportunity to intern with major corporations, investment banks, and money management firms. Our graduates pursue careers in Financial Services, Corporate Finance, and as Financial Analysts, working for investment banks, brokerage firms, the asset management industry, the real estate industry, consulting firms, and other facets of business.

## Management Area

Business Bldg. (03), Room 405  
Phone: 805.756.1302

Area Chair: Kevin Lertwachara

The Management Area's goals are fourfold:

1. to provide students with management theories, strategies, and practices essential for understanding how modern organizations operate and succeed in a complex and global environment,

2. to introduce students to the information technologies that enable the success of critical business processes and enhance worker creativity and productivity,
3. to engage students in learning about team dynamics and team leadership, and
4. to prepare our graduates, through a focus on experiential learning, for rewarding careers in a myriad of industries.

The Management Area offers all business students coursework in organizational behavior, information systems, international management, and business strategy. We offer concentration specific courses in both of the concentrations that are housed in the Management Area: (1) Management and Human Resources, and (2) Information Systems.

## Marketing Area

Business Bldg. (03), Room 403  
Phone: 805.756.2010

Area Chair: Lynn E. Metcalf

Marketing management is a set of processes that identifies customer needs, executes project and services design, devises branding strategy, defines pricing and product channels, and communicates and promotes the benefits of the offer, while maintaining a competitive advantage.

## Interdisciplinary Studies

### Entrepreneurship Concentration

Business Bldg. (03), Room 405  
Phone: 805.756.5188

Concentration Coordinator: Jon York

This interdisciplinary concentration provides an environment in which students develop an entrepreneurial mindset and acquire the knowledge and decision skills necessary to envision, plan and implement new ventures in start-up and existing organizations, domestic and international settings, in either service, product or technology-based companies and in for-profit and non-profit contexts. It draws expertise and coursework from across the College and emphasizes interdisciplinary problem-based learning.

### Consumer Packaging Solutions Concentration

Business Bldg. (03), Room 435  
Phone: 805.756.2129

Concentration Coordinator: Jay Singh

This concentration provides business majors entry into a rapidly expanding and dynamic field, packaging, that has been fueled by the globalization of manufacturing and customer-supplier relationships. This trend has been enabled by new approaches to value chain management, product development and packaging technology. This concentration will allow the students to:

1. conceptualize packaging designs that meet customer needs
2. validate designs with data and customer insight
3. gain familiarity with packaging materials and related test equipment
4. conduct qualitative and quantitative marketing analysis for products



5. comprehend packaging costs, sustainability issues and industry trends and
6. understand supply chain management and logistics related issues

Lessons are drawn from a range of established and emerging industries such as food, automotive, biomedical devices and electronics.

## Industrial Technology Area

Business Bldg. (03), Room 405  
Phone: 805.756.1754

### BS Industrial Technology

Area Chair: Eric Olsen

Industrial Technology prepares individuals to be effective technical managers and entrepreneurial leaders in a rapidly-changing technological and global economy. The baccalaureate curriculum is particularly suited for careers that involve working with people and technology concurrently. It includes instruction in electro-mechanical systems, industrial materials and processes, and quality and safety management that are then applied to technology-based business problems in packaging, value chain management, and technology entrepreneurship. Students take complementary courses in physics, chemistry, calculus and statistics. The curriculum also includes a business core with accounting, economics, marketing, and information systems.

The curriculum offers two areas of emphasis: Operations Technology (OT) and Packaging Technology (PT). The OT focus area offers courses pertinent to general operation management, supply chain management and lean processes, while the PT focus area offers specialized courses in design and testing packaging products and systems.

### Packaging Minor

Industrial Technology  
Business Bldg. (03), Room 405  
Phone: 805.756.1754

The purpose of this interdisciplinary minor is to complement the student's degree major with a planned curriculum in packaging. The program is designed to capitalize on theories and skills learned in other disciplines thereby uniquely preparing students for success as packaging professionals in positions ranging from highly technical research and development through purchasing, production, sales and management.

Students gain the skills needed for the design of package forms and graphics, the specifications of materials and machinery to be used, the evaluation of package systems, as well as the planning and coordinating of packaging requirements. These specialized skills result from an integration of knowledge gained through the packaging curriculum with that of the major discipline. A significant understanding of packaging issues and their impact on the industry is also gained.

### Industrial Technology Minor

Industrial Technology  
Business Bldg. (03), Room 405  
Phone: 805.756.1754

This minor is interdisciplinary. Students learn about the technical, social and business issues related to the use of new technology and

Last updated: 04/22/15

how the technology is integrated into corporate operations. The minor appeals to students who are majoring in nontechnical disciplines.

## Environmental Studies Minor

Please see the College of Science and Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics>) for more information on this interdisciplinary minor.

## Graduate Programs

### Master of Business Administration

Business Bldg. (03), Room 409  
Phone: 805.756.2637  
[mba@calpoly.edu](mailto:mba@calpoly.edu)  
<http://mba.calpoly.edu/>  
Associate Dean: Bradford P. Anderson

### Programs of Study/Specializations Available

MBA - General Management  
MBA - Agribusiness Specialization  
MBA - Graphic Communication Document Systems Management Specialization  
MBA - Architectural Management Track  
MBA - Landscape Architectural Management Track

### General Characteristics

Cal Poly's MBA programs are designed to prepare students to enter successful management positions in industry, government, and not-for-profit organizations. The programs give graduates a broad management background. Cal Poly's MBA programs are 60 to 64 units in length, depending on specialization, and consist of required courses and advanced elective courses.

The learning objectives of the MBA programs are for students to be able to:

- 1.1 Demonstrate competency in the following areas of business: management, quantitative methods, economics, accounting, finance, marketing, operations, and strategy.
- 1.2 Demonstrate strategic integration of the above areas.
- 1.3 Demonstrate the ability to apply analytics to decision making.
- 2.1 Recognize issues and create solutions using an approach that reflects ethical values.
- 3.1 Demonstrate knowledge of the issues involved in conducting business in a diverse, global environment.
- 4.1 Demonstrate professional written communications skills.
- 4.2 Demonstrate professional oral communication and presentation skills.
- 5.1 Recognize leadership skills and link to leadership theory.
- 5.2 Demonstrate effective team behaviors.

### Prerequisites

Students are required to possess a bachelor's degree from an accredited program. The MBA program is specifically designed to provide the essential business knowledge to students without prior

business background. Therefore, no specific prerequisite courses are required, but a basic knowledge of statistics is highly recommended.

## Admission/Acceptance Requirements

Admission to the MBA programs is based upon:

- successful completion of an accredited undergraduate program of study
- prior academic performance with particular emphasis placed on the last 90 quarter units (60 semester units)
- achievement on the Graduate Management Admission Test (GMAT) or Graduate Records Examination general test (GRE), with particular emphasis placed on performance on the quantitative portion
- prior work experience (desirable).

## Culminating Experience

In order to satisfy the culminating experience requirement, students must satisfactorily complete a required assigned comprehensive examination or project. Other options may be available, but must be approved in advance by the Associate Dean.

## PROGRAMS OF STUDY

### MBA – General Management

This program allows students to take electives of particular interest that fit their specific needs or career objectives. The program consists of 36-quarter-units of required courses with the remaining elective units selected from a focused group of advanced courses.

### MBA - Agribusiness Specialization

This specialization is offered in conjunction with the Agribusiness Department in the College of Agriculture, Food and Environmental Sciences. The program is designed for those interested in agribusiness management careers. Graduates are prepared for large farm and ranch management as well as for positions in supporting agribusiness industries such as commodity marketing or food processing.

### MBA - Graphic Communication Document Systems Management Specialization

This specialization is offered in conjunction with the Graphic Communication Department in the College of Liberal Arts, and is designed for those interested in graphic communication-related management careers. The program, focused on document systems management, contains a strong research component, including research assignments relevant to an individual company and the document industry as a whole. Students participate in research and development projects for the Graphic Communication Institute at Cal Poly.

### MBA - Architectural Management Track

This program is available only to those students who are enrolled in Cal Poly's Bachelor of Architecture (BArch) program. During the fifth/final year of the architecture program, students may request permission to enroll in MBA courses. See the Architecture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/architecture>) section of this Catalog for information.

## MBA - Landscape Architecture Management Track

This program is available only to those students who are currently enrolled in Cal Poly's Bachelor of Landscape Architecture (BLA) program. During the fifth/final year of the landscape architecture program, students may request permission to enroll in MBA courses. See the Landscape Architecture (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/landscapearchitecture>) section of this Catalog for information.

### Option to Concurrently Pursue MBA & Another Master's Degree

The Orfalea College of Business permits students to develop an individualized program of study that incorporates the required elements of two distinct Cal Poly graduate degree programs. This option offers graduate students the opportunity to simultaneously pursue an MBA degree in the Orfalea College of Business and an MA or MS degree in one of Cal Poly's other colleges.

To participate in this option, students must apply to, meet the qualifications for, and be accepted into each program separately. Students must first apply for formal admission to one specific Cal Poly graduate program such as the MBA program. After enrollment in a specific graduate program, the student must apply to, meet the qualifications for, and be accepted into the second program. The two degrees must be awarded in the same quarter.

Depending upon the combination of degrees pursued, students may be permitted to substitute courses in the other graduate degree program for similar courses in the MBA program, thereby reducing the overall number of units. Such substitutions must be approved in advance by the OCOB Associate Dean and generally are limited to a maximum of three courses.

## MS Accounting

Business Bldg. (03), Room 409  
Phone: 805.756.2637  
[mba@calpoly.edu](mailto:mba@calpoly.edu)  
<http://mba.calpoly.edu/>

Interim Associate Dean: Rosemary Wild

### General Characteristics

The MS Accounting program is a one-year academic course of study designed to prepare students for careers that require employees to be licensed as a Certified Public Accountant (CPA). This includes careers with international public accounting firms, regional and local CPA firms, industry and government. Students may select a specialization in financial accounting or taxation. The program is designed to meet the CPA eligibility requirements in the state of California effective January 2014.

*All students are required to pass a comprehensive examination which is normally given during the final quarter of the program.*

### Tuition and Fees

The MS Accounting program is offered through Extended Education. As such, the program carries a separate tuition and fee schedule available in the Office of the Associate Dean, Orfalea College of Business.

## Admission/Acceptance Requirements

Acceptance to the program is based upon an applicant's:

- submission of an application for graduate admission via [www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>) ,
- successful completion of an accredited undergraduate program of study
  - Tax Specialization: a minimum of (i) four (4) quarter units in federal taxation *and* (ii) eight (8) quarter units in accounting or two (2) years of equivalent experience in accounting,
  - Financial Accounting Specialization: (i) four (4) quarter units of taxation *and* (ii) eight (8) quarter units of intermediate financial accounting courses<sup>1</sup>,
- prior academic performance with particular emphasis placed on performance during the last 90 graded quarter units completed prior to application (or equivalent), and
- achievement on the Graduate Management Admission Test (GMAT) or Graduate Records Examination general test (GRE), with particular emphasis placed on performance on the quantitative portion.

<sup>1</sup> An "intermediate accounting" course includes comprehensive coverage of financial statements, assets, liabilities, investments, intangibles, equities, revenue recognition and the Cash Flows statement.

## MS Accounting, Specialization in Tax

### Structure

The 45/49-quarter-unit taxation specialization begins with a three-week intensive session in the summer immediately preceding the fall quarter and continues through the spring quarter of the following year. The program requires an internship during the winter quarter.

## MS Accounting, Specialization in Financial Accounting

### Structure

The 45-quarter-unit financial accounting specialization begins in the fall quarter and continues through the spring quarter of the following year.

## MS Economics

Graduate Programs in Economics  
Business Bldg. (03), Room 407  
Phone: 805.756.2783

Area Chair: Steve Hamilton

Associate Dean: Bradford P. Anderson  
Business Bldg. (03), Room 409  
Phone: 805.756.2637  
[econgrad@calpoly.edu](mailto:econgrad@calpoly.edu)  
<http://econgrad.calpoly.edu/>

### General Characteristics

The master of science degree program in economics is a full-time, four-quarter program designed to provide advanced preparation in economics for individuals desiring careers as economists in the academic, governmental, business, and financial communities. The program provides the technical skills required to engage in quantitative

economic analyses that involve forecasting, market assessment, economic feasibility studies, commodity pricing and data analysis.

### Tuition and Fees

The MS Economics program is offered through Extended Education. As such, the program carries a separate tuition and fee schedule available in the Office of the Associate Dean, Orfalea College of Business.

### Prerequisites

For admission to the program with a classified or conditionally classified status, a student should hold a bachelor's degree from an accredited institution with a minimum grade point average of 2.5 in the last 90 quarter units (60 semester units) attempted and have completed coursework in intermediate microeconomics, intermediate macroeconomics, econometrics, calculus, and statistics. Applicants are required to submit scores for the General Test of the Graduate Record Examination. An applicant who meets these standards but lacks the prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing.

### Program of Study

Graduate students must file formal study plans with their advisor, department, college, and university graduate studies office no later than the end of the quarter in which the 12th unit of approved coursework is completed. The formal program of study must include a minimum of 45 units (at least 29 of which must be at the 500 level).

Advancement to master's degree candidacy requires completion of a minimum of 24 units of required courses, specified in a formal program of study, with a minimum grade point average of 3.0. Students must maintain a minimum GPA of 3.0 in all coursework completed subsequent to admission to the program.

### Culminating Experience

Students are required to pass a written comprehensive exam in economics.

## MS Business and Technology

Business Bldg. (03), room 405  
Phone: 805.756.2680

Area Chair: Manocher Djassemi

Associate Dean: Bradford P. Anderson  
Business Bldg. (03), Room 409  
Phone: 805.756.2637  
[mba@calpoly.edu](mailto:mba@calpoly.edu)  
<http://mba.calpoly.edu>

### General Characteristics

The Master of Science in Business and Technology (MS BT) program is designed to prepare students for critical "hands-on" positions in companies as operations-based facilitators.

Two tracks are offered. One provides applied development and learning opportunities for students with an interest in focused, faculty driven research projects. The second is focused upon the development of business-based decision tools with emphasis on technically-focused industrial processes and methods.

## Prerequisites

Students are required to possess a bachelor's degree from an accredited program in industrial technology, engineering or similar technical degree or background.

## Admission Requirements

Admission to the MS BT program is based upon:

1. Successful completion of an accredited undergraduate program of study;
2. Prior academic performance, with particular emphasis placed on performance in the last 90 quarter units (60 semester units);
3. Achievement on the Graduate Record Examination general test (GRE) or the Graduate Management Admission Test (GMAT), with particular emphasis placed on performance on the quantitative portion; and
4. Applicants to the *Applied Research & Development Track* must demonstrate an interest in a research project that is faculty driven (an interview and selection based upon ability to contribute to said projects is likely). Applicants to the *Working Professional Track* must possess related work experience.

## Tuition and Fees

The MS Business and Technology *Working Professional Track* is offered through Extended Education. As such, the program carries a separate tuition and fee schedule available in the Office of the Associate Dean, Orfalea College of Business.

## Program of Study

The program requires 45 quarter-units.

## Culminating Experience

In order to satisfy the culminating experience requirement, students must satisfactorily complete a comprehensive examination at the end of their program. Other courses and/or options may be available, but must be approved in advance by the Associate Dean.

## MBA & MS Engineering, Engineering Management Program

The dual-degree Engineering Management Program (EMP) is an interdisciplinary program linking the MBA and MS in Engineering degree programs. It is a cooperative effort between the Orfalea College of Business and the Cal Poly College of Engineering (Industrial and Manufacturing Engineering Department). Please see MBA/MS Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mbamsengineering>) for more information.

# BS Business Administration

## Program Learning Objectives

Students graduating from our program will be able to:

- 1.1 Apply knowledge to identify opportunities and solve business problems.
- 2.1 Evaluate the social and ethical responsibilities of business organizations.
- 3.1 Exhibit the ability to work in a diverse environment.
- 3.2 Illustrate an understanding of business activities in a global environment.
- 4.1 Demonstrate effective written communication skills.
- 4.2 Demonstrate effective oral communication skills.
- 4.3 Demonstrate effective participation in teams.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

BUS 207	Legal Responsibilities of Business	4
BUS 214	Financial Accounting	4
BUS 215	Managerial Accounting	4
BUS 342	Fundamentals of Corporate Finance	4
BUS 346	Principles of Marketing	4
BUS 387	Organizational Behavior	4
BUS 391	Information Systems	4
BUS 401	General Management and Strategy	4
BUS 404	Governmental and Social Influences on Business	4
Technology Management - Select from the following:		4
IT 303	Lean Six Sigma Green Belt	
IT 326	Product Evaluation	
IT 330	Packaging Fundamentals	
IT 341	Packaging Polymers and Processing	
IT 371	Decision Making in Supply Chain, Services, and Project Management	
International Business - Select from the following:		4
BUS 301	Global Financial Institutions and Markets	
BUS 302	International and Cross Cultural Management	
BUS 303	Introduction to International Business	
BUS 304	Establishing International Supply Chains	
BUS 410	The Legal Environment of International Business	
BUS 427	International Accounting	
BUS 446	International Marketing	

ECON 330	International Trade Theory	
Senior Project - Select from the following:		4
BUS 461 & BUS 462	Senior Project I and Senior Project II	
BUS 416	Volunteer Income Tax Assistance - Senior Project	
BUS 463	Senior Project: Applied Accounting, Auditing and Tax Research	
BUS 464	Applied Senior Project Seminar	
ECON 464	Applied Senior Project	
Concentration courses (see below)		24-28
<b>SUPPORT COURSES</b>		
ECON 221	Microeconomics	4
ECON 222	Macroeconomics (D2) <sup>1</sup>	4
ECON elective (300-400 level)		4
MATH 221	Calculus for Business and Economics (B1) <sup>1</sup>	4
STAT 251	Statistical Inference for Management I (B1) <sup>1,2</sup>	4
STAT 252	Statistical Inference for Management II <sup>2</sup>	5
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		60
<b>FREE ELECTIVES</b>		
Free Electives		19-23
Total units		180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> STAT 301 (4) and STAT 302 (4) may be used as a substitute for STAT 251 (4) and STAT 252 (5). All students must still complete two approved GE B1 courses. STAT 301 and STAT 302 are not GE courses. Students should follow the advising footnote under the SUPPORT section (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics>) of the ECON major: "Students pursuing the Quantitative Concentration should take MATH 141 and MATH 142 instead of MATH 221".

## Concentrations

Concentrations are provided for students preparing for careers in:

- Accounting Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/accountingconcentration>)
- Financial Management Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/financialmanagementconcentration>)
- Management and Human Resources Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/managementandhumanresourcesconcentration>)
- Information Systems Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/informationssystemconcentration>)



- Marketing Management Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/marketingmanagementconcentration>)
- Entrepreneurship Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/entrepreneurshipconcentration>)
- Consumer Packaging Solutions Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bsbusinessadministration/consumerpackagingsolutionsconcentration>)

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no BUS course)	4
Area F	Technology	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Support; also satisfies GE

## Accounting Concentration

The Accounting Concentration prepares students for careers in public accounting (tax and audit), private industry, government, and not-for-profit organizations.

BUS 319	Accounting Information Systems	4
BUS 320	Federal Income Taxation for Individuals	4
BUS 321	Intermediate Accounting I	4
BUS 322	Intermediate Accounting II	4
BUS 424	Accounting Ethics	4
BUS 425	Auditing	4

### Accounting Elective

Select from the following:		4
BUS 412	Advanced Managerial Accounting	
BUS 417	Taxation of Corporations and Partnerships	
BUS 422	Accounting for Government and Not-For-Profit Entities	

Total units 28

## Consumer Packaging Solutions Concentration

BUS 418	Listening to the Customer	4
BUS 419	Strategic Marketing Measurement	4
BUS 451	New Product Development and Launch	4
IT 330	Packaging Fundamentals	4
IT 408	Paper and Paperboard Packaging	4
IT 475	Packaging Performance Testing	4

### Approved Electives

Select from the following:		4
BUS 412	Advanced Managerial Accounting	
BUS 452	Product Management	
IT 233	Product Design with CAD	
IT 326	Product Evaluation	
IT 341	Packaging Polymers and Processing	
IT 403	Quality Systems Management	
IT 415	Supply Chain and Logistics	
IT 435	Packaging Development	
IT 457	Radio Frequency Identification in Supply Chain Management	

Total units 28

## Entrepreneurship Concentration

BUS 310	Introduction to Entrepreneurship	4
BUS 418	Listening to the Customer	4
BUS 436	Entrepreneurial Finance	4
BUS 488	Planning and Managing New Ventures	4
IT 428	Commercialization of New Technologies	4

### Approved Electives

Select from the following:		8
BUS 311	Managing Technology in the International Legal Environment	
BUS 382	Organizations, People, and Technology	
BUS 384	Human Resources Management	
BUS 392	Business Application Development	
BUS 451	New Product Development and Launch	
BUS 477	Managing Change and Development	

BUS 489	Negotiation	
ECON 337	Money, Banking and Credit	
IT 326	Product Evaluation	
IT 330	Packaging Fundamentals	
IT 402	Developing and Presenting New Enterprise Strategies	
IT 406	Industrial Sales	
IT 407	Applied Business Operations	
BUS/IT 470	Selected Advanced Topics (Advanced Topics in Entrepreneurship)	
Total units		28

## Financial Management Concentration

The Financial Management concentration has three required courses, which provide the students with fundamentals of asset valuation, and applies these principles to different securities (bonds, equity, derivatives, and corporate and real assets). The Finance electives enable the students to specialize and deepen their training.

The following are the required and the elective courses in the FM Concentration.

BUS 431	Security Analysis and Portfolio Management	4
BUS 438	Advanced Corporate Finance	4
BUS 439	Fixed Income Securities Market	4
Select from the following:		12
BUS 432	Insurance Planning and Risk Management	
BUS 433	International Finance	
BUS 434	Real Estate Finance	
BUS 435	Real Estate Investment	
BUS 436	Entrepreneurial Finance	
BUS 437	Retirement and Estate Planning	
BUS 441	Computer Applications in Finance	
BUS 442	Introduction to Futures and Options	
BUS 443	Case Studies in Finance	
BUS 444	Financial Engineering and Risk Management	
BUS 445	Ethics and Behavior Finance	
ECON 339	Econometrics <sup>1</sup>	

### Approved Electives

Select from the following		4
BUS 320	Federal Income Taxation for Individuals	
BUS 321	Intermediate Accounting I	
BUS 322	Intermediate Accounting II	
BUS 412	Advanced Managerial Accounting	
BUS 417	Taxation of Corporations and Partnerships	
BUS 425	Auditing	
BUS 427	International Accounting	
ECON 311	Intermediate Microeconomics I	
ECON 313	Intermediate Macroeconomics	
ECON 330	International Trade Theory	
ECON 337	Money, Banking and Credit	
ECON 339	Econometrics	

ECON 340	Advanced Econometrics	
ECON 405	International Monetary Economics	
ECON 406	Applied Forecasting	
ECON 408	Mathematical Economics	
ECON 409	Probability Models for Economic Decisions	
ECON 420	Advanced Macroeconomics	
ECON 424	Monetary Economics	
Total units		28

<sup>1</sup> ECON 339 cannot double count.

## Information Systems Concentration

Concentration Coordinator: Barry D. Floyd

The Information Systems (IS) Concentration prepares students to enter the exciting world of information technology in business. Students learn to integrate key IS concepts and technologies through coursework in database systems, application development, systems analysis and design, software quality, and project management. The IS faculty develop students for professional careers by focusing on teamwork, strong interpersonal skills, turning theory into practice, and employing state-of-the-art technologies in the classroom. IS graduates are in high demand by recruiters because of their ability to apply an understanding of technology to problems while maintaining a focus on the business context. IS graduates enjoy exciting career opportunities as business analysts, social media developers, consultants, systems developers, website designers, and project managers, among many others.

BUS 392	Business Application Development	4
BUS 393	Database Systems in Business	4
BUS 394	System Analysis and Design	4
BUS 395	Systems Design and Implementation	4

### Approved Electives

Select from the following:		8
BUS 470	Selected Advanced Topics (Android Application Development)	
BUS 491	Decision Support Systems	
BUS 494	Integrated Information Systems	
BUS 496	Electronic Commerce	
BUS 498	Directed Topics in Information Systems	
BUS 499	Data Communications and Networking	

Total units	24
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## Management and Human Resources Concentration

Concentration Coordinators: Jean-Francois Coget and A.B. (Rami) Shani

The Management and Human Resources (MHR) concentration prepares students for general leadership and management positions, and careers in more specific Human Resources (HR) positions. Through a resolutely experiential learning approach, the HR portion of the curriculum prepares students to hit the ground running in specific HR functions such as recruitment, staffing, training and development, and compensation, as a starting point for a successful HR career. The

Management portion of the curriculum prepares students for entry-level leadership and management positions, such as management training programs in large corporations, management consulting, and managerial positions in family businesses and other small organizations. Students will master readily applicable management skills such as leadership, organizational design, development, and change, global management, and negotiation.

BUS 382	Organizations, People, and Technology	4
BUS 384	Human Resources Management	4
BUS 386	Employee Training and Development	4
BUS 475	Staffing	4
BUS 477	Managing Change and Development	4

#### Approved Electives

Select from the following: 8

BUS 310	Introduction to Entrepreneurship	
BUS 407	Managing People in Global Markets	
BUS 471	Compensation	
BUS 483	Seminar in Managerial Consultation	
BUS 489	Negotiation	

Total units 28

## Marketing Management Concentration

The Marketing Management Concentration provides students with a rigorous, analytical understanding of marketing and business decision-making. Students learn to generate, analyze, interpret, and present the information that organizations need to satisfy and retain customers; to build brand equity and maximize return on investment; and to develop innovative products and services.

The Marketing Management Concentration provides students with knowledge of a wide range of tools and techniques from fields as diverse as sociology, psychology, anthropology, information technology, new product engineering, and economics. Students learn to leverage information, technology, and knowledge to support innovation in virtually all areas of business, non-profit enterprises, and government.

As a discipline with broad applications, the Marketing Management Concentration offers flexible career paths and work styles. Graduates are in demand for positions in marketing intelligence, product development, product management, advertising, digital marketing, sales, and purchasing.

BUS 418	Listening to the Customer	4
BUS 419	Strategic Marketing Measurement	4
BUS 451	New Product Development and Launch	4
BUS 452	Product Management	4
BUS 454	Marketing Projects	4
BUS 455	Marketing Strategy	4

Total units 24

## BS Economics

### Program Learning Objectives

1. Students will be able to recall and interpret intermediate microeconomic theory;
2. Students will be able to recall and interpret intermediate macroeconomic theory;
3. Students will be able to recall and interpret international economic theory;
4. Students will be able to recall and interpret the fundamental tools of quantitative analysis.
5. Students will be able to apply economic theory to analyze important business, economic or social issues;
6. Students will be able to apply algebraic, graphical or statistical methods to analyze important business, economic or social issues;
7. Students will be able to employ economic research methodology to analyze important business, economic or social issues;
8. Students will be able to employ technical writing skills to analyze important business, economic or social issues.
9. Whenever relevant and appropriate, students will be able to identify and examine diverse perspectives when explaining and comparing solutions to important business, economic or social problems;
10. Whenever relevant and appropriate, students will be able to identify and examine the ethical implications of proposed solutions to important business, economic or social problems.

### Degree Requirements and Curriculum

In addition to the program requirements on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

ECON 221	Microeconomics	4
ECON 222	Macroeconomics (D2) <sup>1</sup>	4
ECON 311 & ECON 312	Intermediate Microeconomics I and Intermediate Microeconomics II	8
ECON 313	Intermediate Macroeconomics	4
ECON 339	Econometrics	4
Select from the following:		4
ECON 461 & ECON 462	Senior Project I and Senior Project II	
ECON 464	Applied Senior Project	
ECON electives (300-400 level)		4
ECON electives (400 level)		16
General Economics or Concentration <sup>2</sup>		28
<b>SUPPORT COURSES</b>		
BUS 207	Legal Responsibilities of Business	4

BUS 214	Financial Accounting	4
BUS 215	Managerial Accounting	4
Select from the following:		4-8
MATH 221	Calculus for Business and Economics <sup>1, 3</sup>	
MATH 141 & MATH 142	Calculus I and Calculus II (B1) <sup>1</sup>	
Select from the following:		8-9
STAT 251 & STAT 252	Statistical Inference for Management I and Statistical Inference for Management II (B1) <sup>1, 4</sup>	
STAT 301 & STAT 302	Statistics I and Statistics II	
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		60
<b>FREE ELECTIVES</b>		
Free Electives		15-20
Total units		180

- 1 Required in Major/Support; also satisfies GE
- 2 Complete at least 8 units 300-400 level ECON coursework plus any 20 units of coursework at 300-400 level, or select a concentration.
- 3 Students pursuing the Quantitative concentration should take MATH 141 and MATH 142 instead of MATH 221.
- 4 Students pursuing the Quantitative concentration should take STAT 301 and STAT 302 instead of STAT 251 and STAT 252.

### Concentrations (select one)

- Quantitative Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics/quantitativeconcentration>)
- Real Estate Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/bseconomics/realestateconcentration>)
- **Business Concentration** - Choose from accounting, entrepreneurship, finance, management, marketing, consumer packaging solutions, and management information systems. For the requirements of each concentration, please check the information listed under the Business major (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness>) .

### General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4

B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
<b>Area C Arts and Humanities</b>		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E Society and the Individual</b>		
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Major) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no ECON course)	4
<b>Area F Technology</b>		
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Major/Support; also satisfies GE

## Quantitative Concentration

Emphasizes the skills needed to analyze market data in fast-paced industries such as manufacturing, financial services, and advertising, and provides the technical training required to engage in consulting. There is also a continued need for quantitative economic analysis by lawyers, accountants, engineers, health service administrators, urban planners, and local, national, and international government agencies. The concentration prepares students for jobs that entail forecasting, market assessment, economic feasibility studies, commodity pricing and data analysis, and provides a solid foundation for graduate study in economics and business.

ECON 406	Applied Forecasting	4
ECON 408	Mathematical Economics	4

### Approved Electives

Select from the following: 20

ECON 340	Advanced Econometrics
ECON 403	Industrial Organization
ECON 404	International Trade Theory
ECON 405	International Monetary Economics
ECON 409	Probability Models for Economic Decisions
ECON 431	Environmental Economics
ECON 432	Economics of Energy and Resources
BUS 431	Security Analysis and Portfolio Management
BUS 439	Fixed Income Securities Market
BUS 442	Introduction to Futures and Options
BUS 444	Financial Engineering and Risk Management
IME 301	Operations Research I
IME 405	Operations Research II
IME 407	Operations Research III
MATH 143	Calculus III
MATH 206	Linear Algebra I
MATH 211	Computational Mathematics I

MATH 212	Computational Mathematics II
MATH 241	Calculus IV
MATH 242	Differential Equations I
MATH 244	Linear Analysis I
MATH 248	Methods of Proof in Mathematics
MATH 304	Vector Analysis
MATH 306	Linear Algebra II
MATH 344	Linear Analysis II
MATH 406	Linear Algebra III
MATH 408	Complex Analysis I
MATH 409	Complex Analysis II
MATH 412	Introduction to Analysis I
MATH 413	Introduction to Analysis II
MATH 414	Introduction to Analysis III
MATH 416	Differential Equations II
MATH 418	Partial Differential Equations
MATH 437	Game Theory
MATH 451	Numerical Analysis I
MATH 453	Numerical Optimization
STAT 323	Design and Analysis of Experiments I
STAT 324	Applied Regression Analysis
STAT 325	Introduction to Probability Models
STAT 330	Statistical Computing with SAS
STAT 331	Statistical Computing with R
STAT 416	Statistical Analysis of Time Series
STAT 419	Applied Multivariate Statistics
STAT 425	Probability Theory
STAT 426	Estimation and Sampling Theory
STAT 427	Mathematical Statistics

Total units 28

## Real Estate Concentration

Provides a program of study that focuses on emerging trends and issues in real estate markets. Students learn to apply economic techniques to real estate markets, and to describe, explain, and predict patterns of real estate prices, building production, and real estate consumption. The program prepares real estate professionals for public sector and private industry jobs in real estate analysis, appraisal, corporate asset management, development, insurance, and investment.

ECON 424	Monetary Economics	4
ECON 434	Urban Economics	4
ECON 435	Economics of Land and Water	4

### Approved Electives

Select from the following: 16

AGB 310	Agribusiness Credit and Finance
AGB 315	Land Economics
AGB 324	Agricultural Property Management and Sales
AGB 326	Rural Property Appraisal
BUS 320	Federal Income Taxation for Individuals
BUS 409	Law of Real Property
BUS 434	Real Estate Finance



BUS 435	Real Estate Investment
BUS 439	Fixed Income Securities Market
CM 475	Real Property Development Principles
CRP 446	Development Review and Entitlement
ECON 406	Applied Forecasting
ECON 409	Probability Models for Economic Decisions
ECON 410	Public Finance and Cost-Benefit Analysis
ECON 431	Environmental Economics
ECON 432	Economics of Energy and Resources
<hr/>	
Total units	28

## Economics Minor

### Required Courses

ECON 221	Microeconomics	4
ECON 222	Macroeconomics	4
ECON 311	Intermediate Microeconomics I	4
ECON 312	Intermediate Microeconomics II	4
ECON 313	Intermediate Macroeconomics	4

### Electives

400 level ECON courses:	8
Total units	28

## BS Industrial Technology

### Program Learning Objectives

1. Demonstrate fundamental knowledge and skills to solve management, technology and applied engineering problems.
2. Recognize the ethical responsibilities as they apply to applications of technology.
3. Demonstrate knowledge of sustainability practices in industry.
4. Act upon decision tools and methods and explain the action taken.
5. Demonstrate effective participation and leadership in teams.
6. Demonstrate effective writing and speaking skills.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

IT 150	Electrical and Mechanical Power Systems	4
IT 233	Product Design with CAD	4
IT 260	Manufacturing Processes and Materials	4
IT 303	Lean Six Sigma Green Belt	4
IT 311	Industrial Safety and Quality Program Leadership	4
IT 326	Product Evaluation	4
IT 330	Packaging Fundamentals (Area F) <sup>1</sup>	4
IT 341	Packaging Polymers and Processing	4
IT 390	Industrial Automation	4
IT 402	Developing and Presenting New Enterprise Strategies	4
or IT 406	Industrial Sales	
IT 407	Applied Business Operations	4

IT 461	Senior Project I	2
IT 462	Senior Project II	2

### Emphasis Areas

Select emphasis area in Operations Technology or Packaging Technology: 20

#### Operations Technology (OT)

IT 403	Quality Systems Management
IT 410	Operations Planning and Control
IT 415	Supply Chain and Logistics
or IT 371	Decision Making in Supply Chain, Services, and Project Management

IT 428	Commercialization of New Technologies
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BUS 215	Managerial Accounting
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#### Packaging Technology (PT)

IT 408	Paper and Paperboard Packaging
IT 409	Packaging Machinery and Processes
IT 435	Packaging Development
IT 457	Radio Frequency Identification in Supply Chain Management
or IT 403	Quality Systems Management
IT 475	Packaging Performance Testing

Approved electives <sup>2</sup>

Select from the following: 20

Any upper division 300-400 level IT courses <sup>3</sup>

BUS 304	Establishing International Supply Chains
BUS 310	Introduction to Entrepreneurship

### SUPPORT COURSES

BUS 214	Financial Accounting	4
BUS 346	Principles of Marketing	4
BUS 391	Information Systems	4
CHEM 110	World of Chemistry (B3 & B4) <sup>1</sup>	4-5
or CHEM 111	Survey of Chemistry	
ECON 201	Survey of Economics (D2) <sup>1</sup>	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
or MATH 221	Calculus for Business and Economics	
PHYS 121	College Physics I	4
PHYS 122	College Physics II	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
or STAT 218	Applied Statistics for the Life Sciences	

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 52

### FREE ELECTIVES

Free Electives	3-4
Total units	180

<sup>1</sup> Required in Major/Support; also satisfies GE

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>3</sup> If a course is taken to meet the emphasis area requirement, it cannot be double-counted as an approved elective.

## General Education (GE) Requirements

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Support) <sup>1</sup>	0
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective (4 units in Major) <sup>1</sup>	0
Total units		52

<sup>1</sup> Required in Major/Support; also satisfies GE

## Packaging Minor

Note: Courses cannot be double counted to meet elective and required courses.

### Required Courses

CHEM 110	World of Chemistry (B3 & B4)	4-5
or CHEM 111	Survey of Chemistry	
GRC 337	Consumer Packaging	3
or FSN 354	Packaging Function in Food Processing	
IT 330	Packaging Fundamentals (Area F)	4
or IT 435	Packaging Development	
Select from the following:		4
PHYS 104	Introductory Physics (B3)	
PHYS 121	College Physics I (B3 & B4)	
PSC 101	Matter and Energy (B3 & B4)	

### Approved Electives

Select from the following:	9-10
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FSN 334	Food Packaging
FSN 354	Packaging Function in Food Processing
GRC 316	Flexographic Printing Technology
GRC 337	Consumer Packaging
IT 330	Packaging Fundamentals
IT 303	Lean Six Sigma Green Belt
IT 341	Packaging Polymers and Processing
IT 400	Special Problems for Advanced Undergraduates
IT 408	Paper and Paperboard Packaging
IT 409	Packaging Machinery and Processes
IT 435	Packaging Development
IT 457	Radio Frequency Identification in Supply Chain Management
IT 475	Packaging Performance Testing

Total units 24-26

## Industrial Technology Minor

### Technology Issues

Select from the following:	4
IT 330	Packaging Fundamentals (Area F)
IT 326	Product Evaluation
IT 341	Packaging Polymers and Processing
IT 371	Decision Making in Supply Chain, Services, and Project Management

### Operations and Packaging electives

(Note: A course taken from this list cannot be double counted as a Technology Issues course.)

Select from the following:	16
IT 150	Electrical and Mechanical Power Systems
IT 233	Product Design with CAD
IT 303	Lean Six Sigma Green Belt
IT 311	Industrial Safety and Quality Program Leadership
IT 326	Product Evaluation
IT 330	Packaging Fundamentals (Area F)
IT 341	Packaging Polymers and Processing (Area F)
IT 371	Decision Making in Supply Chain, Services, and Project Management
IT 403	Quality Systems Management
IT 410	Operations Planning and Control
IT 428	Commercialization of New Technologies

### Humanities and Social Issues

Select from the following:	4
HUM 303	Values and Technology (C4)
PHIL 337	Business Ethics
PSY 350	Teamwork
BUS 311	Managing Technology in the International Legal Environment
BUS 382	Organizations, People, and Technology
BUS 387	Organizational Behavior

Total units 24

## MBA - General Management

<b>MBA Common Required Courses</b>	36
GSB 511 Accounting for Managers	
GSB 512 Quantitative Analysis	
GSB 513 Organizational Behavior	
GSB 523 Managerial Economics	
GSB 524 Marketing Management	
or GSB 573 Marketing Research	
GSB 531 Managerial Finance	
GSB 533 Aggregate Economics Analysis and Policy	
GSB 534 Lean Operations Management	
GSB 562 Seminar in General Management and Strategy	
Advisor approved electives	24
<b>Total units</b>	<b>60</b>

## MBA - Agribusiness Specialization

<b>MBA Common Required Courses</b>	
Select from the following:	36
GSB 511 Accounting for Managers	
GSB 512 Quantitative Analysis	
GSB 513 Organizational Behavior	
GSB 523 Managerial Economics	
GSB 524 Marketing Management	
or GSB 573 Marketing Research	
GSB 531 Managerial Finance	
GSB 533 Aggregate Economics Analysis and Policy	
GSB 534 Lean Operations Management	
GSB 562 Seminar in General Management and Strategy	
<b>Specialization Required Courses</b>	
Select from the following:	20
AGB 514 Agribusiness Managerial Leadership and Communication	
AGB 539 Graduate Internship in Agribusiness	
AGB 543 Agribusiness Policy and Program Analysis	
AGB 554 Food System Marketing	
AGB 555 Technological and Economic Change in Agribusiness	
Advisor approved electives	8
<b>Total units</b>	<b>64</b>

## MBA - Graphic Communication Documents Systems Management Specialization

<b>MBA Common Required Courses</b>	
Select from the following:	36
GSB 511 Accounting for Managers	
GSB 512 Quantitative Analysis	

GSB 513 Organizational Behavior	
GSB 523 Managerial Economics	
GSB 524 Marketing Management	
or GSB 573 Marketing Research	
GSB 531 Managerial Finance	
GSB 533 Aggregate Economics Analysis and Policy	
GSB 534 Lean Operations Management	
GSB 562 Seminar in General Management and Strategy	
<b>Specialization Required Courses</b>	
Select from the following:	16
GRC 595 Cooperative Education Experience (8)	
GRC 500 Special Problems in Graphic Communication for Graduate Students (8)	
Advisor approved electives	12
<b>Total units</b>	<b>64</b>

## MS Accounting, Specialization in Tax

### Program Learning Objectives

#### Graduates Are Prepared To:

- 1.1 Demonstrate competency in tax research and identify potential solutions to tax issues.
- 1.2 Analyze and solve tax compliance issues through the application of analytic/critical thinking skills.
- 1.3 Apply substantive knowledge in a variety of tax preparation projects during a professional internship experience.
- 2.1 Recognize and apply ethical and professional responsibility requirements to tax practice.
- 3.1 Professionally communicate in writing.
- 3.2 Professionally communicate information through oral presentations.

GSB 529 Effective Communication Skills for Managers	4
GSA 536 Taxation of Trusts, Estates, and Transfer Taxes	4
GSA 537 State and Local Taxation	4
GSA 538 Current Developments in Taxation	4
GSA 539 Clinical Tax Education Internship	9
GSA 546 Tax Research and Administrative Procedures	4
GSA 548 Advanced Individual Taxation and Tax Planning	4
GSA 549 Advanced Taxation of Flow-Through Entities	4
GSA 550 Advanced Corporate Taxation	4
GSA 551 International Taxation	4
BUS 417 Taxation of Corporations and Partnerships <sup>1</sup>	4
<b>Total units</b>	<b>45/49</b>

<sup>1</sup> Students who, prior to admission to the program have not successfully completed BUS 417 at Cal Poly (or an identical course elsewhere) will be required to take BUS 417 as a part of this degree program.

## MS Accounting, Specialization in Financial Accounting

### Program Learning Objectives

#### Graduates Are Prepared To:

- 1.1 Analyze financial statement data and conduct business valuations.
- 2.1 Research issues related to accounting standards including international financial reporting standards.
- 3.1 Demonstrate the ability to use databases and develop advanced spreadsheets to analyze financial and auditing information.
- 4.1 Demonstrate the ability to diagram data models and perform risk assessment of internal controls that apply to data/processes.
- 5.1 Recognize and apply ethical and fraud-related concepts in accounting and financial reporting.
- 6.1 Demonstrate effective writing communication skills.
- 6.2 Demonstrate effective oral communication skills.

GSB 529	Effective Communication Skills for Managers	4
GSA 540	Taxation of Corporations and Partnerships	4
GSA 541	Advanced Financial Reporting Issues I	4
GSA 543	Advanced Financial Reporting Issues II	5
GSA 544	Advanced Enterprise Wide Business Processes for Accounting	4
GSA 545	Applied Accounting Research and Communications	4
GSA 552	Fraud Auditing and Examination	4
GSA 553	International Accounting	4
GSA 554	Advanced Spreadsheet Modeling for Accounting	4
GSA 555	Database Modeling and Analysis for Accounting	4
GSA 556	Financial Accounting and Valuation	4
Total units		45

## MS Economics

#### Required Courses

ECON 510	Quantitative Methods I	4
ECON 511	Microeconomic Analysis	4
ECON 512	Macroeconomic Analysis	4
ECON 518	Quantitative Methods II	4
ECON 520	Advanced Econometrics I	4
ECON 522	Advanced Econometrics II	4
Approved Electives (400-500 level) <sup>1</sup>		21
Comprehensive Exam		
Total units		45

<sup>1</sup> To be selected with advisor's approval from economics or other courses in masters programs, such as: Master of Business (GSB), Agribusiness (AGB), Master of City and Regional Planning (CRP), Engineering, Mathematics, Master of Public Policy. Maximum 16 units from 400 level courses. Maximum 12 units from courses other than ECON.

## MS Business and Technology

### Program Learning Objectives

#### Graduates Are Prepared To:

- 1.1 Demonstrate substantive business knowledge and applied skills in operations and packaging technologies within a global environment.
- 2.1 Generate creative and practical solutions by applying decision tools and research methodology.
- 3.1 Recognize and apply appropriate solutions to ethical issues, including: workplace and product safety; conflicts of interest; interaction with others; environmental sustainability; and professional integrity.
- 4.1 Demonstrate professional and technical written communication skills.
- 4.2 Demonstrate professional oral communication skills and presentation of technical information skills.

#### Required Courses

IT 531	Lean Six Sigma Value Chain Management	4
IT 532	Technology Entrepreneurship	4
IT 533	Industrial Processes and Materials	4
IT 534	Advanced Packaging Dynamics for Distribution	4
IT 545	Product Conceptualization and Execution Using Rapid Prototyping	4
GSB 583	Management of Human Resources	4

#### Tracks

Select one of the following tracks: 21

#### Applied Research and Development Track

IT 594	Business and Technology Project I
IT 595	Business and Technology Project II
IT 596	Business and Technology Project III
GSB 529	Effective Communication Skills for Managers
GSB 563	International Business Tour
STAT 513	Applied Experimental Design and Regression Models

#### Working Professional Track

IT 591	Applied Industry Project I
IT 592	Applied Industry Project II
GSB 511	Accounting for Managers
GSB 514	The Legal and Regulatory Environment of Business
GSB 531	Managerial Finance

Total units 45



## College of Engineering

Engineering Bldg. (192), Room 301  
Phone: 805.756.2131  
<http://ceng.calpoly.edu/>

Dean: Debra S. Larson  
Associate Dean: Fred W. DePiero  
Associate Dean: Rakesh K. Goel

### Academic Programs

Program name	Program type
Aerospace Engineering	BS*, MS
Biomedical Engineering	BS, MS, Specialization
Civil and Environmental Engineering	MS
Civil Engineering	BS*
Computer Engineering	BS*
Computer Science	BS**, MS, Minor
Electrical Engineering	BS*, MS
Engineering	MS
Environmental Engineering	BS*
Fire Protection Engineering	MS
General Engineering	BS
Industrial Engineering	BS*, MS
Manufacturing Engineering	BS*
Materials Engineering	BS*
Mechanical Engineering	BS*, MS
Multidisciplinary Design	Minor
Software Engineering	BS*

### Joint Programs

Program name	Program type
Engineering Management	MBA/MS
Environmental Studies	Minor
Liberal Arts & Engineering Studies	BA
Transportation Planning	MCRP/MS

### Graduate Certificate Programs

Program name	Program type
Fire Protection Engineering Applications	Certificate
Fire Protection Engineering Science	Certificate
Space Systems Technology	Certificate

\* Engineering programs accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org/>

\*\* BS Computer Science program accredited by the Computing Accreditation Commission of ABET, <http://www.abet.org/>

Engineering and computer science programs at Cal Poly are strongly oriented toward preparing graduates for immediate entry into professional practice. Students declare their majors when they enter as freshmen, and they generally take at least one course in that major each quarter. This early introduction better motivates and prepares students to master the foundational mathematics, basic science, and engineering science or computer science central to success in all the engineering disciplines.

The undergraduate bachelors of science engineering disciplines listed above provide the education needed for entry to the engineering profession and for continued academic work toward advanced degrees. Many of our graduates enter graduate programs at Cal Poly or other institutions. Cal Poly engineering and computer science graduates are highly desired by industry and find a variety of professional opportunities awaiting them, such as engineering design, computer hardware and software engineering, test and evaluation, systems analysis, modeling and simulation, manufacturing, applied research, development, sales and field engineering. Graduates pursue careers in a broad cross-section of industry, government agencies, public utilities, marketing groups, and educational institutions.

The College of Engineering is an internationally-recognized, premier undergraduate engineering college. Its mission is to provide an excellent Learn by Doing education and to graduate in-demand, Day One-ready professionals. The College vision is to transform students into world class, innovative and collaborative engineers to meet the challenges of the 21<sup>st</sup> century.

State-of-the-art facilities and laboratories form the core of Engineering's project-centered curriculum. Ranging from the Aircraft Design Lab to the Rotor Dynamics Laboratory, these facilities offer advanced technological systems that allow students to link theory with practice. College buildings also promote interdisciplinary project activities, including the Advanced Technology Laboratories, Bonderson Projects Center, and Engineering IV. With 19,000 square feet of space for individual and team-based projects, the Bonderson Center offers enriched opportunities for multidisciplinary projects and collaboration with industry. Engineering IV, a 104,000-square-foot building includes modern classrooms and laboratories for aerospace, mechanical, civil, environmental, industrial and manufacturing engineering programs.

### Engineering Student Affairs

Engineering Bldg (192), Room 301  
Phone: 805.756.2131

Associate Dean: Fred W. DePiero

The College of Engineering Student Affairs encompasses the Advising Center, International Exchange Program, Multicultural Engineering Program, Outreach Services, and the Women's Engineering Program.

### Advising Center

Engineering South (40), Room 111  
Phone: 805.756.1461  
[eadvice.calpoly.edu](mailto:eadvice.calpoly.edu)

Coordinator for Advising Services: Kim Marsalek  
Assistant Coordinator for Advising Services: Dawn Sirois  
Academic Advisor: Jamey Stamets  
Academic Advisor: Greg Roldan  
Academic Advisor: Maria Sklar

The Engineering Advising Center is a student centered office that works in partnership to provide support services that foster student success.

The College of Engineering's Academic Advisors meet with students from all thirteen majors within the College of Engineering. There are also trained Peer Advisors who can answer general questions. Students are encouraged to seek advice early and often throughout their time at Cal Poly.

## Areas of Speciality

- Academic advising and planning courses towards graduation
- Assist students with strategies for success in their academics
- Advising students on academic probation
- Interpretation of curriculum sheets and flowcharts, articulation agreements, requirements towards degree, and online advising tools
- Change of major advising
- Study abroad advising
- College and University policies and procedures
- Process forms related to student's degree progress
- Quarterly advising workshops and programs
- Former Returning Engineering Students (Readmission)

In addition, students are assigned a faculty advisor within their department. A faculty advisor can help with questions regarding: course content, technical electives/concentration, career goals, internships and graduate school.

## International Exchange Program

Engineering South (40), Room 111

Phone: 805.756.1461

[eadvise.calpoly.edu](mailto:eadvise.calpoly.edu)

IEP Advisor: Maria Sklar

The College of Engineering has established exchange agreements with reputable engineering overseas universities. These exchange programs differ from the University wide exchange programs in that they offer students the opportunity to attend overseas universities with an engineering focus, while paying Cal Poly tuition. The partner universities have been specifically selected by the College for their innovative technology and engineering coursework. Most of our partner universities guarantee on-campus housing and offer courses in English, making it easier for our students to take coursework to meet their degree requirements. Participation brings many lasting benefits that enhance students' personal and professional life. Students typically return with improved communication skills, a better understanding of other cultures, a global engineering perspective, and a more marketable resume for industry. The current list of partner universities is located at: [www.eadvise.calpoly.edu/iep/](http://www.eadvise.calpoly.edu/iep/).

## Multicultural Engineering Program (MEP)

Engineering South (40), Room 117

Phone: 805.756.1433

Email: [mep.calpoly.edu](mailto:mep.calpoly.edu)

Coordinator: Maria Manzano

Advisor: Jackie Duerr

The Cal Poly Multicultural Engineering Programming (MEP) mission is to raise the consciousness of the institution and industry of the potential of disadvantaged students, especially those from underrepresented groups, and MEP in a way that results in higher retention and graduation rates and demonstrates industry commitment so that students will be successful in their engineering or computer science field. This compliments the university's goals of increasing retention and graduation rates of disadvantaged students.

This is accomplished through intrusive first year advising, academic support services, and community building. Community building starts with the MEP First Year Seminar offered Fall quarter which focuses on:

University expectations and resources, acquiring team building skills, clarifying career goals, and building a resume.

Community building is then strengthened by the close association with the three professional student engineering clubs supported by MEP operations - American Indian Science & Engineering Society (AISES), Society of Hispanic Professional Engineers (SHPE) and the Society of Black Engineers and Scientists (SBES). In addition, study and tutoring centers are available for students to develop supportive academic peer groups.

An Industry Advisor Board partners with MEP to foster professional development. Industries that recognize MEP as a valuable source for skilled future employees help coordinate summer jobs, internships, and scholarship opportunities.

## Outreach Services

Engineering South (40), Room 119

Phone: 805.756.1320

[outreach@calpoly.edu](mailto:outreach@calpoly.edu)

Outreach is an important part of the mission of Cal Poly's College of Engineering. The K-14 outreach programs stimulate student interest in engineering. Cal Poly attracts non-traditional and underrepresented students to engineering through the outreach activities of the Multicultural Engineering Program and the Women's Engineering Program. By partnering with K-12 schools and community colleges in the community, Cal Poly offers engineering projects and presentations in the classroom. For middle and high school students, schools are invited to visit Cal Poly labs to inspire students with the exciting hands-on opportunities in engineering. The schools are encouraged to implement an engineering curriculum and partner with Cal Poly for support, tutoring and curriculum development.

The Engineering Possibilities in College (EPIC) summer camp provides a hands-on learning opportunity for high school students to explore engineering disciplines.

Cal Poly students are encouraged to volunteer for outreach activities to increase their speaking abilities and share their experiences with aspiring young minds.

## Women's Engineering Program (WEP)

Engineering South (13), Room 216

Phone: 805.756.2350

[wep.calpoly.edu](http://wep.calpoly.edu)

Director: Helene Finger

The mission of the Women's Engineering Program (WEP) is to recruit and retain women engineering and computer science students by focusing on outreach, on-campus support and professional preparation objectives. To meet these objectives, WEP works closely with the Society of Women Engineers (SWE) Cal Poly student section, one of the top student sections in the nation, in supporting a variety of programs directed at pre-college, undergraduate and graduate students.

Outreach activities are directed at students from kindergarten through community college. These programs are designed to encourage pre-university women and girls to consider engineering as a career choice. Outreach recruitment activities include: Building an Engineer workshops, High School Shadow an Engineering Student day, Girl Scout Engineering Badge day, robotics competitions, elementary school workshops, and career fairs.

The Women's Engineering Program provides on-campus support to Cal Poly women engineering students through a variety of academic, leadership and social activities. These activities help students connect to their peers while concurrently assisting them in achieving their educational goals.

On-campus support activities include: scholarships, academic counseling and referrals, pre-registration counseling, big sibling program, test files, SWE meetings, social events, and community service activities.

Professional preparation activities are designed to prepare students for a productive career by facilitating networking with professionals and corporations. Professional preparation activities include: Evening With Industry banquet, Team Tech national design competition, Industry Tours, Resume Book, bi-weekly industry presentations and corporate information sessions.

## MS Engineering

### General Characteristics

The Master of Science degree program in Engineering has the following goals:

- Provide an empowering terminal professional degree for students who intend to become practicing engineers, retaining the strong laboratory emphasis and industrial interaction found in the BS curriculum.
- Provide preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree.
- Provide job-entry education for the more complex and evolving interdisciplinary areas of engineering, such as research and development, innovative design, systems analysis and design, bio-engineering, biomedical engineering, manufacturing, mechatronics, and engineering management.
- Update and upgrade opportunities for practicing engineers.
- Allow graduates to maintain currency in their fields.

To meet the above goals, and to prepare graduates to become effective professionals and leaders, the MS program has the following learning outcomes;

1. Technical competency;
2. Effective communication skills;
3. Awareness of the impacts of technology on society and the environment;
4. Understanding the ethics and responsible professional conduct;
5. Strong interpersonal and teamwork skills;
6. Appreciation of the need for life-long learning;
7. Leadership/planning/decision-making skills;
8. Critical thinking/complex problem-solving skills.

A number of these desired learning outcomes are similar to some of the ABET program outcomes ("A through K") that guide the accreditation process for our undergraduate degree programs. One expects that persons entering our graduate programs, whether or not from an undergraduate engineering program, would already possess many of these attributes to a significant degree. The graduate education would be expected to provide substantial enhancement. Consequently, the learning outcomes for the graduate programs build on the foundation of undergraduate engineering education while taking a more advanced focus appropriate for graduate-level study.

### Prerequisites

For admission as a classified graduate student, an applicant should hold a bachelor's degree in engineering or a closely related field with a minimum grade point average of 2.5 in the last 90 quarter units (60 semester units) attempted. Some programs impose higher GPA requirements. Applicants for most graduate engineering programs are required to submit scores for the General Test of the Graduate Record Examination. An applicant who meets program standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing. Contact the individual program graduate coordinator for details.

### Program of Study

Each graduate student must prepare a formal study plan with his or her advisor early in the program, usually before the 12th unit of approved courses is completed.

The formal program of study must include a minimum of 45 units (at least 23 of which must be at the 500 level) with a specialization in one of the following areas: Biochemical Engineering, Bioengineering, Biomedical Engineering, Integrated Technology Management, Materials Engineering, Water Engineering, or another individualized course of study.

### Requirements

The broad curriculum requirements for the Master of Science degree in Engineering are:

1. a number of required units in the field of specialization, in many cases supplemented by analytical and technical breadth requirements;
2. additional units taken as advisor-approved electives;
3. at least 23 units of the 45 unit program at the 500 level;
4. at least 32 units taken "in residence."

In some specializations, two culminating requirement options are available: a thesis/project option, which requires coursework and an up-to-9 unit thesis or project with oral defense; or a non-thesis/project option, which involves additional coursework and a comprehensive examination. The non-thesis option is normally allowed only for students who have completed a senior project or have had significant prior engineering project experience.

The College of Engineering offers two joint programs: in conjunction with the Orfalea College of Business, the MBA/MS Engineering, with a specialization in Engineering Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mbamsengineering>) ; and with the College of Architecture and Environmental Design (City and Regional Planning Department), the MCRP/MS Engineering, with a specialization in Transportation Planning (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mcrpmsengineeringtransportationplanning/#graduatetext>) .

## **MS Engineering, Specialization in Biochemical Engineering**

## **MS Engineering, Specialization in Bioengineering**

## **MS Engineering, Specialization in Biomedical Engineering**

## **MS Engineering, Specialization in Integrated Technology Management**

The program goal is to develop "industry ready" graduates who will be integrators of engineering disciplines, industry concerns, and technology management. Many of the program courses involve actual integrated problems or opportunities from industrial organizations in a collaborative learning environment. The overall goals addressed by this program are for students to develop:

1. Technical knowledge and integration competencies in the engineering management;
2. Critical thinking/problem solving competencies;
3. Effective oral and written competencies;
4. Social, leadership, and decision-making competencies;
5. Independent analytical, research, and creative competencies;
6. An appreciation of the need for life-long learning;
7. Strong interpersonal and teamwork skills;
8. An awareness of the impacts of technology on society and the environment.

## **MS Engineering, Specialization in Materials Engineering**

## **MS Engineering, Specialization in Water Engineering**

## **MS Fire Protection Engineering**

### **General Characteristics**

The profession of Fire Protection Engineering is directed toward the identification, analysis and mitigation of fire hazards and risks across a broad spectrum of applications, including buildings, consumer products, industrial processes, transportation vehicles, infrastructure facilities and the wildland-urban interface.

A pilot program, the Master of Science in Fire Protection Engineering prepares individuals to assess and reduce the potential for property and human loss from fire in these and other settings. Students learn to analyze how buildings are used, how fires start, how fires grow, and how fire and smoke affect people, buildings and property. Fire protection engineers use the latest engineering and construction technologies to:

1. Design systems that control fires, alert people to danger and provide means for escape;
2. Evaluate buildings to identify fire risks of and the means to prevent or mitigate them;
3. Conduct fire safety research on consumer products and construction materials; and
4. Investigate fires to discover how fires start, how they spread, why protective measures fail, and how those measures could be designed more effectively.

To meet these program goals, the fire protection engineering curriculum requires that students successfully complete a total of 45 units including a fire protection engineering project as the culminating experience (FPE 596). The culminating experience will be innovative and require independent thinking. Typically, the students will perform a detailed fire and life safety evaluation of a selected building, the preparation of a comprehensive report documenting the results of this evaluation and the presentation of their analysis and findings in an oral defense to a review committee. Other innovative culminating experiences of similar scope and complexity may be submitted for approval.

### **Program Goals**

The Fire Protection Engineering program is designed to build on the skills, knowledge, and broad engineering principles students acquire in an undergraduate engineering program. The required and elective courses composing the Master of Science degree in Fire Protection Engineering address the specific body of knowledge required by the fire protection engineering profession. Students completing the program will possess the technical knowledge, skills and tools required to practice fire protection engineering in a variety of local, national and international settings. Upon completion of this program, students should possess the necessary knowledge and skills to pursue professional certification and licensure in the fire protection engineering discipline. Furthermore, the program addresses unique fire challenges faced by California and other western states, including wildland-urban interface fires and post-earthquake fires. Upon completing the requirements for a Master of Science degree in Fire Protection Engineering, students should be able to:

- Identify relevant fire safety codes, standards and regulations, comprehend the fire safety performance objectives and criteria associated with these documents, and apply these fire safety objectives and criteria to a broad range of applications.
- Analyze the flammability characteristics of different materials, interpret the results of standard and non-standard fire test methods and evaluate the fire hazards associated with different materials in a range of anticipated settings.
- Analyze the dynamics of fires in and around buildings and other structures through the application of fundamental principles and the use of state-of-the-art computer-based fire simulation models.
- Understand how people interact with fire conditions in buildings and calculate evacuation times through the application of fundamental principles of people movement and the use of state-of-the-art computer-based evacuation models.
- Design fire detection and alarm systems, fire suppression systems, smoke management systems, egress systems and structural fire protection to achieve specified performance objectives.
- Perform comprehensive fire and life safety evaluations of buildings and other structures through application of the knowledge, skills and tools acquired in this program and effectively communicate the results and findings of such evaluations.

### **Prerequisites**

For admission as a classified graduate student, an applicant should hold a bachelor's degree in engineering or a closely related field from a regionally accredited institution, college, or university. An undergraduate grade point average of 3.0 is required. On occasion, where other credentials are exceptionally strong, a GPA in the 2.5-3.0 range may be accepted.



## Tuition and Fees

As a special session program through Extended Education, the MS Fire Protection Engineering program is administratively and academically completely self-supporting. As such, the program carries a separate tuition and fee schedule. Please refer to [www.fpe.calpoly.edu/cost.html](http://www.fpe.calpoly.edu/cost.html) for the current cost of the program.

## MBA/MS Engineering, Specialization in Engineering Management

The dual-degree Engineering Management Program (EMP) is an interdisciplinary program linking the MBA and MS in Engineering degree programs. The MBA/MS Engineering, Specialization in Engineering Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mcrpmsengineeringtransportationplanning/#graduatetext>) is a cooperative effort between the Orfalea College of Business and the Cal Poly College of Engineering (Industrial and Manufacturing Engineering Department). Students are required to have a prerequisite degree in engineering, computer science, or equivalent technical degree to be admitted to both the College of Engineering and the Orfalea College of Business, and to be enrolled in both degree programs. Successful participants are awarded both MBA and MS in Engineering degrees, each with a specialization in Engineering Management.

## MCRP/MS Engineering, Specialization in Transportation Planning

The The MCRP/MS Engineering with Specialization in Transportation Planning (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mbamsengineering>) is a joint interdisciplinary program between the College of Engineering and the City and Regional Planning Department of the College of Architecture and Environmental Design. Participation in the program requires enrollment in both Colleges. Participants successfully completing the program are awarded both the MCRP and the MS in Engineering, each with a Specialization in Transportation Planning.

## Graduate Certificate Programs

### Fire Protection Engineering Applications

#### General Characteristics

The courses offered in the Fire Protection Engineering Applications graduate certificate program will prepare students for a specialized career in fire protection engineering. Students completing the certificate program will be prepared for careers in:

- Consulting/Design Engineering Firms
- Fire Equipment and Systems Manufacturers
- Hospitals and Health Care Facilities
- Insurance Industry
- Research and Testing Laboratories
- Fire Departments
- Government

#### Program Goals

Upon completing the requirements for the graduate certificate, students should be able to:

1. Identify relevant fire safety codes, standards and regulations, comprehend the fire safety performance objectives and criteria

associated with these documents, and apply these fire safety objectives and criteria to a broad range of applications.

2. Understand how people interact with fire conditions in buildings and calculate evacuation times through the application of fundamental principles of people movement and the use of state-of-the-art computer-based evacuation models.
3. Design fire detection and alarm systems, fire suppression systems, structural fire protection systems, and egress systems to achieve specified performance objectives.

To meet these program goals, the fire protection engineering applications curriculum requires that students successfully complete a total of 16 units.

## Fire Protection Engineering Science

### General Characteristics

The courses offered in the Fire Protection Engineering Science graduate certificate program will prepare students for a specialized career in fire protection engineering. Students completing the certificate program will be prepared for careers in:

- Forensic Investigations;
- Nuclear Fire Safety;
- Fire Science Research (R&D facility, Testing Lab, etc.)
- Government
- Fire Departments

#### Program Goals

Upon completing the requirements for the graduate certificate, students should be able to:

1. Apply concepts associated with the thermal sciences, including thermodynamics, fluid mechanics, and heat transfer, to the analysis of fire protection engineering problems.
2. Analyze the flammability characteristics of different materials, interpret the results of standard and non-standard fire test methods and evaluate the fire hazards associated with different materials in a range of anticipated settings.
3. Analyze the dynamics of fires in and around buildings and other structures through the application of fundamental principles and the use of state-of-the-art computer-based fire simulation models.

To meet these program goals, the fire protection engineering science curriculum requires that students successfully complete a total of 16 units.

## Fire Protection Engineering Science & Fire Protection Engineering Applications

### Tuition and Fees

As a special session programs through Extended Education, the MS Fire Protection Engineering program and Fire Protection Engineering graduate certificate are administratively and academically completely self-supporting. As such, the programs carry a separate tuition and fee schedule. Please refer to <http://fpe.calpoly.edu/cost.html> for the current cost of the program.



## Blended BS + MS Engineering Program

The blended program provides motivated students with an accelerated route to the MS Engineering, with simultaneous conferring of both bachelor's and master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status.

Students who matriculate from an ABET accredited BS program into this blended program have an additional requirement for their thesis. ABET requires that curricula include a major design experience, to ensure that students are ready for engineering practice. The experience should build on prior coursework, and should incorporate engineering standards and constraints. Hence, students matriculating from an ABET accredited program must have a master's thesis that includes this major design experience in order to complete their undergraduate degree requirements.

## Eligibility for Blended BS+MS Engineering

Students majoring in BS General Engineering, BS Computer Engineering, BS Manufacturing Engineering, and BS Materials Engineering may be eligible to pursue the blended program toward the MS Engineering with a specialization in Biochemical Engineering, Bioengineering, Biomedical Engineering, Materials Engineering, or Integrated Technology Management. They may also be able to pursue blended programs incorporating other MS degrees or specializations in the College of Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/#graduatetext>) .

In addition, students in departments with their own master's degrees may be able to pursue masters degrees in other areas, or the MS Engineering degree via the blended program, based on agreements between their bachelors granting program and their target masters program.

Participation in the program is based on prior academic performance and other measures of professional promise. Students are selected by a faculty committee, chosen on the basis of the student's area of interest.

## Program of Study

Some programs allow students to complete a capstone experience that integrates the senior project with the graduate thesis. This arrangement also increases the possibilities for industrial interaction in students' professional programs.

The blended program may allow students to earn graduate credit for several senior electives, effectively decreasing the summed unit requirements for both degrees. Requirements concerning shared units vary by degree program. Contact the program graduate coordinator for details.

## Other Blended Programs

Blended BS+MS programs are also available in Aerospace Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering>) , Biomedical Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/biomedicalgeneralengineering>) , Civil and Environmental Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/civilenvironmentalengineering>) , Computer Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/>

[collegeofengineering/computerscience](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/electricalengineering)) , Electrical Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/electricalengineering>) , Industrial Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/industrialmanufacturingengineering>) , and Mechanical Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering>) . Additional information about these programs may be obtained from the individual departments.

## MS Engineering, Specialization in Biochemical Engineering

### Required Courses

Analytical methods for engineering	6
Advanced mathematics	3
Select one of the following:	9

ENGR 599 Design Project (Thesis) (2, 2, 5)

9 units of approved technical electives and written comprehensive examination

Select from the following: 19

ME 541	Advanced Thermodynamics
ME 552	Advanced Heat Transfer I
ME 553	Advanced Heat Transfer II
ENVE 421	Mass Transfer Operations
ENGR 581	Biochemical Engineering I
ENGR 582	Biochemical Engineering II
ENGR 583	Biochemical Engineering III

### Approved Electives

Approved Electives	8
Total units	45

## MS Engineering, Specialization in Bioengineering

### Required Courses

ENGR 551	Advanced Topics in Bioengineering	4
MATE 530	Biomaterials	4
ENGR 581	Biochemical Engineering I	4
ENGR 599	Design Project (Thesis)	9

Select from the following: 12

BIO 432	Vertebrate/Human Anatomy and Physiology I
CSC 471	Introduction to Computer Graphics
CSC 473	Advanced Rendering Techniques
CSC 474	Computer Animation
CSC 541	Numerical Methods
ENGR 451	Special Topics in Bioengineering
ENGR 582	Biochemical Engineering II
ENVE 443	Bioremediation Engineering I
ENVE 536	Biological Wastewater Treatment Processes Engineering
IME 507	Graduate Seminar
MATE 425	Corrosion Engineering
MATE 501	Advanced Engineering Materials
ME 401	Stress Analysis
ME 504	Finite Element Analysis I
ME 551	Mechanical Systems Analysis
ME 552	Advanced Heat Transfer I
ME 553	Advanced Heat Transfer II
ME 554	Computational Heat Transfer
ME 556	Advanced Heat Transfer III
STAT 419	Applied Multivariate Statistics

STAT 512 Statistical Methods

STAT 542 Statistical Methods for Engineers

### Approved Engineering Electives

Electives	12
Total units	45

## MS Engineering, Specialization in Biomedical Engineering

### Required Courses

BMED 450	Contemporary Issues in Biomedical Engineering	4
BMED 460	Engineering Physiology	4
BMED 530	Biomaterials	4
BMED 550	Current and Evolving Topics in Biomedical Engineering	4
BMED 563	Biomedical Engineering Graduate Seminar	2
BMED 599	Design Project (Thesis) <sup>1</sup>	9

### Approved Engineering, Science and Mathematics Electives

Electives	18
Total units	45

<sup>1</sup> BMED 591 and/or BMED 592 are not required but can substitute for up to 4 units of thesis.

## MS Engineering, Specialization in Integrated Technology Management

### Required Courses

IME 503	Applied Statistical Methods in Engineering	4
IME 507	Graduate Seminar (2, 2)	4
IME 556	Technological Project Management	4
IME 580	Manufacturing Systems	4
IME 596	Team Project/Internship	10

### Approved Electives

Approved Electives	19
Total units	45

## MS Engineering, Specialization in Materials Engineering

### Required Courses

MATE 599	Design Project (Thesis) (2, 2, 5)	9
Select from the following:		15

MATE 425	Corrosion Engineering
MATE 410	Nanoscale Engineering
MATE 430	Microfabrication
MATE 440	Welding Metallurgy and Joining of Advanced Materials
MATE 450	Fracture and Failure Analysis
MATE 501	Advanced Engineering Materials
MATE 504	Research Methods in Materials Engineering

MATE 510	Materials Analysis	
MATE 522	Advanced Ceramics	
MATE 550	Micro Systems	
MATE 570	Selected Advanced Topics	
MATE 571	Selected Advanced Laboratory	
MATE 590	Solidification and Densification	
MATE/BMED 530	Biomaterials	
MATE/CHEM 446	Surface Chemistry of Materials	
MATE/IME 458	Microelectronics and Electronics Packaging	

**Approved Electives**

Approved Electives	21
Total units	45

## MS Engineering, Specialization in Water Engineering

**Required Courses**

Analysical methods for engineering		6
ECON 410	Public Finance and Cost-Benefit Analysis	4
BRAE 414	Irrigation Engineering	4
BRAE 532	Water Wells and Pumps	4
BRAE 533	Irrigation Project Design	4
CE 533	Advanced Water Resources Engineering	4
Select one of the following:		9

BRAE 599 Thesis in BioResource and Agricultural Engineering (2, 2, 5)

CE 599 Design Project (Thesis) (2, 2, 5)

9 units of approved technical electives and written comprehensive examination

**Approved Electives**

Select from the following:	10
BRAE 405	Chemigation
BRAE 435	Drainage
BRAE 440	Agricultural Irrigation Systems
CE 434	Groundwater Hydraulics and Hydrology
CE 435	Engineering Hydrology
CE 440	Hydraulic Systems Engineering
CE 573	Public Works Administration
ENVE 438	Water and Wastewater Treatment Design
ENVE 439	Solid Waste Management
ENVE 535	Physico-Chemical Water and Wastewater Treatment

Total units	45
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## MS Fire Protection Engineering

**Required Courses**

FPE 501	Fundamental Thermal Sciences	4
FPE 502	Fire Dynamics	4
FPE 503	Flammability Assessment Methods	4

FPE 504	Fire Modeling	4
FPE 521	Egress Analysis and Design	4
FPE 522	Fire Detection, Alarm and Communication Systems	4
FPE 523	Water-based Fire Suppression	4
FPE 524	Structural Fire Protection	4
FPE 596	Culminating Experience in Fire Protection Engineering <sup>1</sup>	5

**Technical Electives**

Select from the following:	8
FPE 551	Fire Safety Regulation and Management
FPE 552	Smoke Management and Special Hazards
FPE 554	Forensic Fire Analysis
FPE 555	Fire Protection Management in the Wildland-Urban Interface (WUI)
FPE 556	Advanced Heat Transfer III
ME 541	Advanced Thermodynamics
ME 554	Computational Heat Transfer

Total units	45
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<sup>1</sup> FPE 599 Design Thesis can substitute for FPE 596 and one technical elective for a total of 9 units.

## Fire Protection Engineering Applications Graduate Certificate

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### Prerequisites

For admission as a classified graduate student, an applicant should hold a bachelor's degree in engineering, fire science, fire protection and safety, or a closely related field from a regionally accredited institution, college, or university. An undergraduate grade point average of 3.0 is required. On occasion, where other credentials are exceptionally strong, a GPA in the 2.5-3.0 range may be accepted.

### Core Courses

FPE 521	Egress Analysis and Design	4
FPE 522	Fire Detection, Alarm and Communication Systems	4
FPE 523	Water-based Fire Suppression	4
FPE 524	Structural Fire Protection	4
Total units		16

## Fire Protection Engineering Science Graduate Certificate

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### Prerequisites

For admission as a classified graduate student, an applicant should hold a bachelor's degree in engineering or a closely related field from a regionally accredited institution, college, or university. An undergraduate grade point average of 3.0 is required. On occasion, where other credentials are exceptionally strong, a GPA in the 2.5-3.0 range may be accepted.

FPE 501	Fundamental Thermal Sciences	4
FPE 502	Fire Dynamics	4
FPE 503	Flammability Assessment Methods	4
FPE 504	Fire Modeling	4
Total units		16

## Aerospace Engineering

Engineering III Bldg. (41A), Room 134  
Phone: 805.756.7172

College of Engineering Advising Center  
Engineering South (40), Room 114  
Phone: 805.756.1461; Fax: 805.756.2376

Department Chair: Eric A. Mehiel

### Academic Programs

Program name	Program type
Aerospace Engineering	BS, MS
Multidisciplinary Design	Minor

### Graduate Certificate Program

Program name	Program type
Space Systems Technology	Certificate

The Bachelor of Science degree in Aerospace Engineering prepares students for engineering work related to aerodynamics, flight testing, structures, propulsion, control systems, vehicle dynamics, stability and control, flight simulation, and design for both fixed and rotary wing aircraft, missiles, and spacecraft. The problems faced by the aerospace industry offer an unusual engineering challenge. Much of the analysis and testing must be accomplished at the very frontiers of knowledge. Nevertheless, products must be designed and manufactured; thus, an exceptionally wide range of engineering abilities is required within the industry and government.

The Aerospace Engineering Department's mission is to educate students using a laboratory-based, hands-on approach. This approach, coupled with a systems view of engineering, is encouraged through coursework and a group-based capstone design experience. This educational philosophy has yielded engineers capable of working in positions of technical responsibility and leadership in a modern multidisciplinary, systems-based environment.

Graduates in Aerospace Engineering 1) are well rounded engineers for positions of technical responsibility and leadership in a modern multidisciplinary system-oriented environment that emphasizes problem solving; 2) achieve high-quality professional performance in both aeronautical and astronautical engineering by integrating a systems view of engineering that is built upon group based design experiences; and 3) demonstrate a solid foundation in aerodynamics, controls, structures, propulsion and their integration into systems design.

Aerospace Engineering graduates obtain employment in all phases of the aerospace industry such as general design, aerodynamics, stress analysis, flight testing, flight simulation, dynamics, stability and control, and propulsion systems.

The BS degree program in Aerospace Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org/>. It places emphasis on both analysis and design, with supplementary basic work in laboratory projects. Throughout the entire program there is constant interplay between theory and application. Opportunities are available for advanced elective work in the student's field of special interest.

The program maintains laboratory facilities for fabrication, propulsion, structures and composites, aerodynamics, dynamics and control, flight simulation and flight test, aerothermodynamics, and design.

Aerospace students may participate in two student chapters of national professional societies—the American Institute of Aeronautics and Astronautics and the Society for the Advancement of Material and Process Engineering. There is also a student chapter of the national aerospace engineering honor society, Sigma Gamma Tau.

### Undergraduate Programs

#### BS Aerospace Engineering

The Bachelor of Science degree in Aerospace Engineering prepares students for engineering work related to aerodynamics, flight testing, structures, propulsion, control systems, vehicle dynamics, stability and control, flight simulation, and design for both fixed and rotary wing aircraft, missiles, and spacecraft. The program's faculty have developed a number of educational objectives to support this mission. These objectives are:

- Be life-long learners who continue to pursue professional development;
- Participate and thrive in a multi-disciplinary, systems-oriented work environment;
- Contribute to the solution of complex technical problems that exist in the aerospace industry; and
- Understand their ethical role as a professional engineer and strive to promote a practice of integrity, tolerance, and respect in the workplace.

#### Multidisciplinary Design Minor

The minor enhances students' ability to work in multidisciplinary engineering teams. The students develop an understanding of the design process and the role of systems engineering in product design and development including costs analysis. They also learn the systems integration process and how different subsystems are interfaced to develop a successful product.

### Graduate Programs

#### MS Aerospace Engineering

##### General Characteristics

The Master of Science program in Aerospace Engineering prepares the student for entry into a well-established field of aerospace engineering. Two versions of the master's program are available: MS Aerospace Engineering with Specialization in Research or MS Aerospace Engineering with Specialization in Space Systems Engineering.

##### General Prerequisites

For admission as a classified graduate student, an applicant must hold a bachelor's degree in engineering or a closely related physical science with a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted. Applicants are required to submit satisfactory scores for the General (Aptitude) Test of the Graduate Record Examination.

An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student



and must make up any deficiencies before advancement to classified graduate standing. Information pertaining to specific requirements for admission to graduate standing (classified or conditionally classified) may be obtained from the Graduate Coordinator, Department of Aerospace Engineering.

## General Program of Study

Graduate students must file a formal study plan with their advisor, department, college and graduate studies office by no later than the end of the quarter in which the 12th unit of approved courses is completed. The formal program of study must include a minimum of 45 units (at least 24 of which must be at the 500 level).

## Program Learning Objectives

1. Competency in advanced mathematics, science, and aerospace engineering knowledge.
2. Ability to apply advanced mathematics, science, and aerospace engineering knowledge to a project that is conducted independently.
3. Make a specific contribution to a field that is relevant to aerospace professionals.
4. Ability to convey effectively engineering ideas and results both orally and in writing.
5. Awareness of professional and ethical responsibility.
6. Awareness of global, contemporary issues related to aerospace engineering and the society at large.
7. Awareness of rapid advancement of modern technology and ability for life-long learning.

## MS Aerospace Engineering, Specialization in Research Characteristics

Emphasizes engineering science and research activity. Graduates have an increased capability for complex research, development, and innovative design, and are prepared for further study in engineering, leading to the Doctor of Engineering or Ph.D. or advanced positions within industry.

## Program of Study

A thesis is required as a culminating experience. Students work with their advisor and the Department Graduate Coordinator to develop a program of study which supports their thesis topic. A thesis topic would typically be in an area such as: dynamics and control, fluid dynamics and aerodynamics, multidisciplinary design and optimization, aerospace propulsion, aerospace structures, and systems engineering.

For the most recent, comprehensive list of courses offered by the department, please contact the Department Graduate Coordinator or see the listing at <http://aero.calpoly.edu>.

## MS Aerospace Engineering, Specialization in Space Systems Engineering Characteristics

Emphasizes space systems and systems engineering. It is designed to accommodate students with undergraduate degrees in science or engineering disciplines other than aerospace engineering. Students develop an understanding of all subsystems in a space vehicle

and how they are combined to form a complete space vehicle. The program also presents the basic principles of systems engineering and their application to space vehicle design. A project is required as a culminating experience.

## Graduate Certificate Program Space Systems Technology *New Program, effective Fall 2014* General Characteristics

Space-based systems are complex in nature and require a multi-disciplinary team of hard working engineers to develop, deploy and operate. The particular technologies involved in space-based systems are also complex and require engineers with a broad knowledge base. Furthermore, space-based systems operate on the edge of their design performance. Therefore, understanding the interaction of the functional units and technologies is exceedingly important.

The graduate certificate in Space Systems Technology will prepare the engineer working in the space industry in key areas of spacecraft technology. Students will learn about all major functional units of a space-based system from spacecraft dynamics to software architecture. The goal of the graduate certificate in Space Systems Technology is to educate working engineers with a system-level awareness in the complex technologies of space-based systems. The certificate is designed with the non-aerospace engineering in mind, but is open to all those working in the industry.

## Program Goals

1. Understand how and why a spacecraft functions as a system in an operational context.
2. Evaluate the interconnectedness of spacecraft functional elements and analyze and assess the results of this evaluation.
3. Understand the role and function of software as a functional element and its integration/interconnections with other components and operations of a space system.
4. Analyze and understand the orbital and attitude dynamics of the spacecraft with regard to mission objectives.
5. Effectively communicate (read, write, speak, and listen) with any engineer working on any functional element of a space program to define system requirements and interfaces.
6. Create opportunities for professional growth and career advancement through continued learning and interaction with the space technology community.

## Admission Requirements

Successful applicants to the Space System Technology certificate program will have a bachelor's degree in engineering or relevant field of study (minimum 3.0 GPA) from an accredited institution. Applicants with non-engineering degrees in areas commonly found within the Aerospace Engineering Industry (e.g. physics and mathematics) will be considered for admission at the discretion of the program. Additionally, the applicant must have at least 2 years of engineering work experience. Work experience may substitute, at the discretion of the program, for the relevancy of the bachelor's degree and for the minimum GPA requirements.

## Tuition and Fees

As a special session program through Extended Education, the Space Systems Technology graduate certificate is administratively and

academically completely self-supporting. As such, the program carries a separate tuition and fee schedule.

## Blended BS + MS Aerospace Engineering

The blended program provides motivated students with an accelerated route to the MS Aerospace Engineering, with simultaneous conferring of both bachelor's and master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status.

### Eligibility

Students majoring in BS Aerospace Engineering may be eligible to pursue the blended program toward the MS Aerospace Engineering. Participation in the program is based on prior academic performance and other measures of professional promise, with a minimum GPA of 2.5 required (3.0 GPA recommended). Students are selected by a faculty committee. Please see Graduate Programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation/#graduateandpostbaccalaureateadmissionrequirements>) for eligibility criteria.

### Program of Study

The program allows students to complete a more meaningful capstone experience that integrates the senior project with the graduate thesis. This arrangement also increases opportunities for industrial interaction.

The blended program allows students to double count up to nine units of coursework to fulfill the requirements for the BS and MS degrees.

## BS Aerospace Engineering

### Program Learning Outcomes

#### ABET-Defined Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
- 10A knowledge of contemporary issues
- 11 An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

AERO 121	Aerospace Fundamentals	2
AERO 215	Introduction to Aerospace Design	2
AERO 300	Aerospace Engineering Analysis	5
AERO 301 & AERO 302 & AERO 303	Aerothermodynamics I and Aerothermodynamics II and Aerothermodynamics III	12
AERO 304	Experimental Aerothermodynamics	2
AERO 320	Fundamentals of Dynamics and Control	4
AERO 331	Aerospace Structural Analysis I	4
AERO 431	Aerospace Structural Analysis II	4
AERO 433	Experimental Stress Analysis	1
AERO 460	Aerospace Engineering Senior Seminar	1
AERO 465	Aerospace Systems Senior Laboratory	1
CE 204	Mechanics of Materials I	3
CE 207	Mechanics of Materials II	3
EE 201 & EE 251	Electric Circuit Theory and Electric Circuits Laboratory	4
Concentration Courses <sup>2</sup>		41

### SUPPORT COURSES

BIO 213	Life Science for Engineers (B2) <sup>1</sup>	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>1</sup>	2
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
IME 144	Introduction to Design and Manufacturing	4
MATE 210	Materials Engineering	3
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
PHYS 131	General Physics I (Add'l Area B) <sup>1</sup>	4
or PHYS 141	General Physics IA	
PHYS 132	General Physics II	4

PHYS 133	General Physics III	4
STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		40
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		190

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> See Concentrations below

## Concentrations (select one)

- Aeronautics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/bsaerospaceengineering/aeronauticsconcentration>)
- Astronautics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/bsaerospaceengineering/astronauticsconcentration>)

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 8 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		40

<sup>1</sup> Required in Support; also satisfies GE

## Aeronautics Concentration

AERO 306	Aerodynamics and Flight Performance	4
AERO 307	Experimental Aerodynamics	2
AERO 401	Propulsion Systems	5
AERO 405	Supersonic and Hypersonic Aerodynamics	4
AERO 420	Aircraft Dynamics and Control	4
AERO 443	Aircraft Design I	10
& AERO 444	and Aircraft Design II	
& AERO 445	and Aircraft Design III	

### Aeronautics Approved Electives. <sup>1</sup>

Select from the following:		12
AERO 351	Introduction to Orbital Mechanics	
AERO 353	Spacecraft Environment	
AERO 360	Creative Problem Solving in Engineering Design <sup>2</sup>	
AERO 406	Applied Computational Fluid Dynamics	
AERO 407	Reentry Aerodynamics	
AERO 409	Flight Test	
AERO 416	Principles of Rotary Wing Flight	
AERO 419	Simulation of Aerospace Vehicles and Systems	
AERO 421	Spacecraft Attitude Dynamics and Control	
AERO 425	Aircraft Performance	
AERO 432	Advanced Composite Structures Analysis	
AERO 435	Aerospace Numerical Analysis	
AERO 450	Introduction to Aerospace Systems Engineering	
AERO 452	Spaceflight Dynamics II	
AERO 446	Introduction to Space Systems	
AERO 470	Selected Advanced Topics	
AERO 510	Systems Engineering I	
AERO 511	Systems Engineering II	
AERO 512	Aerospace Vehicle Software Application	
AERO 515	Continuum Mechanics	
AERO 517	Multidisciplinary Design and Optimization	
AERO 519	Fundamentals of Vehicle Dynamics and Control	
AERO 522	Boundary-Layer Theory	
AERO 523	Turbulence	
AERO 524	Low Gravity Fluid Dynamics and Heat Transfer	
AERO 525	Computational Fluid Dynamics	
AERO 526	Spacecraft Thermal/Fluid Control	
AERO 530	Inelastic Structural Analysis	
AERO 532	Advanced Aerospace Composite Design	
AERO 533	Finite Elements for Aerospace Structural Analysis	
AERO 534	Aerospace Structural Dynamics Analysis	
AERO 535	Advanced Aerospace Structural Analysis	
AERO 540	Elements of Rocket Propulsion	
AERO 541	Air Breathing Propulsion	
AERO 550	Analysis and Design of Flight Control Systems	
AERO 551	Global Positioning Satellite Navigation Systems	
AERO 552	Advanced Control of Spacecraft and Aircraft	
AERO 553	Advanced Linear Control Theory	

AERO 557	Advanced Orbital Mechanics	
AERO 560	Spacecraft Dynamics and Control	
AERO 561	Vehicle Integration and Testing	
AERO 562	Space Operations	
AERO 565	Advanced Topics in Aircraft Design	
AERO 566	Advanced Topics in Spacecraft Design	
AERO 567	Launch Vehicle and Missile Design	
AERO 570	Selected Advanced Topics <sup>2</sup>	
AERO 571	Selected Advanced Topics Laboratory <sup>2</sup>	

Total units 41

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of postbaccalaureate studies and/or goals.

<sup>2</sup> Require a petition.

## Astronautics Concentration

AERO 351	Introduction to Orbital Mechanics	4
AERO 353	Spacecraft Environment	4
AERO 354	Space Environment Laboratory	2
AERO 402	Spacecraft Propulsion Systems	5
AERO 421	Spacecraft Attitude Dynamics and Control	4
AERO 446	Introduction to Space Systems	4
AERO 447	Spacecraft Design I	10
& AERO 448	and Spacecraft Design II	
& AERO 449	and Spacecraft Design III	

### Astronautics Approved Electives <sup>1</sup>

Select from the following: 8

AERO 306	Aerodynamics and Flight Performance	
AERO 360	Creative Problem Solving in Engineering Design <sup>2</sup>	
AERO 405	Supersonic and Hypersonic Aerodynamics	
AERO 406	Applied Computational Fluid Dynamics	
AERO 407	Reentry Aerodynamics	
AERO 409	Flight Test	
AERO 416	Principles of Rotary Wing Flight	
AERO 419	Simulation of Aerospace Vehicles and Systems	
AERO 420	Aircraft Dynamics and Control	
AERO 425	Aircraft Performance	
AERO 432	Advanced Composite Structures Analysis	
AERO 435	Aerospace Numerical Analysis	
AERO 446	Introduction to Space Systems	
AERO 450	Introduction to Aerospace Systems Engineering	
AERO 452	Spaceflight Dynamics II	
AERO 470	Selected Advanced Topics	
AERO 510	Systems Engineering I	
AERO 511	Systems Engineering II	
AERO 512	Aerospace Vehicle Software Application	
AERO 515	Continuum Mechanics	
AERO 517	Multidisciplinary Design and Optimization	
AERO 519	Fundamentals of Vehicle Dynamics and Control	
AERO 522	Boundary-Layer Theory	

AERO 523	Turbulence	
AERO 524	Low Gravity Fluid Dynamics and Heat Transfer	
AERO 525	Computational Fluid Dynamics	
AERO 526	Spacecraft Thermal/Fluid Control	
AERO 530	Inelastic Structural Analysis	
AERO 532	Advanced Aerospace Composite Design	
AERO 533	Finite Elements for Aerospace Structural Analysis	
AERO 534	Aerospace Structural Dynamics Analysis	
AERO 535	Advanced Aerospace Structural Analysis	
AERO 540	Elements of Rocket Propulsion	
AERO 541	Air Breathing Propulsion	
AERO 550	Analysis and Design of Flight Control Systems	
AERO 551	Global Positioning Satellite Navigation Systems	
AERO 552	Advanced Control of Spacecraft and Aircraft	
AERO 553	Advanced Linear Control Theory	
AERO 557	Advanced Orbital Mechanics	
AERO 560	Spacecraft Dynamics and Control	
AERO 561	Vehicle Integration and Testing	
AERO 562	Space Operations	
AERO 565	Advanced Topics in Aircraft Design	
AERO 566	Advanced Topics in Spacecraft Design	
AERO 567	Launch Vehicle and Missile Design	
AERO 570	Selected Advanced Topics <sup>2</sup>	
AERO 571	Selected Advanced Topics Laboratory <sup>2</sup>	

Total units 41

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals. Only 4 units of 300-level coursework is allowed as an approved elective.

<sup>2</sup> Require a petition.

## Multidisciplinary Design Minor

Non-AERO students in the minor are admitted by permission of the minor coordinator, and not held to the prerequisites for:

AERO 443	Aircraft Design I	
& AERO 444	and Aircraft Design II	
& AERO 445	and Aircraft Design III	
AERO 447	Spacecraft Design I	
& AERO 448	and Spacecraft Design II	
& AERO 449	and Spacecraft Design III	
IME 418	Product-Process Design	

### Introductory Courses

IME 314	Engineering Economics	3
IME 418	Product-Process Design	4
BUS 382	Organizations, People, and Technology	4
PSY 350	Teamwork	4

### Core Courses

AERO 450	Introduction to Aerospace Systems Engineering	4
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Select from the following: 10

AERO 443 Aircraft Design I  
 & AERO 444 and Aircraft Design II  
 & AERO 445 and Aircraft Design III (4, 3, 3)

AERO 447 Spacecraft Design I  
 & AERO 448 and Spacecraft Design II  
 & AERO 449 and Spacecraft Design III (4, 3, 3)

Total units 29

## MS Aerospace Engineering, Specialization in Research

### Required Courses

MATH 501 Analytic Methods in Applied Mathematics 4  
 MATH 502 or approved numerical methods elective 4

### Advisor Approved Electives

500-level AERO courses 16  
 400-500 level courses from the College of Engineering or College of Science and Mathematics 12

### Culminating Experience

AERO 599 Thesis (Design Project) (2, 2, 5) 9

Total units 45

## MS Aerospace Engineering, Specialization in Space Systems Engineering

### Systems Engineering Courses

AERO 450 Introduction to Aerospace Systems Engineering 4  
 AERO 510 Systems Engineering I 4  
 AERO 511 Systems Engineering II 4

### Space Systems Courses

AERO 546 Spacecraft Systems Design 4  
 AERO 512 Aerospace Vehicle Software Application 4  
 AERO 519 Fundamentals of Vehicle Dynamics and Control 4  
 AERO 566 Advanced Topics in Spacecraft Design 4

### Advisor Approved Electives

Must be 500-level courses from the College of Engineering 12

### Culminating Experience

AERO 596 Culminating Experience in Space Systems Engineering 5

Total units 45

## Space Systems Technology Graduate Certificate

AERO 512 Aerospace Vehicle Software Application 4  
 AERO 519 Fundamentals of Vehicle Dynamics and Control 4  
 AERO 546 Spacecraft Systems Design 4  
 AERO 566 Advanced Topics in Spacecraft Design 4

Total units 16



# Biomedical & General Engineering

Engineering Bldg. (13), Room 260  
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## Academic Programs

Program name	Program type
Biomedical Engineering	BS, MS
General Engineering	BS

## Biomedical Engineering

Biomedical engineering is an interdisciplinary field in which the principles and tools of traditional engineering fields, such as mechanical, materials, electrical, and chemical engineering, are applied to biomedical problems. Engineering plays an increasingly important role in medicine in projects that range from basic research in physiology to advances in biotechnology and the improvement of health care delivery. By its very nature, biomedical engineering is broad and requires a foundation in the engineering sciences as well as in physiology and other biological sciences.

## General Engineering

The mission of the General Engineering Program is to provide students with the highest quality technical and professional engineering education, with a particular emphasis in new or evolving interdisciplinary areas, while allowing the student to participate in designing their curricula.

## Undergraduate Programs

### BS Biomedical Engineering

#### Program Mission and Goals

The mission of the Biomedical Engineering program is to maintain an effective learning environment that enables and empowers graduates for careers of service, leadership and distinction in engineering or other fields. Our approach is to use a participatory, learn-by-doing, "hands-on" laboratory, projects and design centered approach to achieve this end.

To succeed in this mission, the educational objectives of the program are to facilitate graduates to:

1. Utilize a knowledge base with a core foundation in engineering, physical and biological sciences, which will enable them to apply their skills to a variety of challenges in their chosen field. Our graduates will demonstrate innovation, creativity, adaptability, and critical thinking to solve problems in disciplines related to biomedical engineering that are relevant to industry, academia, or medicine, and health related fields.
2. Demonstrate leadership in their chosen fields, and make decisions that are socially and ethically responsible. Our graduates will function effectively in multidisciplinary team

environments and communicate effectively to a variety of audiences.

3. Engage in opportunities to extend their undergraduate education throughout their careers, as demonstrated by such things as pursuing graduate study, taking short courses, or attending conferences.

The program offers a four-year curriculum leading to a B.S. degree. The main educational objectives of the program are to prepare graduates who will excel in the biomedical engineering profession, understand that their education is a continuous enterprise, and seek graduate degrees for increased flexibility and mobility. The curriculum provides a sound theoretical background, practical engineering knowledge and solid laboratory exposure. It highlights an immediate introduction to the major, strong personal interaction with faculty, strong partnerships with industrial participants and a signature laboratory emphasis.

The application of engineering to medicine and biology underpins a strong and growing segment of the industrial sector, and continues to be an area of inherent interest to students. The need for well educated professionals in this interdisciplinary area has become more acute as the technology being applied has become more sophisticated. Evolution in computing, electronics, signal analysis and mechatronic systems have resulted in dramatic improvements in diagnostic efforts, therapeutic approaches and bioindustrial applications. Studies of biological materials, physiological mechanisms, biochemical kinetics and heat and mass transport in biological systems require engineering expertise. With the advent of research into artificial organs, prosthetic devices and tissue engineering, applied medical research and applied biological research has taken on a distinct engineering aspect.

Biomedical engineering combines engineering expertise with medical needs for the enhancement of health care. It is a branch of engineering in which knowledge and skills are developed and applied to define and solve problems in biology and medicine. Students choose the biomedical engineering field to be of service to people; for the excitement of working with living systems; and to apply advanced technology to the complex problems of medical care.

Some well established specialty areas exist within the field of biomedical engineering: *bioinstrumentation*, *biomechanics*, *biomaterials*, *systems physiology*, *tissue engineering*, *clinical engineering*, and *rehabilitation engineering*.

*Bioinstrumentation* is the application of electronics and measurement principles and techniques to develop devices used in diagnosis and treatment of disease. Computers are becoming increasingly important in bioinstrumentation, from the microprocessor used to do a variety of small tasks in a single purpose instrument to the extensive computing power needed to process the large amount of information in a medical imaging system. *Biomechanics* is mechanics applied to biological or medical problems. It includes the study of motion, of material deformation, of flow within the body and in devices, and transport of chemical constituents across biological and synthetic media and membranes. *Biomaterials* describes both living tissue and materials used for implantation. Understanding the properties of the living material is vital in the design of implant materials. *Systems physiology* is the term used to describe that aspect of biomedical engineering in which engineering strategies, techniques and tools are used to gain a comprehensive and integrated understanding of the function of living organisms ranging from bacteria to humans. *Tissue engineering* is a rapidly developing field that combines engineered materials with living cells to restore or replace lost organ function. *Clinical engineering* is

the application of technology for health care in hospitals. The clinical engineer is a member of the health care team along with physicians, nurses and other hospital staff. *Rehabilitation engineering* is a new and growing specialty area of biomedical engineering. Rehabilitation engineers expand capabilities and improve the quality of life for individuals with physical impairments.

In addition to the objectives for all engineering programs, the goal of the BS program in Biomedical Engineering is the preparation of engineering professionals who have: (1) an understanding of biology and physiology; (2) an ability to apply advanced mathematics to problems at the interface of engineering and biology; (3) an ability to measure and interpret data from living systems; and (4) an ability to address the problems associated with the interaction between living and nonliving systems.

## BS General Engineering

Flexibility, core competency and self-determination are the keywords for students of the General Engineering Program. The mission of the General Engineering Program is to provide students with the highest quality technical and professional engineering education, with a particular emphasis in new or evolving interdisciplinary areas, while allowing the students to participate in designing their curricula. General Engineering graduates have directed the technical electives in their programs towards studies of project management, technical sales, law, medicine and a hundred other paths defined by their keen intellects and adventuresome spirits.

The primary goal of the General Engineering Program is to provide students with a theoretically rigorous and a laboratory-centered, practice-oriented, hands-on education that allows graduates to immediately participate and to excel in professional environments. The program is underpinned by a rigorous selection of mathematics, science, basic engineering and liberal-arts courses. The students, with their advisors, then select forty technical elective classes that allow the students to put their own mark on their degrees, ensuring a unique competency with a solid underpinning.

General Engineering graduates are ready for immediate entry into the professional engineering field. They demonstrate an ability to satisfy their personal needs for further education, as expressed in their matriculation to graduate or professional schools in many cases, and an interest in life-long learning in all cases. They possess a solid engineering foundation which underpins a successful career. They can become leaders, based on strong communication skills, a capacity to form teams and perform in teams, and an understanding of the economic and social impact of their decisions.

In addition to the abilities expected of all engineering graduates, articulated in the section of this catalog describing the College of Engineering, General Engineering graduates are expected to leave the University with special capabilities pertinent to their own concentrations.

The Bachelor of Science degree in General Engineering is designed to allow students the latitude in course selection required to educate themselves either in the classical study of engineering or in new and evolving interdisciplinary technologies such as bioengineering, biochemical engineering and mechatronics. The degree is an excellent preparation for an applied terminal masters degree in these interdisciplinary fields such as the Blended BS+MS program described in the MS Engineering section of this catalog. General Engineering can also accommodate those students who wish to major in engineering but have not presently decided in which specific program their

interest is centered. The curriculum builds a sound foundation in the fundamental principles of engineering and engineering systems during the early years of study. During their final quarters of study, students customize their study plan with the help of a faculty advisor and are given the opportunity to focus their education while still at the undergraduate level. The BS degree in General Engineering is, therefore, a direct path to employment in a classic engineering field or in an area of emerging technology. It is also a natural step toward a professional or a graduate degree.

General Engineering students are encouraged to participate in the Blended BS+MS program. This program recognizes that the expertise required of entry level engineers in many fields, particularly new and evolving technological fields, implies that a masters degree is a prerequisite for success. The program allows motivated students to reduce the time necessary to earn both degrees.

All practitioners of engineering must have an understanding of the physical sciences and mathematics. Further, they must have a firm grasp of engineering sciences. The General Engineering curriculum provides the framework for this matrix of understanding, upon which the practitioner may begin to develop a unique area of expertise.

This program is for directed, highly motivated students. The technical elective courses are selected to be consistent with a sharply defined career goal. Each student is required to submit a study plan to the coordinator prior to the end of the first quarter of their junior year. Study plans selected in the past have emphasized engineering physics, management of technology, bioengineering, ocean engineering and engineering in unique environments.

One example of a highly multidisciplinary field of study is *mechatronics*, defined as the application of decision making to physical systems. Today's engineered products are complex, composed of integrated mechanical and electronic components, and operate with the aid of control software. Design and fabrication of such products requires knowledge of manufacturing, mechanical engineering, electronics and materials as well as experience with concurrent engineering tools. Embedded computers of all sizes and capabilities are used in the decision making elements of products which daily affect the lives of essentially each resident in the developed world. Microcontrollers and mechatronic systems are found in devices as mundane as lawnmowers and as esoteric as deep space probes, and every system in between.

## Concentrations or Individualized Course of Study

### Bioengineering Concentration

Provides students with interdisciplinary exposure in a burgeoning field. The program highlights an immediate introduction to the major, strong personal interaction with faculty, strong partnerships with industrial participants and a signature laboratory emphasis. Rooted in a strong engineering exposure, the curriculum allows students to pursue applied biotechnical research in practical, interdisciplinary settings. Students and faculty are concerned with the design, analysis, integration and operation of engineered materials and engineered systems in biological applications. Typical areas of study include bioinstrumentation, bioelectric signals and communication, remediation and bioindustrial systems.

## Graduate Programs

### MS Biomedical Engineering

#### General Characteristics

The Master of Science degree program in Biomedical Engineering is well-suited for those individuals who desire depth in engineering application to living systems, with a strong pragmatic and rigorous, hands-on educational experience. Graduates will be well-equipped to make significant contributions to the biomedical field. The MS in Biomedical Engineering program objectives are to:

- Provide graduates with a rigorous, broad-based advanced education in engineering coupled with applied biology that will prepare graduates for the many diverse career opportunities of biomedical engineering.
- Provide an empowering professional degree for students who intend to become practicing engineers
- Provide job-entry education for the more complex and evolving interdisciplinary area of biomedical engineering.
- Provide a base that enables graduates to maintain currency in their fields.
- Provide preparation for further study in engineering and/or medicine, leading to the Doctor of Engineering, MD, Ph.D., or MD/Ph.D. degrees.

#### Prerequisites

For admission as a classified graduate student, an applicant must possess a bachelor's degree in engineering or a closely related physical science with a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted. Applicants for graduate engineering programs are required to submit scores for the General Test of the Graduate Record Examination. Applicants are also required to submit 3 letters of reference in support of their application. A college level biology course, with laboratory, for biology majors is highly recommended. Applicants who meet these standards but lack prerequisite coursework may be admitted as conditionally classified students and must make up any deficiencies before advancement to candidacy. Applicants from other academic disciplines, such as biology or chemistry are encouraged to apply and may be admitted to the program conditionally in order to make up deficiencies in prerequisite coursework. Information regarding specific admission requirements and classification as a graduate student may be obtained from the Graduate Coordinator, Biomedical Engineering.

#### Program of Study

Graduate students must file formal study plans with their advisor, department, college, and university graduate studies office as well as fulfill the Graduation Writing Requirement no later than the end of the quarter in which the 12th unit of approved graduate course work is completed. The formal program of study must include a minimum of 45 units with:

1. At least 23 units of the 45 unit program at the 500 level.
2. A thesis or project as the mandatory culminating experience.

### MS Biomedical Engineering, Specialization in Stem Cell Research

#### Characteristics

Prepares students for research careers working with stem cells. Graduates of the program are well- prepared to matriculate into

stem-cell focused doctoral programs. Following completion of a PhD in a stem-cell focused program (and likely post-doctoral training), students would have job opportunities as principal investigators at universities/non-profit research institutes or as lead scientists at for profit institutions. Graduates are also well prepared for immediate employment as research specialists/laboratory managers at universities, research institutes, or private companies in the field of stem cells/regenerative medicine.

#### Culminating Experience

Students who obtain a degree in the Master of Science in Biomedical Engineering with a specialization in Stem Cell Research are not required to complete . In place of the thesis as a culminating experience, students are required to complete a non-traditional Comprehensive Exam. This non-traditional Comprehensive Exam includes a 9-month internship in a stem cell research laboratory<sup>1</sup> (BMED 593 /ASCI 593 /BIO 593), a quarter-long project course at Cal Poly (BMED 594 /ASCI 594 /BIO 594), a written report of their internship research, a written report of their quarter-long project course, and an oral presentation of their internship research. Through the completion of these components, students demonstrate their "ability to integrate the knowledge of the area, show critical and independent thinking, and demonstrate mastery of the subject matter."

<sup>1</sup> Students will complete their internship in stem cell research laboratories at UCSD, the Salk Institute, the Scripps Research Institute, Stanford University, or Novocell Inc.

## BS Biomedical Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
- 10A knowledge of contemporary issues
- 11An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

In addition to these objectives, the program prepares graduates to have:

- An understanding of biology and physiology
- The capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology

- The ability to make measurements on and interpret data from living systems
- The capability to address the problems associated with the interaction between living and non-living materials and systems.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

BMED 101	Introduction to the Biomedical Engineering Major	1
BMED 102	Introduction to Biomedical Engineering Analysis	1
BMED 212	Introduction to Biomedical Engineering	3
BMED 310	Biomedical Engineering Measurement and Analysis	4
BMED 410	Biomechanics	4
BMED 420	Principles of Biomaterials Design	4
BMED 425	Biomedical Engineering Transport	4
BMED 430	Biomedical Modeling and Simulation	2
BMED 440	Bioelectronics and Instrumentation	4
BMED 450	Contemporary Issues in Biomedical Engineering	4
or ENGR 451	Special Topics in Bioengineering	
BMED 455	Biomedical Engineering Design I	4
BMED 456	Biomedical Engineering Design II: Senior Project	4
BMED 460	Engineering Physiology	4
Approved Technical Electives		12
BMED 355	Electrical Engineering Concepts for Biomedical Engineering	
BMED 404	Applied Finite Element Analysis	
BMED 434	Microfabrication	
BMED 435	Microfabrication Laboratory	
BMED 445	Bipotential Instrumentation	
BMED 450	Contemporary Issues in Biomedical Engineering	
BMED 510	Principles of Tissue Engineering	
BMED 515	Introduction to Biomedical Imaging	
BMED 525	Skeletal Tissue Mechanics	
BMED 530	Biomaterials	
BMED 531	Micro Systems	
BMED 535	Bioseparations	
BMED 540	Microcirculation	
BMED 545	Cell Transplantation and Biotherapeutics	
BMED 550	Current and Evolving Topics in Biomedical Engineering	
BMED 555	Neural Systems Simulation and Modeling	
CHEM 444	Polymers & Coatings I	

CHEM 446	Surface Chemistry of Materials
CHEM 447	Polymers and Coatings Laboratory I
CSC 448	Bioinformatics Algorithms
EE 361	Electronics Laboratory
ENGR 451	Special Topics in Bioengineering
IME 327	Test Design and Analysis in Manufacturing Engineering
IME 356	Manufacturing Automation
IME 427	Design of Experiments
IME 430	Quality Engineering
IME 435	Reliability for Design and Testing
IME 577	Engineering Entrepreneurship
MATE 440	Welding Metallurgy and Joining of Advanced Materials
MATE 445	Joining of Advanced Materials Laboratory
ME 305	Introduction to Mechatronics
ME 326	Intermediate Dynamics
ME 343	Heat Transfer
ME 401	Stress Analysis

### SUPPORT COURSES

BIO 161	Introduction to Cell and Molecular Biology (B2/B4) <sup>1</sup>	4
CE 204	Mechanics of Materials I	3
Select from the following:		8
CHEM 124 & CHEM 125	General Chemistry for the Engineering Disciplines I and General Chemistry for the Engineering Disciplines II (B3/B4) <sup>1</sup>	
CHEM 127 & CHEM 128	General Chemistry for Agriculture and Life Science I and General Chemistry II (B3/B4) <sup>1</sup>	
CE 207	Mechanics of Materials II	3
or EE 321	Electronics	
CSC 231	Programming for Engineering Students	2
EE 201	Electric Circuit Theory	3
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
MATE 210	Materials Engineering	3
MATH 141 & MATH 142	Calculus I and Calculus II (B1) <sup>1</sup>	8
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
ME 228	Engineering Design Communication	2
ME 302	Thermodynamics I	3
ME 341	Fluid Mechanics I	3
PHYS 141	General Physics IA (Add'l Area B)	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
ZOO 331	Human Anatomy and Physiology I	5



or ZOO 332	Human Anatomy and Physiology II	
Approved Support Electives <sup>2</sup>		12
BIO 302	Human Genetics	
BIO 303	Survey of Genetics	
BIO 351	Principles of Genetics	
BIO 405	Developmental Biology	
BIO 426	Immunology	
BIO 441	Bioinformatics Applications	
BIO 452	Cell Biology	
BIO 475	Molecular Biology Laboratory	
BUS 310	Introduction to Entrepreneurship	
CHEM 216	Organic Chemistry for Life Sciences I	
CHEM 217	Organic Chemistry for Life Sciences II	
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 219	Organic Chemistry Laboratory III for Life Sciences	
CHEM 312	Survey of Organic Chemistry	
CHEM 313	Survey of Biochemistry and Biotechnology	
CHEM 316	Organic Chemistry I	
CHEM 317	Organic Chemistry II	
CHEM 318	Organic Chemistry III	
CHEM 371	Biochemical Principles	
CHEM 377	Chemistry of Drugs and Poisons	
CHEM 444	Polymers & Coatings I	
CHEM 445	Polymers & Coatings II	
CHEM 446	Surface Chemistry of Materials	
CE 207	Mechanics of Materials II	
CSC 448	Bioinformatics Algorithms	
EE 251	Electric Circuits Laboratory	
EE 321	Electronics	
EE 361	Electronics Laboratory	
KINE 406	Neuroanatomy	
MATH 344	Linear Analysis II	
MCRO 221	Microbiology	
or MCRO 224	General Microbiology I	
MCRO 225	General Microbiology II	
MCRO 320	Emerging Infectious Diseases	
MCRO 402	General Virology	
ME 251	Introduction to Detailed Design with Solid Modeling	
PHYS 417	Nonlinear Dynamical Systems	
ZOO 332	Human Anatomy and Physiology II	
ZOO 428	Hematology	
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		40
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		192

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved support electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		40

<sup>1</sup> Required in Support; also satisfies GE

## BS General Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context



9. A recognition of the need for, and an ability to engage in life-long learning
- 10A knowledge of contemporary issues
- 11 An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

CE 204	Mechanics of Materials I	3
CSC 234	C and Unix	3-4
or CSC 101	Fundamentals of Computer Science I	
EE 201	Electric Circuit Theory	3
ENGR 110 & ENGR 111	Engineering Science I and Engineering Science II	5
IME 314	Engineering Economics	3
MATE 210 & MATE 215	Materials Engineering and Materials Laboratory I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
ME 302	Thermodynamics I	3
ME 341	Fluid Mechanics I	3
ME 343	Heat Transfer	4
ENGR 481 & ENGR 482 & ENGR 483	Senior Project Design Laboratory I and Senior Project Design Laboratory II and Senior Project Design Laboratory III	6

Or

Sr. Project-appropriate engineering discipline

Concentration or Individual Course of Study <sup>1</sup> 41

### SUPPORT COURSES

BIO 213	Life Science for Engineers	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>2</sup>	2

Select from the following: 8

CHEM 124 General Chemistry for the Engineering  
& CHEM 125 Disciplines I  
and General Chemistry for the Engineering  
Disciplines II (B3/B4) <sup>2</sup>

CHEM 127 General Chemistry for Agriculture and Life  
& CHEM 128 Science I  
and General Chemistry II (B3/B4) <sup>2</sup>

ENGL 149 Technical Writing for Engineers (A3) <sup>2</sup> 4

MATH 141 Calculus I 8  
& MATH 142 and Calculus II (B1) <sup>2</sup>

MATH 143 Calculus III (Add'l Area B) <sup>2</sup> 4

MATH 241 Calculus IV 4

MATH 244 Linear Analysis I 4

Select from the following: 4

MATH 344 Linear Analysis II

STAT 312 Statistical Methods for Engineers

STAT 321 Probability and Statistics for Engineers and  
Scientists

STAT 350 Probability and Random Processes for  
Engineers (B6) <sup>2</sup>

PHYS 141 General Physics IA (Add'l Area B) 4

PHYS 132 General Physics II 8  
& PHYS 133 and General Physics III

Physical Science Electives

Select from the following: 8

CHEM 129 General Chemistry III

CHEM 216 Organic Chemistry for Life Sciences I

CHEM 217 Organic Chemistry for Life Sciences II

CHEM 312 Survey of Organic Chemistry

CHEM 313 Survey of Biochemistry and Biotechnology

GEOL 102 Introduction to Geology

GEOL 201 Physical Geology

GEOL 205 Earthquakes

GEOL 241 Physical Geology Laboratory

GEOL 305 Fundamentals of Seismology

PHYS 107 Introduction to Meteorology

PHYS 211 Modern Physics I

PHYS 212 Modern Physics II

PHYS 323 Optics

PHYS 417 Nonlinear Dynamical Systems

### GENERAL EDUCATION

(See GE program requirements below.) 40

Total units 184-185

- <sup>1</sup> A minimum of 36 units at 300-400 level must be completed, in a concentration, individual course of study or free electives, in addition to those required in Major, Support and General Education, for a total of 60 upper division units.

- <sup>2</sup> Required in Support; also satisfies GE

## Concentration or Individualized Course of Study (Select one)

- Bioengineering Concentration (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/biomedicalgeneralengineering/bsgeneralengineering/bioengineeringconcentration>)

### Individualized Course of Study

Permits students to pursue a course of study which meets their individual needs and interests. The individualized course of study consists of 41 units of technical electives with a minimum of 36 units at the 300-400 level. Courses are selected by the student with the advice and approval of the student's academic advisor and department chair.

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in major)		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		40

<sup>1</sup> Required in Support; also satisfies GE

## Bioengineering Concentration

CSC 341	Numerical Engineering Analysis	4
ENGR 451	Special Topics in Bioengineering	4
or BMED 450	Contemporary Issues in Biomedical Engineering	
IME 144	Introduction to Design and Manufacturing	4
MATH 344	Linear Analysis II	4
ME 326	Intermediate Dynamics	4
Select from the following:		12
BIO 361	Principles of Physiology	
BIO 432	Vertebrate/Human Anatomy and Physiology I	
BIO 442	Behavioral Ecology	
CHEM 371	Biochemical Principles	
CSC 471	Introduction to Computer Graphics	
EE 336	Microprocessor System Design	
EE 419	Digital Signal Processing	
ENVE 304	Process Thermodynamics	
ENVE 331	Introduction to Environmental Engineering	

ENVE 421	Mass Transfer Operations	
ENVE 443	Bioremediation Engineering I	
MATE 330	Composite Materials Systems	
ME 328	Introduction to Design	
ME 329	Intermediate Design	
ME 401	Stress Analysis	
ME 428	Senior Design Project I	
STAT 312	Statistical Methods for Engineers	
STAT 321	Probability and Statistics for Engineers and Scientists	
STAT 350	Probability and Random Processes for Engineers	
Approved Electives (300-level or higher)		9
Total units		41

## MS Biomedical Engineering

### Required Courses

BMED 460	Engineering Physiology <sup>1</sup>	4
BMED 530	Biomaterials	4
BMED 550	Current and Evolving Topics in Biomedical Engineering	4
BMED 563	Biomedical Engineering Graduate Seminar	2
BMED 599	Design Project (Thesis) <sup>2</sup>	9

### Approved Engineering, Science and Mathematics Electives

A minimum of 8 units from an advisor approved list of mathematics, statistics, biology, or analytic engineering courses, with at least 4 units at the 500 level. Typical courses could be, but are not limited to:

BMED 404	Applied Finite Element Analysis	
CSC 448	Bioinformatics Algorithms	
IME 503	Applied Statistical Methods in Engineering	
MATH 418	Partial Differential Equations	
MATH 501	Analytic Methods in Applied Mathematics	
MATH 502	Numerical Methods in Applied Mathematics	
STAT 513	Applied Experimental Design and Regression Models	

Remaining elective units are advisor approved. <sup>3</sup>

Total units	45
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<sup>1</sup> BMED 460 is not required for BMED undergraduates as it is a core course in the major.

<sup>2</sup> BMED 591 and/or BMED 592 can substitute for up to 4 units of thesis. Recommended for BMED BS 4+1 students.

<sup>3</sup> BMED 520 is required for non-BMED undergraduate majors.

## MS Biomedical Engineering, Specialization in Stem Cell Research

### Required Courses

BMED 460	Engineering Physiology	4
BMED 510	Principles of Tissue Engineering	4

BMED 512	Biomedical Engineering Horizons	4
BMED 515	Introduction to Biomedical Imaging	4
BMED 545	Cell Transplantation and Biotherapeutics	4
BMED 563	Biomedical Engineering Graduate Seminar	2
BMED/ASCI/BIO 593	Stem Cell Research Internship	10
BMED/ASCI/BIO 594	Applications in Stem Cell Research	2
BIO 534	Principles of Stem Cell Biology	2
BIO 590 & ASCI 581	Seminar in Biology and Graduate Seminar in Animal Science	2
<b>Approved Electives</b>		
Approved engineering, science and mathematics electives		7
Total units		45

## Civil & Environmental Engineering

Engineering Bldg. (13), Room 266

Phone: 805.756.2947

Email: [ceenve@calpoly.edu](mailto:ceenve@calpoly.edu)

<http://ceenve.calpoly.edu>

Department Chair: Daniel C. Jansen

College of Engineering Advising Center

Engineering South (40), Room 111

Phone: 805.756.1461

### Academic Programs

Program name	Program type
Civil Engineering	BS
Environmental Engineering	BS
Civil and Environmental Engineering	MS

The Civil and Environmental Engineering Department at Cal Poly, San Luis Obispo offers a rigorous and engaging educational experience that fully embraces Cal Poly's "Learn by Doing" approach.

### Undergraduate Programs

#### BS Civil Engineering

Graduates of a civil engineering program must have the engineering skills needed to plan, design, construct, and maintain infrastructure and industrial facilities. In addition, graduates must have the broad education necessary to communicate effectively with other engineers, architects, planners, administrators, government officials, and the general public. The faculty and staff of the Civil Engineering program at Cal Poly understand these needs and take pride in preparing their students for the challenges associated with engineering practice.

The Civil Engineering program at Cal Poly has quickly grown into one of the largest and most respected programs in California and the nation. The program consistently attracts top student candidates because of its modern, well-equipped laboratories, the close interaction that occurs between undergraduates and full-time faculty, and a strong reputation among employers in the civil engineering and construction industries. Scientific depth is included within the curriculum for those students who are interested in graduate study.

The Civil Engineering program recognizes the importance of student organizations and strongly supports the American Society of Civil Engineers (ASCE) Student Chapter as well as Chi Epsilon, the national civil engineering honor society. These student groups sponsor opportunities for professional development, community service, and social activities which help to complement the formal academic program. The ASCE Student Chapter, an active member of the campus community, has been recognized as the nation's most outstanding civil engineering student organization twice during the past decade.

The Civil Engineering program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. The program's mission is to prepare students for successful careers in civil engineering by providing a high quality, practice-oriented education that emphasizes design project experiences, "hands-on" laboratory activities, and teamwork. The program's faculty, in consultation with

civil engineering practitioners and alumni, have developed a number of educational objectives to support this mission. These objectives are:

- Successfully perform essential engineering functions in civil engineering practice;
- Communicate effectively with industry professionals and community members;
- Work in an ethical and professional manner to positively impact the environment and society;
- Pursue life-long learning through continuing education opportunities, graduate degrees, and/or other certification; and
- Progress towards professional licensure.

The undergraduate curriculum in civil engineering is designed to support the educational objectives. Therefore, the curriculum includes broad coverage of mathematics, engineering and basic sciences, liberal arts, humanities, and social sciences. The program also includes a number of required civil engineering courses that are designed to ensure that students become proficient in four areas of civil engineering: geotechnical, structural, transportation, and water resources.

All majors must complete a two-quarter senior design project that focuses on current civil engineering design procedures, standards and multiple realistic constraints. Topics related to interpersonal communication, teamwork, leadership, ethics, and professional practice are also covered so that students have an understanding of the issues and skills to become a successful design professional.

Flexibility within the curriculum allows students to select from a wide range of upper division civil engineering technical electives. Student use these technical electives to focus in one of the four areas of civil engineering noted above or to design a "general" curriculum that allows for a broad range of civil engineering interests. Students must formally consult with a faculty advisor prior to selecting and enrolling in upper division civil engineering technical electives.

#### BS Environmental Engineering

The BS program in Environmental Engineering is concerned with the interrelation of people, materials, and processes in a complex and changing environment. The broad field of environmental engineering includes control of air and water pollution, environmental health and safety, solid waste, hazardous waste management, and pollution prevention.

The program offers a sound background in the fundamentals of thermodynamics, fluid mechanics, mass transfer, water resources, and geotechnical engineering. The problem-oriented approach to instruction, in modern well-equipped laboratories, provides an excellent opportunity to gain understanding and experience of the discipline. The program is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

The main focus of the program is to prepare graduates for practice in professional engineering. Thus, Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum, especially in the numerous design-centered laboratories. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

The Environmental Engineering program educational objectives are that its graduates will:

- Apply environmental engineering principles to analyze and solve real-world engineering challenges.
- Think independently, engage in life-long learning, and continue their development as professionals.
- Are prepared to pursue graduate study and licensure.
- Communicate effectively, both orally and in writing, and collaborate successfully in teams.
- Address the ethical, societal, and global issues encountered in environmental engineering.

An engineering approach to the subject enables graduates of the program to pursue careers in industry, consulting firms, and public agencies concerned with air and water pollution control, groundwater, potable water treatment, solid waste management, and hazardous waste management.

Various program constituencies, such as graduates and employers, are consulted periodically for input on the appropriateness as well as the attainment of the educational objectives. Other indicators such as student/alumni placement and success rates in the statewide fundamentals in engineering examination are also used to evaluate attainment.

The Society of Environmental Engineers offers technical programs and other activities, including field trips each year to study typical installations of systems. Student memberships also are available in the Air and Waste Management Association, the California Water Pollution Control Association, and the Water Environment Federation.

## Graduate Program

### MS Civil and Environmental Engineering

#### General Characteristics

The Master of Science program in Civil and Environmental Engineering has the following objectives:

- Job-entry education for the more complex areas of engineering, such as research and development, innovative design, systems analysis and design, and managerial engineering;
- Updating opportunities for practicing engineers;
- Graduate preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree.

#### Prerequisites

For admission as a classified graduate student, an applicant must hold a bachelor's degree in engineering or a closely related physical science with a minimum GPA of 3.0 in the last 90 quarter units (60 semester) attempted. Applicants are required to submit satisfactory scores for the General (Aptitude) Test of the Graduate Record Examination. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make-up any deficiencies before advancement to classified graduate standing.

Information pertaining to specific requirements for admission to graduate standing (classified or conditionally classified) may be obtained from the Graduate Coordinator, Civil and Environmental Engineering Department.

## Program of Study

Graduate students must file a formal study plan with their advisor, department, college and university graduate studies office by no later than the end of the quarter in which the 12th unit of approved courses is completed. The formal program of study must include a minimum of 45 units (at least 23 of which must be at the 500 level). With the graduate advisor's approval, students select their elective units in one of the following areas of study: geotechnical engineering, structural engineering, transportation and planning, or water resources and environmental engineering.

The broad curriculum requirements for the MS in Civil and Environmental Engineering are:

- a minimum of 45 total units;
- 2 units of Graduate Seminar (CE 591 and CE 592)
- a minimum of 20 units of advisor approved electives within the major;
- a minimum of 8 units of advisor-approved electives outside the primary area of focus;
- at least 23 units of the 45 unit program at the 500 level;
- a comprehensive examination (non-thesis option) or a written thesis with oral defense (thesis option).

Two program options are available:

### Thesis option

36 units of advisor-approved coursework and 9 units of research/design resulting in a written thesis and oral defense examination administered by a panel of at least three faculty.

### Non-thesis option

45 units of advisor-approved coursework and a 1-unit comprehensive examination consisting of written and oral component administered by a panel of three faculty (maximum of three opportunities to pass this examination). Not an option for the blended BS+MS program.

## Blended BS + MS Civil and Environmental Engineering

The blended program provides motivated students with an accelerated route to an MS in Civil and Environmental Engineering, with simultaneous conferring of both bachelor's and master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status.

### Eligibility

Students majoring in BS Civil Engineering or BS Environmental Engineering may be eligible to pursue the blended program toward an MS in Civil and Environmental Engineering after completing all required support and CE/ENVE 300-level classes. Participation in the program is based on prior academic performance and other measures of professional promise, with a minimum GPA of 3.0. Please see Graduate Programs (<http://catalog.calpoly.edu/graduateeducation/#generalpoliciesgoverninggraduatestudiestext>) for additional eligibility criteria.

### Program of Study

Students originating in the BS Civil and Environmental Engineering programs are required to take:



Select one of the following Series:

4-6

#### Series A

CE 466	Senior Design Project I
CE 467	Senior Design Project II

#### Series B

CE 468	Community Engineering Senior Design Project I
CE 469	Community Engineering Senior Design Project II

#### Series C

ENVE 466	Senior Project Design Laboratory I	
ENVE 467	Senior Project Design Laboratory II	
CE 599	Design Project (Thesis)	9
or ENVE 599	Design Project (Thesis)	

The blended program allows students to earn graduate credit for several of their senior electives, effectively decreasing the summed unit requirements for both degrees. Students in the blended program are required to complete a thesis.

## BS Civil Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
- 10A knowledge of contemporary issues
- 11An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

CE 111	Introduction to Civil Engineering	1
CE 112	Design Principles in Civil Engineering	2
CE 113	Computer Aided Drafting in Civil Engineering	2

Select from the following:

CE 201	Mechanics of Materials (6)	
CE 204 & CE 207	Mechanics of Materials I and Mechanics of Materials II (3, 3)	
CE 321 & CE 322	Fundamentals of Transportation Engineering and Fundamentals of Transportation Engineering Laboratory	5
CE 251	Programming Applications in Engineering	2
CE 259	Civil Engineering Materials	2
CE 336	Water Resources Engineering	4
CE 337	Hydraulics Laboratory	1
CE 351	Structural Analysis	4
CE 355	Reinforced Concrete Design	4
CE 381 & CE 382	Geotechnical Engineering and Geotechnical Engineering Laboratory	5

Select from the following:

CE 466 & CE 467	Senior Design Project I and Senior Design Project II	6
CE 468 & CE 469	Community Engineering Senior Design Project I and Community Engineering Senior Design Project II	

### Technical Electives<sup>2, 3</sup>

In consultation with faculty advisor, select from CE 356, CE 371 or 24 CM 371, ENVE 325, any 400-500 level CE and ENVE courses not required in the major (maximum of 4 units from the following list):

Select a maximum of 4 units from the following:

ARCE 305	Masonry Design
ARCE 372	Steel Structures Design Laboratory
ARCE 403	Advanced Steel Structures Laboratory
BRAE 345	Aerial Photogrammetry and Remote Sensing
BRAE 447	Advanced Surveying with GIS Applications
BRAE 532	Water Wells and Pumps
CE/ME/BMED 404	Applied Finite Element Analysis
CHEM 341	Environmental Chemistry: Water Pollution
CM 334	Construction Law
CM 432	Design-Build Project Management
CRP 420	Land Use Law
CRP 435	Transportation Theory
CRP/NR 404	Environmental Law
CRP/NR 408	Water Resource Law and Policy
ERSC/GEOL 401	Field-Geology Methods
ERSC/GEOL 402	Geologic Mapping
GEOL 415	Structural Geology
IME 314	Engineering Economics
MATE 425	Corrosion Engineering
MATE 450	Fracture and Failure Analysis
MATH 344	Linear Analysis II

SS 423	Soil and Water Chemistry	
SS 442	Soil Vadose Zone and Groundwater Processes	
SS/BIO/NR 421	Wetlands	
<b>SUPPORT COURSES</b>		
BIO 213	Life Science for Engineers (B2) <sup>1</sup>	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>1</sup>	2
BRAE 239	Engineering Surveying	4
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
CHEM 125	General Chemistry for the Engineering Disciplines II	4
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
ENVE 331	Introduction to Environmental Engineering	4
GEOL 201	Physical Geology	3
MATE 210	Materials Engineering	3
MATE 215	Materials Laboratory I	1
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
ME 302	Thermodynamics I	3
ME 341	Fluid Mechanics I	3
PHYS 141	General Physics IA (Add'l Area B) <sup>1</sup>	4
PHYS 132 & PHYS 133	General Physics II and General Physics III	8
STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
Approved Engineering Science Elective <sup>2, 4</sup>		
Select from the following:		2-4
CSC 231	Programming for Engineering Students	
CSC 234	C and Unix	
CSC 341	Numerical Engineering Analysis	
CSC 342	Numerical Analysis I	
EE 201	Electric Circuit Theory	
IME 314	Engineering Economics	
MATH 211	Computational Mathematics I	
MATH 304	Vector Analysis	
MATH 344	Linear Analysis II	
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		40
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		189-191

- <sup>1</sup> Required in Support; also satisfies GE
- <sup>2</sup> Consultation with advisor is recommended prior to selecting technical electives or approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>3</sup> Additional guidelines for technical electives:
  1. More than 4 units of coursework outside CE/ENVE is only permitted in special/ unusual cases and requires written justification by the student, and approval by the Department Chair.
  2. CE 400, CE 500 and ENVE 400, ENVE 500 require a course substitution form and no more than 4 total units are allowed.
  3. No more than 8 combined units of CE 470 / ENVE 470, CE 471 / ENVE 471, CE 570 / ENVE 570, CE 571 / ENVE 571 can be credited.
  4. Co-op, graduate seminar, senior project/design, and thesis courses are not permitted.
  5. Only one course can be credited for CE 458 / CE 558; CE 459 / CE 556.
- <sup>4</sup> The courses selected to satisfy this requirement may not be used to satisfy other major, support, or general education requirements (no double counting of coursework).

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		40

- <sup>1</sup> Required in Support; also satisfies GE

## BS Environmental Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
10. A knowledge of contemporary issues
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

#### MAJOR COURSES

CE 113	Computer Aided Drafting in Civil Engineering	2
Select from the following:		6
CE 201	Mechanics of Materials (6)	
CE 204	Mechanics of Materials I	
& CE 207	and Mechanics of Materials II (3, 3)	
CE 336	Water Resources Engineering	4
CE 337	Hydraulics Laboratory	1
CE 381	Geotechnical Engineering	4
CE 434	Groundwater Hydraulics and Hydrology	4
ENVE 111	Introduction to the Environmental Engineering Profession	1
ENVE 264	Environmental Fluid Mechanics	4
ENVE 304	Process Thermodynamics	3
ENVE 309	Noise and Vibration Control	3
ENVE 325	Air Quality Engineering	4
ENVE 331	Introduction to Environmental Engineering	4
ENVE 411	Air Pollution Control	3

ENVE 421	Mass Transfer Operations	4
ENVE 426	Air Quality Measurements	3
ENVE 434	Water Chemistry and Water Quality Measurements	4
ENVE 436	Introduction to Solid and Hazardous Waste Management	4
ENVE 438	Water and Wastewater Treatment Design	3
ENVE 450	Industrial Pollution Prevention	4
ENVE 455	Environmental Health and Safety	4
ENVE 466	Senior Project Design Laboratory I	4
& ENVE 467	and Senior Project Design Laboratory II	
Technical Electives <sup>1,2</sup>		11

#### SUPPORT COURSES

CHEM 127	General Chemistry for Agriculture and Life Science I (B3/B4) <sup>3,4</sup>	4
CHEM 128	General Chemistry II	4
CHEM 129	General Chemistry III	4
CHEM 312	Survey of Organic Chemistry (trans equiv CHEM 212)	5
CSC 231	Programming for Engineering Students	2
ENGL 149	Technical Writing for Engineers (A3) <sup>4</sup>	4
MATH 141	Calculus I (B1) <sup>4</sup>	4
MATH 142	Calculus II (B1) <sup>4</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>4</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
MCRO 221	Microbiology (B2) <sup>4</sup>	4
or MCRO 224	General Microbiology I	
ME 211	Engineering Statics	3
PHYS 141	General Physics IA (Add'l Area B) <sup>4</sup>	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
STAT 312	Statistical Methods for Engineers (B6) <sup>4</sup>	4

#### GENERAL EDUCATION (GE)

(See GE program requirements below.)

#### FREE ELECTIVES

Free Electives	0
Total units	190

<sup>1</sup> To be selected in accordance with the A.B.E.T. 24-unit and Culminating Engineering Design requirement, in consultation with your academic advisor.

<sup>2</sup> No more than 4 units of ENVE 400 or CE 400 can be counted towards technical electives.

<sup>3</sup> CHEM 124, CHEM 125 substitute for CHEM 127, CHEM 128.

<sup>4</sup> Required in Support; also satisfies GE

### General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .

- Minimum of 8 units required at the 300 level.

<b>Area A Communication</b>	
A1	Expository Writing 4
A2	Oral Communication 4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup> 0
<b>Area B Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup> 0
B2	Life Science (4 units in Support) <sup>1</sup> 0
B3	Physical Science (4 units in Support) <sup>1</sup> 0
B4	One lab taken with either a B2 or B3 course
B6	Upper-division Area B (4 units in Support) <sup>1</sup> 0
Additional Area B units (8 units in Support) <sup>1</sup> 0	
<b>Area C Arts and Humanities</b>	
C1	Literature 4
C2	Philosophy 4
C3	Fine/Performing Arts 4
C4	Upper-division elective (PHIL 340 or NR 360 recommended) 4
<b>Area D/E Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement) (40404) 4
D2	Political Economy 4
D3	Comparative Social Institutions 4
D4	Self Development (CSU Area E) 4
Total units 40	

<sup>1</sup> Required in Support; also satisfies GE

## MS Civil and Environmental Engineering

### Program Learning Objectives

1. Apply and synthesize technical knowledge to solve solutions to advanced Civil and Environmental Engineering problems in a chosen subject area of mastery (Environmental, Geotechnical, Structural, Water Resources, or Transportation Engineering).
2. Demonstrate the ability for lifelong learning necessary for the constantly evolving nature of engineering design and practice.
3. Effectively communicate technical information orally and in writing.
4. Demonstrate independent thinking and decision making skills.
5. Integrate ethical and professional components into the solutions of complex engineering problems.
6. Evaluate engineering systems for sustainable performance and create solutions to encompass a project's full lifecycle.

#### Required Courses

CE 591	Graduate Seminar I	1
CE 592	Graduate Seminar II	1
Select one of the following options:		9
CE/ENVE 599 Design Project (Thesis)		

Or 8 units of advisor approved analysis and design electives within the major (nonthesis option) and

CE 596 Comprehensive Examination

#### Advisor approved analysis and design electives within a specific area of focus

Select from the following: <sup>1</sup> 20-26

CE 400	Special Problems <sup>2</sup>
CE 401	Advanced Mechanics of Materials
CE 405	Concrete Materials
CE 407	Structural Dynamics
CE 421	Traffic Engineering
CE 422	Highway Geometrics and Design
CE 423	Intelligent Transportation Systems
CE 424	Public Transportation
CE 434	Groundwater Hydraulics and Hydrology
CE 431	Coastal Hydraulics I
CE 432	Coastal Hydraulics II
CE 433	Open Channel Hydraulics
CE 434	Groundwater Hydraulics and Hydrology
CE 440	Hydraulic Systems Engineering
CE 454	Structural Design
CE 455	Design of Timber Structures
CE 456	Seismic Principles for Civil and Environmental Engineering
CE 457	Bridge Engineering
CE 458	Fiber Reinforced Polymer (FRP) Design
CE 459	FRP Strengthening of Reinforced Concrete Structures
CE 464	Professional Practice
CE 474	Environmental Compliance and Permitting
CE 475	Civil Infrastructure and Building Systems
CE 481	Analysis and Design of Shallow Foundations
CE 482	Conventional Subsurface Exploration
CE 486	Introduction to Geological Engineering
CE 487	Design of Foundations and Slopes in Rock
CE 488	Engineering Risk Analysis
CE 500	Individual Study <sup>2</sup>
CE 501	Advanced Matrix Analysis of Structures I
CE 502	Advanced Matrix Analysis of Structures II
CE 504	Finite Element Analysis I
CE 505	Finite Element Analysis II
CE 521	Highway Pavement Designs
CE 523	Transportation Systems Planning
CE 525	Airport Planning and Design
CE 527	Sustainable Mobility
CE 528	Transportation Economics and Analysis
CE 529	Modeling and Simulation in Transportation
CE 533	Advanced Water Resources Engineering
CE 535	Water Resources Systems Planning and Analysis
CE 537	Groundwater Contamination
CE 539	Environmental Hydraulics

CE 552	Analysis and Seismic Design of Reinforced Concrete
CE 553	Ductile Design of Steel Structures
CE 555	Advanced Civil Engineering Materials Laboratory
CE 557	Seismic Analysis and Design for Civil Engineers
CE 559	Prestressed Concrete Design
CE 571	Selected Advanced Laboratory
CE 573	Public Works Administration
CE 574	Computer Applications in Civil Engineering
CE 581	Advanced Geotechnical Engineering
CE 582	Geotechnical In-Situ Testing
CE 583	Geotechnical Earthquake Engineering
CE 584	Lateral Support Systems
CE 585	Slope Stability Analysis
CE 586	Analysis and Design of Deep Foundations
CE 588	Ground Improvement
CE 589	Geosynthetics Engineering
ENVE 400	Special Problems <sup>2</sup>
ENVE 411	Air Pollution Control
ENVE 421	Mass Transfer Operations
ENVE 434	Water Chemistry and Water Quality Measurements
ENVE 436	Introduction to Solid and Hazardous Waste Management
ENVE 438	Water and Wastewater Treatment Design
ENVE 439	Solid Waste Management
ENVE 443	Bioremediation Engineering I
ENVE 450	Industrial Pollution Prevention
ENVE 455	Environmental Health and Safety
ENVE 466	Senior Project Design Laboratory I
ENVE 467	Senior Project Design Laboratory II
ENVE 500	Individual Study <sup>2</sup>
ENVE 535	Physico-Chemical Water and Wastewater Treatment
ENVE 536	Biological Wastewater Treatment Processes Engineering
ENVE 542	Sustainable Environmental Engineering
ENVE 551	Environmental Unit Operations
ENVE 552	Environmental Problems of the Semiconductor Industry

**Advisor approved electives outside the primary area of focus**

Approved electives outside the primary area of focus <sup>1</sup>	8-14
<b>Total units</b>	<b>45</b>

<sup>1</sup> To be selected after consultation with your academic advisor and the CE/ENVE graduate coordinator

<sup>2</sup> No more than 4 total units of technical elective credit from CE 400, CE 500 and ENVE 400, ENVE 500 combined.



## Computer Engineering

Engineering East Building (20), Room 215

Phone: 805.756.1229

[www.cpe.calpoly.edu/](http://www.cpe.calpoly.edu/)

Director: John Oliver

College of Engineering Advising Center

Engineering South (40), Room 114

Phone: 805.756.1461

### Academic Program

Program name	Program type
Computer Engineering	BS

The mission of the Computer Engineering Program (CPE) is to provide students with a well-rounded education encompassing the theory and practice of selected, balanced topics in electrical engineering and computer science, to enable students to contribute and continue their education in a wide range of computer-related engineering careers. The program seeks to emphasize "hands-on" experience, problem solving skills, the creative process and responsible action. Through professional development activities, faculty contribute to the advancement of the state-of-the-art, and strive to directly incorporate this experience in the classroom.

Four educational objectives inspire alumni of the Cal Poly Computer Engineering program to excel professionally:

1. Make positive contributions to society and the practice of computer engineering by applying foundational knowledge and the engineering process to solve engineering problems.
2. Work in an individual or team environment in a socially responsible manner.
3. Engage in lifelong learning through continued professional development or graduate studies.
4. Communicate effectively and demonstrate leadership.

The program prepares graduates for professional practice in industry, as well as continued study in graduate school. Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum, especially in the numerous design-centered laboratories. In the required senior capstone experience, which is a group-project based course completed over two quarters, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

This integrated approach allows students to work effectively in such diverse areas as digital systems simulation and digital control systems. Knowledge and laboratory experience in computer architecture and structures provide the understanding necessary to design and build computer systems, computer networks and digital communications systems. A thorough knowledge of modern microprocessors and microcontrollers enables the graduate to apply these technologies in applications such as robotics, medical and data acquisition. Twelve units of technical electives allow students the option to specialize in an area of special interest. Current areas of special interest include:

- robotics
- embedded systems
- computer architecture
- computer networks

- computer based controls
- software systems
- graphics and multimedia
- electronics implementation and VLSI

In addition to a sound theoretical background in computer engineering concepts, students experience practical design courses intended to build problem solving skills. Laboratory courses supplement the program to develop "hands on" skills in all areas of study. Students are exposed to a wide variety of computing equipment: microprocessor development systems, workstations and personal computers, and advanced network hardware and software.

Active student groups of interest to computer engineering majors include the Computer Engineering Society, the IEEE Student Branch, the Association for Computing Machinery, the Society of Women Engineers, Women Involved in Software and Hardware, and many other project-oriented student clubs and activities.

For more information about the CPE program, please visit <http://eadvice.calpoly.edu>.

### Undergraduate Program BS Computer Engineering

The Bachelor of Science in Computer Engineering prepares students interested in the design and application of computers and computer-based systems. The program incorporates a firm foundation in both electrical engineering and computer science, with a focus on the integration of hardware and software systems.

### Blended and Graduate Programs

Graduates of the Computer Engineering Program are qualified for admission to Cal Poly master's degree programs in electrical engineering, computer science, general engineering, and biomedical engineering.

The opportunity also exists for advanced students to begin graduate study in these areas prior to completion of the BS degree, via a blended program. This provides a number of advantages to qualified students, and makes it possible for completion of both the BS and MS degrees in as little as five years. Computer engineering students participating in a blended program are permitted to fulfill the computer engineering senior project requirement with the master's degree thesis. Students must be prepared for engineering practice via the curriculum which culminates in a major design experience based on the knowledge and skills acquired in earlier coursework and incorporating engineering standards and realistic constraints, as listed in the ABET Engineering Criteria. Further details are provided in the graduate study sections for each of these programs.

## BS Computer Engineering

### Program Learning Outcomes

In addition to the general abilities expected of College of Engineering graduates, computer engineering students are expected to graduate with:

1. An ability to apply knowledge of mathematics, science, and engineering.

2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to function on multidisciplinary teams.
5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for, and an ability to engage in life-long learning.
10. A knowledge of contemporary issues.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

In addition to the general abilities expected of College of Engineering graduates, computer engineering students are expected to graduate with:

- Knowledge of probability and statistics, including applications appropriate to CPE program objectives.
- Knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to CPE program objectives.
- Knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

CPE 100	Computer Engineering Orientation	1
CPE 123	Introduction to Computing <sup>1</sup>	4
CPE 101	Fundamentals of Computer Science I	4
CPE 102	Fundamentals of Computer Science II	4
or CPE 108	Accelerated Introduction to Computer Science	
CPE 103	Fundamentals of Computer Science III	4
Select from the following:		4
CPE 129 & CPE 169	Digital Design and Digital Design Laboratory (3, 1)	
CPE/EE 133	Digital Design (4)	
Select from the following:		4

CPE 229 & CPE 269	Computer Design and Assembly Language Programming and Computer Design and Assembly Language Programming Laboratory (3, 1)	
CPE/EE 233	Computer Design and Assembly Language Programming (4)	
CPE 315	Computer Architecture	4
CPE 329	Programmable Logic and Microprocessor-Based Systems Design	4
CPE 350	Capstone I	4
CPE 357	Systems Programming	4
CPE 450	Capstone II	4
CPE 453	Introduction to Operating Systems	4
CPE 461 & CPE 462	Senior Project I and Senior Project II	5
CPE 464	Introduction to Computer Networks	4
CSC 141	Discrete Structures I	4
EE 112	Electric Circuit Analysis I	2
EE 211 & EE 241	Electric Circuit Analysis II and Electric Circuit Analysis Laboratory II	4
EE 212 & EE 242	Electric Circuit Analysis III and Electric Circuit Analysis Laboratory III	4
EE 228	Continuous-Time Signals and Systems	4
EE 306 & EE 346	Semiconductor Device Electronics and Semiconductor Device Electronics Laboratory	4
EE 307 & EE 347	Digital Electronics and Integrated Circuits and Digital Electronics and Integrated Circuits Laboratory	4

### Technical Electives <sup>2,3,4</sup>

Select from the following: 12

Any 300-500 level CPE Course	
Any 300-500 level CSC or EE Course <sup>4</sup>	
CPE 400	Special Problems for Undergraduates (up to 4 units) <sup>7</sup>
Up to four units from the following:	
BMED 440	Bioelectronics and Instrumentation
BMED 450	Contemporary Issues in Biomedical Engineering (Tissue Engineering)
CHEM 312	Survey of Organic Chemistry
CSC 300	Professional Responsibilities
ENGR 551	Advanced Topics in Bioengineering (Microcirculation)
IME 301	Operations Research I
IME 303	Project Organization and Management
IME 314	Engineering Economics
IME 319	Human Factors Engineering
IME 351	Advanced Material Removal Process Design
IME 401	Sales Engineering
IME 457	Advanced Electronic Manufacturing
IME/MATE 458/CPE 488	Microelectronics and Electronics Packaging
MATE 430	Microfabrication
MATE 435	Microfabrication Laboratory

MATE 550	Micro Systems	
MATH 304	Vector Analysis	
MATH 408	Complex Analysis I	
MATH 409	Complex Analysis II	
MATH 412	Introduction to Analysis I	
MATH 413	Introduction to Analysis II	
MATH 414	Introduction to Analysis III	
MATH 451	Numerical Analysis I <sup>5</sup>	
MATH 453	Numerical Optimization	
ME 318	Mechanical Vibrations	
ME 341	Fluid Mechanics I	
ME 343	Heat Transfer	
ME 405	Mechatronics	
ME 415	Energy Conversion	
PHYS 322	Vibrations and Waves	
PHYS 323	Optics	
PHYS 403	Nuclear and Particle Physics	
PHYS 408	Electromagnetic Fields and Waves I	
PHYS 412	Solid State Physics	
PHYS 424	Theoretical Physics	
PHYS 452	Solid State Physics Laboratory	
UNIV/HNRS 424	Design of Museum Displays of Science, Engineering and Technology	

**SUPPORT COURSES**

BIO 213	Life Science for Engineers (B2) <sup>6</sup>	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>6</sup>	2
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>6</sup>	4
Approved CSC, EE, Math or Science Elective. <sup>2</sup>		3-4
Select from the following:		
CHEM 125	General Chemistry for the Engineering Disciplines II	
CSC 349	Design and Analysis of Algorithms	
EE 328	Discrete Time Signals and Systems	
MATE 210 & MATE 215	Materials Engineering and Materials Laboratory I (both needed)	
ME 211	Engineering Statics	
ENGL 149	Technical Writing for Engineers (A3) <sup>6</sup>	4
IME 156 or IME 157 or IME 458	Basic Electronics Manufacturing Electronics Manufacturing Microelectronics and Electronics Packaging	2-4
MATH 141 & MATH 142	Calculus I and Calculus II (B1) <sup>6</sup>	8
MATH 143	Calculus III (Add'l Area B) <sup>6</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
PHYS 141	General Physics IA (Add'l Area B) <sup>6</sup>	4
PHYS 132 & PHYS 133	General Physics II and General Physics III	8
PHYS 211	Modern Physics I	4

STAT 350	Probability and Random Processes for Engineers (B6) <sup>6</sup>	4
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**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 40

**FREE ELECTIVES**

Free Electives 0

Total units 193-196

- 1 An additional 4 units of approved technical electives may be substituted, although new students are strongly encouraged to take CSC 123/CPE 123.
- 2 Consultation with advisor is recommended prior to selecting approved elective; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- 3 The courses selected to satisfy this requirement may not be used to satisfy other major, support, or general education requirements (no double counting of coursework).
- 4 The following courses may not be used to satisfy this requirement: COOP units; BUS 499; CSC 302, CSC 303, CSC 310, CSC 400, CSC 500; EE 321, EE 361, EE 400, EE 460, EE 500, EE 563.
- 5 Not for students with credit in CSC 341 or CSC 342.
- 6 Required in Major/Support; also satisfies GE
- 7 CPE 400 requires an approved course substitution form and no more than 4 total units required.

**General Education (GE) Requirements**

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A Communication		
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B Science and Mathematics		
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C Arts and Humanities		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E Society and the Individual		
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4

D4	Self Development (CSU Area E)	4
Total units		40

<sup>1</sup> Required in Major/Support; also satisfies GE

## Computer Science

Computer Science Bldg. (14), Room 254

Phone: 805.756.2824

<https://www.csc.calpoly.edu/>

Department Chair: Ignatios Vakalis

### College of Engineering Advising Center

Engineering South (40), Room 114

Phone: 805.756.1461

## Academic Programs

Program name	Program type
Computer Engineering	BS
Computer Science	BS, MS, Minor
Software Engineering	BS

The Computer Science Department educates students in the discipline of computer science and teaches them to apply their education to solve practical problems in a socially responsible way. To support the department's educational mission, faculty engage in research and professional development.

In all of the department's programs, laboratory experiences ensure that students have both a theoretical and practical understanding of computer science. Individual and team projects, culminating in the capstone experience of a senior project, reinforce concepts and provide students the opportunity to apply and communicate their knowledge.

The department has active student chapters of the Association for Computing Machinery, IEEE Computer Society and Upsilon Pi Epsilon (the national computer honor society). Student teams compete in national competitions and student organizations sponsor industry/student events.

The department, with industry support, provides a modern computing environment that includes the most current software tools running on a variety of workstations and servers. Projects in advanced courses are supported by specialized laboratories for databases, computer architecture, operating systems, software engineering, computer networks, computer graphics, and human/computer interaction.

## Undergraduate Programs

### BS Computer Science

The BS Computer Science program provides in-depth study of computer science fundamentals and practice, including programming concepts and languages, software engineering, operating systems and computer architecture.

In addition, the major offers a wide choice of technical electives that allows students to focus on particular areas of computer science and their application. Typical areas of emphasis include databases, distributed computing, software engineering, programming languages, graphical user interfaces, operating systems, computer networks, computer graphics, and artificial intelligence.

The curriculum is project-oriented and develops students' ability to solve problems using modern computing concepts. Students can expect to complete many projects in a variety of programming languages and on a variety of computer systems. During their last year

of study, students complete a senior project, either individually or as members of a team, spanning two academic quarters.

Graduates of the computer science program are well prepared to become successful professionals and to pursue graduate study.

They are sought by the computer industry for positions as software developers, quality assurance and test engineers, and other technical positions in computer-related industries.

The Computer Science program has three broad program educational objectives (PEOs) that graduates are expected to attain within a few years of graduation.

Graduates are expected to:

- Apply current technical knowledge and skills to develop and implement computer solutions in their professional careers and can adapt to new technologies. Graduates are expected to attain sufficient background to successfully pursue graduate studies if they wish to do so;
- Effectively communicate and work as part of a team in order to be an effective member of the workplace and society, and
- Have a positive and ethical attitude concerning the computing profession and its impact on individuals, organizations and society. Have a desire to continue to grow intellectually and professionally in their chosen field.

The BS Computer Science program is accredited by the Computing Accreditation Commission of ABET, <http://www.ABET.org>.

### BS Software Engineering

The BS in Software Engineering prepares students to become software professionals who develop software products on time, within budget, and that meet customer requirements. Building on the fundamentals of computer science, the program focuses on practical aspects of building and deploying software systems in a socially responsible way. The program's educational mission supports the faculty in research and professional development that keeps them current in their field and in touch with current industry practices and trends.

The hallmark of the program is "hands on" experience where students follow a curriculum that builds on traditional computer science but differs from the BS in Computer Science in the following ways:

1. Classes emphasize the team approach to building software and provide leadership opportunities for every student.
2. Classes place an emphasis on software processes and lifecycles.
3. Classes include significant learning in engineering and management areas such as quality assurance, testing, metrics, maintenance, configuration management and interpersonal management skills.
4. The curriculum has a stronger emphasis on mathematics and the use of engineering methods in software design.

The software engineering curriculum culminates in a year-long capstone sequence where the students work in teams to build a large software system. Students are required to develop an ability to work in a significant application domain through the requirement of an advisor approved cooperative education experience.

Department programs are designed to be flexible. Although freshmen choose their major when they apply for admission, students can



easily switch among software engineering, computer engineering and computer science since the lower division curricula are similar.

The software industry increasingly requires both a software and an engineering background for their cutting edge projects. Graduates with a BS in Software Engineering can expect to find significant opportunities in software development and management, software engineering and marketing.

The Software Engineering program has three broad program educational objectives (PEOs) that graduates are expected to attain within a few years of graduation.

Graduates are expected to:

- Apply the software engineering body of knowledge and other technical knowledge and skills to specify, design, and implement complex software systems and multiple levels of abstraction. Students will have sufficient background to successfully pursue graduate studies if they wish to do so;
- Can effectively communicate and work as part of a multidisciplinary team in order to be an effective member of the workplace and society, and
- Have a positive and ethical attitude concerning the computing profession and its impact on individuals, organizations and society. Have a desire to continue to grow intellectually and professionally in their chosen field.

The BS Software Engineering program is accredited by the Engineering Accreditation Commission of ABET, <http://www.ABET.org>.

## BS Computer Engineering

This program is jointly administered by the Computer Science Department and the Electrical Engineering Department. For information regarding this program, please refer to Computer Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/computerengineering>).

## Computer Science Minor

Nearly all disciplines use the capabilities of computers. The minor consists of a core and upper-division courses selected in consultation with an advisor. The core provides common knowledge and skills needed by anyone who wishes to advance further in computer science. The remaining courses enable students to specialize in areas relevant to their goals.

### Prerequisite

CSC/CPE 101	Fundamentals of Computer Science I (must be taken before admission to the minor)	4
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Admission to the minor is limited and selection is based upon the applicant's performance in:

CSC/CPE 101	Fundamentals of Computer Science I	4
CSC/CPE 102	Fundamentals of Computer Science II	4
CSC/CPE 103	Fundamentals of Computer Science III	4
CSC 141	Discrete Structures I	4

Students who intend to minor in computer science should consult the College of Engineering Advising Center website for GPA and course grade requirements for admission to the minor. In addition, they should contact the Advising Center for further information *before* planning to enter the minor.

Before formally applying, students must make an appointment at the College of Engineering Advising Center. The computer science minor is not open to CSC, CPE or Software Engineering (SE) major students. Questions concerning the minor should be directed to the Advising Center.

## Graduate Program

### MS Computer Science

The MS program in Computer Science offers students the opportunity to prepare for careers in several areas of emphasis including software engineering, computer architecture, programming languages, theory of computing, operating systems, database systems, distributed computing, computer networks, artificial intelligence, computer graphics, and human computer interaction. The program is designed for maximum flexibility to allow students to concentrate in one or more areas of study.

Admission to the program requires a baccalaureate degree from an accredited institution and good standing at the last college attended. Applicants with a bachelor's degree in computer science, software engineering, or computer engineering are required to have a minimum 3.0 grade point average in the last 90 quarter hours (60 semester hours) of study, including a minimum 3.0 grade point average in major courses. A minimum grade point average of 3.25 is required for all other applicants. A satisfactory score on the General Graduate Record Exam (GRE) is required; applicants are expected to achieve the following minimum scores: 425 verbal, 650 quantitative, 4.0 analytical writing on the old GRE test, or their matching equivalents on the revised GRE test (currently standing at 148 verbal, 151 quantitative and 4.0 analytical writing). A satisfactory score on the TOEFL is required for applicants with degrees from institutions from countries where English is not a native language; expected minimum scores are: 80 for internet-based test with a minimum 20 on each portion; 213 for computer-based test; 550 for paper-based test, plus 4.5 on TWE. All applicants must provide three letters of recommendation. Women and underrepresented minorities are strongly encouraged to apply for admission.

Qualified U.S. students who do not have an undergraduate degree in computer science, computer engineering, or software engineering may be admitted as conditionally classified students. Conditionally classified students must complete the necessary undergraduate coursework to be admitted to candidacy. While fulfilling the undergraduate requirements, conditionally classified students retain official status as graduate students in the University.

Conditionally classified students may advance to candidacy by completing each of the following undergraduate courses with a "B" or better grade. These courses do not count toward the graduate degree:

CSC/CPE 103	Fundamentals of Computer Science III	4
CSC/CPE 307	Introduction to Software Engineering	4
or CSC/CPE 308	Software Engineering I	
CSC/CPE 315	Computer Architecture	4
CSC/CPE 349	Design and Analysis of Algorithms	4
CSC/CPE 357	Systems Programming	4
CSC/CPE 430	Programming Languages I	4
CSC 445	Theory of Computation I	4
CSC/CPE 453	Introduction to Operating Systems	4

The department may offer several graduate teaching assistantships. Preference is given to continuing graduate students and experienced teachers. Other grant, fellowship, scholarship and loan information can be obtained from the Financial Aid office.

## Degree Requirements

Students must file a Formal Study Plan with the Computer Science Department office no later than the end of the quarter in which they complete the twelfth unit of coursework to be counted toward the degree. The formal study plan identifies specific courses to be taken to fulfill requirements of the MS degree. The formal study plan may be amended with approval of the graduate coordinator.

## Blended BS + MS Computer Science

The department offers an accelerated program for motivated, well-qualified students. The blended program allows BS Computer Science, BS Computer Engineering, and BS Software Engineering students to progress toward the Master's degree while still undergraduates. The scheduling flexibility provided by the program enables students to complete the BS and MS degrees efficiently.

## Eligibility

Students majoring in BS Computer Science, BS Software Engineering, and BS Computer Engineering are eligible to apply to the blended program if they meet the following minimum eligibility requirements:

- Junior status and completion of 20 units of CSC/CPE courses past CSC 103/CPE 103;
- Meet the minimum GPA requirement of 3.0; and
- Have not enrolled in senior project.

Participation in the program is based on prior academic performance and other measures of professional promise. Students are selected by a faculty committee.

## Program of Study

Students in the blended program complete all courses required for the MS degree and all courses required for the BS degree except the senior project. Completion of the MS thesis may satisfy the senior project requirement. Please refer to your undergraduate degree department office for any restrictions on the master's thesis where a major design experience is required to complete the undergraduate degree.

Upon completion of the program, students are awarded the BS and the MS degrees at the same graduation ceremony and at the same time. Degrees are earned concurrently.

## BS Computer Science

### Program Learning Outcomes

1. An ability to apply knowledge of computing and mathematics appropriate to the discipline.
2. An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
3. An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
4. An ability to function effectively on teams to accomplish a common goal.

5. An understanding of professional, ethical, legal, security, and social issues and responsibilities.
6. An ability to communicate effectively with a range of audiences.
7. An ability to analyze the local and global impact of computing on individuals, organizations, and society.
8. Recognition of the need for, and an ability to engage in continuing professional development.
9. An ability to use current techniques, skills, and tools necessary for computing practice.
10. An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension and the tradeoffs involved in design choices.
11. An ability to apply design and development principles in the construction of software systems of varying complexity.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generatededucationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

CSC/CPE 123	Introduction to Computing <sup>4</sup>	4
CSC/CPE 101	Fundamentals of Computer Science I	4
Select from the following:		4
CSC/CPE 102	Fundamentals of Computer Science II	
CSC/CPE 108	Accelerated Introduction to Computer Science	
CSC/CPE 103	Fundamentals of Computer Science III	4
CSC 141	Discrete Structures I	4
CSC/CPE 225	Introduction to Computer Organization <sup>1</sup>	4
CSC/CPE 300	Professional Responsibilities	4
Select from the following:		4/8
CSC/CPE 307	Introduction to Software Engineering (4)	
CSC 308 & CSC 309	Software Engineering I and Software Engineering II (8) <sup>2</sup>	
CSC/CPE 315	Computer Architecture	4
CSC/CPE 349	Design and Analysis of Algorithms	4
CSC/CPE 357	Systems Programming	4
CSC/CPE 430	Programming Languages I	4
CSC 445	Theory of Computation I	4
CSC/CPE 453	Introduction to Operating Systems	4
CSC 491 & CSC 492	Senior Project Lab I and Senior Project Lab II (2, 3)	5
Technical Electives <sup>3</sup>		24/28

Select from the lists in technical electives guidelines below

**SUPPORT COURSES**

Select from the following: 4-5

BIO 111	General Biology (B2)	
BIO 161	Introduction to Cell and Molecular Biology (B2)	
BIO 213	Life Science for Engineers	
& ENGR 213	and Bioengineering Fundamentals (B2)	
BOT 121	General Botany (B2)	
MCRO 221	Microbiology (B2)	
MCRO 224	General Microbiology I (B2)	
ENGL 149	Technical Writing for Engineers (A3)	4
MATH 141	Calculus I (B1)	4
MATH 142	Calculus II (B1)	4
STAT 321	Probability and Statistics for Engineers and Scientists (B6)	4
or STAT 312	Statistical Methods for Engineers	

Approved Support Electives <sup>3</sup> 8

The courses selected may not be used to satisfy other Major, Support, or General Education requirements (no double counting of coursework)

Select from the following: 8

ENGL 302	Writing: Advanced Composition	
ENGL 310	Corporate Communication	
ENGL 392	English Grammar for Writers and Teachers	
PSY 252	Social Psychology	
PSY 302	Behavior in Organizations	
RELS 370	Religion, Gender, and Society	
COMS 201	Advanced Public Speaking	
COMS 301	Business and Professional Communication	
COMS 315	Intergroup Communication	

**Mathematics/Statistics Electives**

Select from the following: 8

MATH 143	Calculus III	
MATH 206	Linear Algebra I	
MATH 241	Calculus IV	
MATH 244	Linear Analysis I	
MATH 248	Methods of Proof in Mathematics	
MATH 306	Linear Algebra II	
MATH 335	Graph Theory	
MATH 336	Combinatorial Math	
MATH 437	Game Theory	
MATH 470	Selected Advanced Topics	
STAT 325	Introduction to Probability Models	

**Science Elective (Additional Area B)**

Select from the following: 4

BIO 111	General Biology	
BIO 161	Introduction to Cell and Molecular Biology	
BOT 121	General Botany	
CHEM 124	General Chemistry for the Engineering Disciplines I	
MCRO 221	Microbiology	
MCRO 224	General Microbiology I	
PHYS 141	General Physics IA (no double counting of units)	

Physical Science Electives (B3/B4) (Additional Area B) 12

CHEM 124	General Chemistry for the Engineering Disciplines I	
& CHEM 129	and General Chemistry for the Engineering Disciplines II	
	and General Chemistry III	
PHYS 141	General Physics IA	
& PHYS 132	and General Physics II	
& PHYS 133	and General Physics III	

**GENERAL EDUCATION (GE)**

(See list of GE program requirements below.) 40

**FREE ELECTIVES**

Free Electives 0

**Total units** 181-182

- 1 CPE 129 & CPE 169 or CPE 133, and CPE 229 & CPE 269 or CPE 233 may be substituted for CSC 225.
- 2 CSC 309 counts as technical elective.
- 3 Consultation with advisor is recommended prior to selecting technical electives or approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- 4 An additional 4 units of CSC/CPE technical electives may be substituted, although new students are strongly encouraged to take CSC/CPE 123

**Technical Electives Guidelines**

Courses used to satisfy any other major, support, or general education requirement are not allowed to count toward Technical Elective requirement. Credit/No Credit grading is not allowed.

Select Technical Electives from the following: <sup>1</sup>

CSC/CPE 301	Personal Software Process
CSC/CPE 305	Individual Software Design and Development
CSC/CPE 309	Software Engineering II
CSC/CPE 316	Micro Controllers and Embedded Applications
CSC 342	Numerical Analysis I
CSC/CPE 344	Music Programming
CSC 358	Computer System Administration
CSC/CPE 365	Introduction to Database Systems
CSC/CPE 366	Database Modeling, Design and Implementation
CSC/CPE 369	Distributed Computing I
CSC/CPE 378	Interactive Entertainment Engineering
CSC 400	Special Problems
CSC/CPE 402	Software Requirements Engineering
CSC/CPE 405	Software Construction

CSC/CPE 406	Software Deployment
CSC/CPE 409	Current Topics in Software Engineering
CSC/CPE 416	Autonomous Mobile Robotics
CSC/CPE 419	Applied Parallel Computing
CSC/CPE 431	Programming Languages II
CSC/CPE 435	Introduction to Object Oriented Design Using Graphical User Interfaces
CSC/CPE 436	Mobile Application Development
CSC/CPE 437	Dynamic Web Development
CSC/CPE 448	Bioinformatics Algorithms
CSC/CPE 449	Current Topics in Algorithms
CSC/CPE 454	Implementation of Operating Systems
CSC/CPE 456	Introduction to Computer Security
CSC/CPE 458	Current Topics in Computer Systems
CSC/CPE 464	Introduction to Computer Networks
CSC/CPE 465	Advanced Computer Networks
CSC/CPE 466	Knowledge Discovery from Data
CSC/CPE 468	Database Management Systems Implementation
CSC/CPE 469	Distributed Computing II
CSC/CPE 471	Introduction to Computer Graphics
CSC/CPE 473	Advanced Rendering Techniques
CSC/CPE 474	Computer Animation
CSC/CPE 476	Real-Time 3D Computer Graphics Software
CSC/CPE 478	Current Topics in Computer Graphics
CSC 479	Computer Graphics Seminar
CSC/CPE 480	Artificial Intelligence
CSC/CPE 481	Knowledge Based Systems
CSC/CPE 483	Current Topics in Human-Computer Interaction
CSC/CPE 484	User-Centered Interface Design and Development

CSC/CPE 485	Autonomous Robot Navigation
CSC 486	Human-Computer Interaction Theory and Design
CSC/CPE 489	Current Topics in Artificial Intelligence
CSC 490	Selected Advanced Topics
CSC 496	Selected Advanced Laboratory
CSC 508	Software Engineering I
CSC 509	Software Engineering II
CSC/CPE 520	Computer Architecture
CSC 530	Languages and Translators
CSC 540	Theory of Computation II
CSC 541	Numerical Methods
CSC 550	Operating Systems
CSC/CPE 556	Computer Security
CSC 560	Database Systems
CSC/CPE 564	Computer Networks: Research Topics
CSC 568	Distributed Systems
CSC/CPE 569	Distributed Computing
CSC 570	Current Topics in Computer Science
CSC 572	Computer Graphics
CSC/CPE 580	Artificial Intelligence
CSC/CPE 581	Computer Support for Knowledge Management
CSC 582	Introduction to Natural Language Processing
CPE 336	Microprocessor System Design
CPE 400	Special Problems for Undergraduates
CPE 415	Microcomputer Systems
CPE 428	Computer Vision
CPE 482	Advanced Topics in Systems for Computer Engineering
CPE 488	Microelectronics and Electronics Packaging

The following restrictions must be satisfied.

4 units must be satisfied by a course that has as a prerequisite either

- 1) An upper-division course required by the major (excluding CSC 357) or
- 2) Another technical elective.

Select from the following:

CSC/CPE 316	Micro Controllers and Embedded Applications
CSC/CPE 366	Database Modeling, Design and Implementation
CSC/CPE 402	Software Requirements Engineering
CSC/CPE 405	Software Construction
CSC/CPE 406	Software Deployment

CSC/CPE 409	Current Topics in Software Engineering	CSC/CPE 564	Computer Networks: Research Topics
CSC/CPE 416	Autonomous Mobile Robotics	CSC 568	Distributed Systems
CSC/CPE 431	Programming Languages II	CSC 572	Computer Graphics
CSC/CPE 435	Introduction to Object Oriented Design Using Graphical User Interfaces	CSC/CPE 580	Artificial Intelligence
CSC/CPE 437	Dynamic Web Development	CSC/CPE 581	Computer Support for Knowledge Management
CSC/CPE 449	Current Topics in Algorithms	CSC 582	Introduction to Natural Language Processing
CSC/CPE 454	Implementation of Operating Systems	CPE 415	Microcomputer Systems
CSC/CPE 456	Introduction to Computer Security	Up to 4 units may be taken from CSC 358, CSC 400, CPE 400, CSC 479 (maximum 2 units), or CSC 490.	
CSC/CPE 458	Current Topics in Computer Systems	Up to 4 units may be taken from approved external electives.	
CSC/CPE 465	Advanced Computer Networks	Select from the following:	
CSC/CPE 466	Knowledge Discovery from Data	AERO 450	Introduction to Aerospace Systems Engineering
CSC/CPE 468	Database Management Systems Implementation	ART 384	Digital 3D Modeling and Design
CSC/CPE 469	Distributed Computing II	BUS 310	Introduction to Entrepreneurship
CSC/CPE 473	Advanced Rendering Techniques	CHEM 216	Organic Chemistry for Life Sciences I
CSC/CPE 474	Computer Animation	CHEM 217	Organic Chemistry for Life Sciences II
CSC/CPE 476	Real-Time 3D Computer Graphics Software	CHEM 218	Organic Chemistry for Life Sciences III
CSC/CPE 478	Current Topics in Computer Graphics	CHEM 312	Survey of Organic Chemistry
CSC 479	Computer Graphics Seminar	ECON 339	Econometrics
CSC/CPE 481	Knowledge Based Systems	EE 201 & EE 251	Electric Circuit Theory and Electric Circuits Laboratory
CSC/CPE 483	Current Topics in Human-Computer Interaction	EE 314	Introduction to Communication Systems
CSC/CPE 484	User-Centered Interface Design and Development	EE 336	Microprocessor System Design
CSC 486	Human-Computer Interaction Theory and Design	EE 424	Introduction to Remote Sensing
CSC/CPE 489	Current Topics in Artificial Intelligence	ENVE 542	Sustainable Environmental Engineering
CSC 508	Software Engineering I	IME 301	Operations Research I
CSC 509	Software Engineering II	IME 314	Engineering Economics
CSC/CPE 520	Computer Architecture	IME 356	Manufacturing Automation
CSC 530	Languages and Translators	MATH 206	Linear Algebra I
CSC 540	Theory of Computation II	MATH 241	Calculus IV
CSC 541	Numerical Methods	MATH 242	Differential Equations I
CSC 550	Operating Systems	MATH 244	Linear Analysis I
CSC/CPE 556	Computer Security	MATH 248	Methods of Proof in Mathematics
CSC 560	Database Systems	MATH 304	Vector Analysis
		MATH 341	Theory of Numbers
		MATH 350	Mathematical Software
		MATH 412	Introduction to Analysis I
		ME 211	Engineering Statics
		ME 212	Engineering Dynamics
		ME 405	Mechatronics
		PHIL 412	Epistemology
		PHIL 422	Philosophy of Mind
		PSY 329	Research Methods in Psychology
		PSY 333	Quantitative Research Methods for the Behavioral Sciences
		PSY 351	Group Dynamics
		PSY 457	Memory and Cognition
		STAT 323	Design and Analysis of Experiments I
		STAT 324	Applied Regression Analysis



STAT 330	Statistical Computing with SAS	
<b>Total units</b>		24/28

- <sup>1</sup> A total of 28 technical elective units selected from upper-division and graduate CSC and CPE courses that are open to those in the major and that are not otherwise required by the major. Subtract 4 units if CSC 308 and CSC 309 are taken instead of CSC 307. Add 4 units if CSC 123 is not taken.

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
<b>Total units</b>		<b>40</b>

- <sup>1</sup> Required in Support; also satisfies GE.

## BS Software Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering.
2. An ability to design and conduct experiments, as well as to analyze and interpret data.
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

4. An ability to function on multi-disciplinary teams.
5. An ability to identify, formulate, and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for, and an ability to engage in life-long learning.
- 10A knowledge of contemporary issues.
- 11 An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

CSC/CPE 123	Introduction to Computing <sup>2</sup>	4
CSC/CPE 101	Fundamentals of Computer Science I	4
Select from the following:		4
CSC/CPE 102	Fundamentals of Computer Science II	
CSC/CPE 108	Accelerated Introduction to Computer Science	
CSC/CPE 103	Fundamentals of Computer Science III	4
CSC 141	Discrete Structures I	4
CSC/CPE 225	Introduction to Computer Organization	4
CSC/CPE 300	Professional Responsibilities	4
CSC/CPE 305	Individual Software Design and Development	4
CSC/CPE 308	Software Engineering I	4
CSC/CPE 309	Software Engineering II	4
CSC/CPE 349	Design and Analysis of Algorithms	4
CSC/CPE 357	Systems Programming	4
CSC/CPE 402	Software Requirements Engineering	4
CSC/CPE 405	Software Construction	4
CSC/CPE 406	Software Deployment	4
CSC/CPE 430	Programming Languages I	4
CSC/CPE 484	User-Centered Interface Design and Development	4
CSC 491 & CSC 492	Senior Project Lab I and Senior Project Lab II	5
Select Technical Electives based on guidelines below <sup>3</sup>		20
<b>SUPPORT COURSES</b>		
Select from the following:		4-5

BIO 111	General Biology (B2 & B4) <sup>1</sup>	
BIO 161	Introduction to Cell and Molecular Biology (B2 & B4) <sup>1</sup>	
BIO 213 & ENGR 213	Life Science for Engineers and Bioengineering Fundamentals (B2) <sup>1</sup>	
BOT 121	General Botany (B2 & B4) <sup>1</sup>	
MCRO 221	Microbiology (B2 & B4) <sup>1</sup>	
MCRO 224	General Microbiology I (B2 & B4) <sup>1</sup>	
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
IME 314	Engineering Economics	3
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
Select from the following:		4
MATH 248	Methods of Proof in Mathematics	
MATH 304	Vector Analysis	
MATH 335	Graph Theory	
MATH 336	Combinatorial Math	
MATH 451	Numerical Analysis I	
PSY 201/202	General Psychology (D4) <sup>1</sup>	4
PSY 350	Teamwork	4
or PSY 351	Group Dynamics	
Science Electives (B3/4, Additional 4 units Area B) <sup>1</sup>		12
Select either:		
CHEM 124 & CHEM 125	General Chemistry for the Engineering Disciplines I	
CHEM 129	and General Chemistry for the Engineering Disciplines II	
	and General Chemistry III	
PHYS 141 & PHYS 132 & PHYS 133	General Physics IA and General Physics II and General Physics III	
STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		36
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		188-189

## Technical Electives Guidelines

Courses used to satisfy any other Major, Support, or General Education requirement are not allowed to count toward Technical Elective requirement. Credit/No Credit grading is not allowed.

Contact the CSC Department for further information.

Select Technical Electives from the following: <sup>4</sup>

CSC/CPE 301	Personal Software Process
CSC/CPE 315	Computer Architecture

CSC/CPE 316	Micro Controllers and Embedded Applications
CSC 342	Numerical Analysis I
CSC/CPE 344	Music Programming
CSC 358	Computer System Administration
CSC/CPE 365	Introduction to Database Systems
CSC/CPE 366	Database Modeling, Design and Implementation
CSC/CPE 369	Distributed Computing I
CSC/CPE 378	Interactive Entertainment Engineering
CSC 400	Special Problems
CSC/CPE 409	Current Topics in Software Engineering
CSC/CPE 416	Autonomous Mobile Robotics
CSC/CPE 419	Applied Parallel Computing
CSC/CPE 431	Programming Languages II
CSC/CPE 435	Introduction to Object Oriented Design Using Graphical User Interfaces
CSC/CPE 436	Mobile Application Development
CSC/CPE 437	Dynamic Web Development
CSC 445	Theory of Computation I
CSC/CPE 448	Bioinformatics Algorithms
CSC/CPE 449	Current Topics in Algorithms
CSC/CPE 453	Introduction to Operating Systems
CSC/CPE 454	Implementation of Operating Systems
CSC/CPE 456	Introduction to Computer Security
CSC/CPE 458	Current Topics in Computer Systems
CSC/CPE 464	Introduction to Computer Networks
CSC/CPE 465	Advanced Computer Networks
CSC/CPE 466	Knowledge Discovery from Data
CSC/CPE 468	Database Management Systems Implementation
CSC/CPE 469	Distributed Computing II
CSC/CPE 471	Introduction to Computer Graphics
CSC/CPE 473	Advanced Rendering Techniques

CSC/CPE 474	Computer Animation
CSC/CPE 476	Real-Time 3D Computer Graphics Software
CSC/CPE 478	Current Topics in Computer Graphics
CSC 479	Computer Graphics Seminar
CSC/CPE 480	Artificial Intelligence
CSC/CPE 481	Knowledge Based Systems
CSC/CPE 483	Current Topics in Human-Computer Interaction
CSC/CPE 485	Autonomous Robot Navigation
CSC 486	Human-Computer Interaction Theory and Design
CSC/CPE 489	Current Topics in Artificial Intelligence
CSC 490	Selected Advanced Topics
CSC 508	Software Engineering I
CSC 509	Software Engineering II
CSC/CPE 520	Computer Architecture
CSC 530	Languages and Translators
CSC 540	Theory of Computation II
CSC 541	Numerical Methods
CSC 550	Operating Systems
CSC/CPE 556	Computer Security
CSC 560	Database Systems
CSC/CPE 564	Computer Networks: Research Topics
CSC 568	Distributed Systems
CSC/CPE 569	Distributed Computing
CSC 570	Current Topics in Computer Science
CSC 572	Computer Graphics
CSC/CPE 580	Artificial Intelligence
CSC/CPE 581	Computer Support for Knowledge Management
CSC 582	Introduction to Natural Language Processing
CPE 336	Microprocessor System Design
CPE 400	Special Problems for Undergraduates
CPE 415	Microcomputer Systems
CPE 428	Computer Vision
CPE 482	Advanced Topics in Systems for Computer Engineering
CPE 488	Microelectronics and Electronics Packaging

The following restrictions must be satisfied

4 of these units must be satisfied by a course that has as a prerequisite either

- 1) An upper-division course required by the major (excluding CSC 357) or
- 2) Another technical elective

Select from the following:

CSC/CPE 316	Micro Controllers and Embedded Applications
CSC/CPE 366	Database Modeling, Design and Implementation
CSC/CPE 409	Current Topics in Software Engineering
CSC/CPE 416	Autonomous Mobile Robotics
CSC/CPE 431	Programming Languages II
CSC/CPE 435	Introduction to Object Oriented Design Using Graphical User Interfaces
CSC/CPE 437	Dynamic Web Development
CSC 445	Theory of Computation I
CSC/CPE 449	Current Topics in Algorithms
CSC/CPE 454	Implementation of Operating Systems
CSC/CPE 456	Introduction to Computer Security
CSC/CPE 465	Advanced Computer Networks
CSC/CPE 466	Knowledge Discovery from Data
CSC/CPE 468	Database Management Systems Implementation
CSC/CPE 469	Distributed Computing II
CSC/CPE 473	Advanced Rendering Techniques
CSC/CPE 474	Computer Animation
CSC/CPE 476	Real-Time 3D Computer Graphics Software
CSC/CPE 478	Current Topics in Computer Graphics
CSC 479	Computer Graphics Seminar
CSC/CPE 481	Knowledge Based Systems
CSC/CPE 483	Current Topics in Human-Computer Interaction
CSC 486	Human-Computer Interaction Theory and Design
CSC/CPE 489	Current Topics in Artificial Intelligence
CSC 508	Software Engineering I
CSC 509	Software Engineering II
CSC/CPE 520	Computer Architecture
CSC 530	Languages and Translators
CSC 540	Theory of Computation II
CSC 541	Numerical Methods
CSC 550	Operating Systems
CSC/CPE 556	Computer Security

CSC 560	Database Systems
CSC/CPE 564	Computer Networks: Research Topics
CSC 568	Distributed Systems
CSC 572	Computer Graphics
CSC/CPE 580	Artificial Intelligence
CSC/CPE 581	Computer Support for Knowledge Management
CSC 582	Introduction to Natural Language Processing
CPE 415	Microcomputer Systems
Up to 4 units may be taken from CSC 358, CSC 400, CPE 400, CSC 479 (maximum 2 units), or CSC 490.	
Up to 4 units may be taken from approved external electives.	
Select from the following:	
AERO 450	Introduction to Aerospace Systems Engineering
ART 384	Digital 3D Modeling and Design
BUS 310	Introduction to Entrepreneurship
CHEM 216	Organic Chemistry for Life Sciences I
CHEM 217	Organic Chemistry for Life Sciences II
CHEM 218	Organic Chemistry for Life Sciences III
CHEM 312	Survey of Organic Chemistry
ECON 339	Econometrics
EE 201 & EE 251	Electric Circuit Theory and Electric Circuits Laboratory
EE 314	Introduction to Communication Systems
EE 336	Microprocessor System Design
EE 424	Introduction to Remote Sensing
ENVE 542	Sustainable Environmental Engineering
IME 301	Operations Research I
IME 356	Manufacturing Automation
MATH 206	Linear Algebra I
MATH 242	Differential Equations I
MATH 248	Methods of Proof in Mathematics
MATH 304	Vector Analysis
MATH 341	Theory of Numbers
MATH 350	Mathematical Software
MATH 412	Introduction to Analysis I
ME 211	Engineering Statics
ME 212	Engineering Dynamics
ME 405	Mechatronics
PHIL 412	Epistemology
PHIL 422	Philosophy of Mind
PSY 329	Research Methods in Psychology
PSY 333	Quantitative Research Methods for the Behavioral Sciences
PSY 351	Group Dynamics
PSY 457	Memory and Cognition
STAT 323	Design and Analysis of Experiments I
STAT 324	Applied Regression Analysis
STAT 330	Statistical Computing with SAS
<b>Total units</b>	<b>20</b>

- <sup>1</sup> Required in Major/Support; also satisfies GE.
- <sup>2</sup> An additional 4 units of CSC/CPE technical electives may be substituted, although new students are strongly encouraged to take CSC 123/CPE 123.
- <sup>3</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>4</sup> A total of 20 technical elective units selected from upper-division and graduate CSC and CPE courses that are open to those in the major and that are not otherwise required by the major. 24 units if CSC 123 is not taken.

## General Education (GE) Requirements

- 72 units required, 36 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support)	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Support) <sup>1</sup>	0
<b>Total units</b>		<b>36</b>

- <sup>1</sup> Required in Major/Support; also satisfies GE.

## Computer Science Minor

### Required Courses

CSC/CPE 102	Fundamentals of Computer Science II	4
CSC/CPE 103	Fundamentals of Computer Science III	4
CSC 141	Discrete Structures I	4
CSC/CPE 225	Introduction to Computer Organization	4

CSC/CPE 357	Systems Programming	4
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**Approved Electives<sup>1</sup>**

Select from the following:	12
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CPE 482	Advanced Topics in Systems for Computer Engineering
CSC 342	Numerical Analysis I
CSC 358	Computer System Administration
CSC 400	Special Problems <sup>2</sup>
CSC 445	Theory of Computation I
CSC 486	Human-Computer Interaction Theory and Design
CSC 490	Selected Advanced Topics <sup>2</sup>
CSC 508	Software Engineering I
CSC 509	Software Engineering II
CSC 530	Languages and Translators
CSC 540	Theory of Computation II
CSC 541	Numerical Methods
CSC 550	Operating Systems
CSC 560	Database Systems
CSC 570	Current Topics in Computer Science
CSC 572	Computer Graphics
CSC/CPE 300	Professional Responsibilities
CSC/CPE 301	Personal Software Process
CSC/CPE 305	Individual Software Design and Development
CSC/CPE 307	Introduction to Software Engineering
CSC/CPE 308	Software Engineering I
CSC/CPE 309	Software Engineering II
CSC/CPE 315	Computer Architecture
CSC/CPE 316	Micro Controllers and Embedded Applications
CSC/CPE 344	Music Programming
CSC/CPE 349	Design and Analysis of Algorithms
CSC/CPE 365	Introduction to Database Systems
CSC/CPE 366	Database Modeling, Design and Implementation
CSC/CPE 369	Distributed Computing I
CSC/CPE 378	Interactive Entertainment Engineering
CSC/CPE 402	Software Requirements Engineering
CSC/CPE 405	Software Construction
CSC/CPE 406	Software Deployment

CSC/CPE 409	Current Topics in Software Engineering
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CSC/CPE 416	Autonomous Mobile Robotics
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CSC/CPE 419	Applied Parallel Computing
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CSC/CPE 430	Programming Languages I
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CSC/CPE 431	Programming Languages II
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CSC/CPE 435	Introduction to Object Oriented Design Using Graphical User Interfaces
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CSC/CPE 436	Mobile Application Development
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CSC/CPE 437	Dynamic Web Development
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CSC/CPE 448	Bioinformatics Algorithms
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CSC/CPE 449	Current Topics in Algorithms
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CSC/CPE 453	Introduction to Operating Systems
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CSC/CPE 454	Implementation of Operating Systems
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CSC/CPE 456	Introduction to Computer Security
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CSC/CPE 458	Current Topics in Computer Systems
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CSC/CPE 464	Introduction to Computer Networks
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CSC/CPE 465	Advanced Computer Networks
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CSC/CPE 466	Knowledge Discovery from Data
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CSC/CPE 468	Database Management Systems Implementation
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CSC/CPE 469	Distributed Computing II
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CSC/CPE 471	Introduction to Computer Graphics
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CSC/CPE 473	Advanced Rendering Techniques
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CSC/CPE 474	Computer Animation
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CSC/CPE 476	Real-Time 3D Computer Graphics Software
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CSC/CPE 478	Current Topics in Computer Graphics
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CSC 479	Computer Graphics Seminar <sup>3</sup>
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CSC/CPE 480	Artificial Intelligence
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CSC/CPE 481	Knowledge Based Systems
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CSC/CPE 483	Current Topics in Human-Computer Interaction
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CSC/CPE 484	User-Centered Interface Design and Development	CSC 560	Database Systems		
CSC/CPE 485	Autonomous Robot Navigation	CSC 564	Computer Networks: Research Topics		
CSC/CPE 489	Current Topics in Artificial Intelligence	CSC 568	Distributed Systems		
CSC/CPE 520	Computer Architecture	CSC 569	Distributed Computing		
CSC/CPE 556	Computer Security	CSC 570	Current Topics in Computer Science		
CSC/CPE 564	Computer Networks: Research Topics	CSC 572	Computer Graphics		
CSC/CPE 569	Distributed Computing	CSC 580	Artificial Intelligence		
CSC/CPE 580	Artificial Intelligence	CSC 581	Computer Support for Knowledge Management		
CSC/CPE 581	Computer Support for Knowledge Management	CSC 582	Introduction to Natural Language Processing		
CSC/CPE 582	Introduction to Natural Language Processing	<b>Thesis/Project and Seminar</b>			
		CSC 590	Thesis Seminar	1	
		CSC 596	Thesis I	2	
		CSC 597	Thesis II	3	
		CSC 599	Thesis III	3	
		<b>Electives</b>			
		Selected with Graduate Coordinator approval			16
		Total units			45

For further information or advisement students should communicate with the Graduate Coordinator of the Computer Science Department.

Total units	32
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For further information or advisement students should communicate with the Graduate Coordinator of the Computer Science Department.

- 1 Choose from CSC/CPE upper-division courses open to CSC majors. Must be approved via the CSC minor form upon acceptance to the minor.
- 2 Requires form/approval
- 3 Maximum of 2 units

## MS Computer Science

### Program Learning Objectives

1. Prepared for successful careers in a computing-related field, including careers that involve positions of technical leadership and advanced responsibility
2. Exposed to a broad range of computer-science subjects in coursework that emphasizes technical subject matter.
3. Able to perform, analyze, evaluate and synthesize computer science research, in particular, know how to present research findings in oral and written form.
4. Prepared for life-long learning in the discipline of computer science, including continued formal graduate education.
5. Aware of the impacts of computing technology on society and understand ethics and responsible professional conduct.

The MS degree requires at least 45 units beyond the undergraduate degree. Courses must be chosen according to the following requirements:

Select from the following:	20
CSC 508	Software Engineering I
CSC 509	Software Engineering II
CSC 520	Computer Architecture
CSC 530	Languages and Translators
CSC 540	Theory of Computation II
CSC 541	Numerical Methods
CSC 550	Operating Systems
CSC 556	Computer Security

## Electrical Engineering

Engineering East Bldg. (20), Room 200  
Phone: 805.756.2781  
[www.ee.calpoly.edu](http://www.ee.calpoly.edu)

Department Chair: Dennis Derickson

College of Engineering Advising Center  
Engineering South (40), Room 114  
Phone: 805.756.1461

### Academic Programs

Program name	Program type
Computer Engineering	BS
Electrical Engineering	BS, MS

The Electrical Engineering Department offers a Bachelor of Science degree and a Master of Science degree in Electrical Engineering, and supports the Bachelor of Science degree in Computer Engineering. Both undergraduate degrees are accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

The mission of the Electrical Engineering Department is to educate students to achieve excellence in the discipline of electrical engineering and to teach them to apply their education to solve practical problems in a socially responsible way. Students are prepared for careers of service, leadership, and distinction in a wide range of engineering and other related fields using a participatory, learn-by-doing, and "hands-on" laboratory, project, and design centered approach. Students are encouraged to participate in lifelong learning as essential in the presence of the ever-increasing pace of technological change.

Diversity in the student, faculty and staff is embraced and enhances the quality and creativity of the campus experience and environment.

The primary educational objectives of the Electrical Engineering program are to prepare graduates to:

1. Excel in the electrical engineering profession;
2. Embrace life-long learning as a necessary component to remain current in their profession; and
3. Pursue graduate degrees for enhanced skills and opportunities.

The Electrical Engineering degree programs prepare graduates for distinguished practice in professional engineering; equipping students for pursuing engineering solutions to urgent problems while being responsibly aware of all implications. To that end, the curriculum provides a sound theoretical background along with current, practical engineering knowledge. Cal Poly's "learn by doing" philosophy is emphasized by integrating design throughout the curriculum in numerous design-centered laboratories that provide students with hands-on experiences in design synthesis, analysis, characterization, and verification.

The student begins the major in the first quarter with an orientation class and laboratory; and generally has one or more major courses each quarter until graduation. The many laboratory courses provide practical experience and lead logically from demonstration of theory into design applications.

During their junior and senior years, students choose technical electives to gain additional expertise in one or more areas of specialization within electrical engineering. These courses deal with

the development, design and application of circuits, electronic devices, computers, and systems for communication, controls, information processing and display, and system instrumentation. Senior courses in this area provide specialized preparation in a selected area such as active and passive network synthesis, advanced communications systems, computer system design, microelectronic circuit engineering, microprocessor systems applications, microwave engineering, photonics, and solid state devices.

Other courses deal with industrial process control systems, power electronics, and with generation, distribution, control and utilization of electric power. Senior elective courses in this area provide specialized preparation in a selected area such as advanced control systems, energy conversion, power system analysis, protection and stability, and solid state motor control.

Employers recognize that students who have completed such specialized technical courses are early contributors in the workforce. Students wishing to pursue graduate work may select appropriate senior courses in keeping with this goal.

In the required senior design project, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to solve practical problems.

Involvement in faculty research is possible for graduate students and outstanding undergraduate students. Research areas include computer-aided education, automotive and transportation applications, signal and image processing, electric vehicles, computer architecture and software systems, photonics, polymer electronics, power systems, power electronics, and electric power quality.

Students are encouraged to participate in professional organizations and clubs such as: Institute of Electrical and Electronics Engineers (IEEE), Audio Engineering Society (AES), IEEE Computer Society (IEEE-CS), Power and Energy Society (PES), Eta Kappa Nu (HKN), Society of Photo-Optical Instrumentation Engineers (SPIE), Student Electrical Engineering Council (SEEC), and Amateur Radio Club. The Electric Power Institute, sponsored by the university and underwritten by major utility companies and electrical equipment manufacturers, offers advanced seminars and lectures in the electrical power field and facilitates student and faculty interaction with industry.

### Undergraduate Programs

#### BS Computer Engineering

This program is jointly offered by the Computer Science Department and the Electrical Engineering Department. For information regarding this program, please refer to Computer Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/computerengineering>).

#### BS Electrical Engineering

Students are prepared for careers of service, leadership, and distinction in engineering and other related fields using a participatory, learn-by-doing, and "hands-on" laboratory, project, and design centered approach. Students are encouraged to participate in lifelong learning in the presence of rapid technological change.

## Graduate Program

### MS Electrical Engineering

#### General Characteristics

The Master of Science program in Electrical Engineering serves students and practicing engineers seeking:

- Job-entry education for the more complex areas of engineering, such as research and development, innovative design, systems analysis and design, and managerial engineering;
- Updating and upgrading opportunities for practicing engineers;
- Graduate preparation for further study in engineering, leading to the Doctor of Engineering or Ph.D. degree;
- A base which allows graduates to maintain currency in their fields.

#### Prerequisites

For admission as a classified graduate student, an applicant must hold a bachelor's degree in engineering or a closely related physical science with a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted. Applicants for graduate engineering programs are required to submit satisfactory scores for the General (Aptitude) Test of the Graduate Record Examination. Foreign applicants must have satisfactory scores on the TOEFL and TWE exams. An applicant who meets these standards but lacks prerequisite coursework may be admitted as a conditionally classified student and must make up any deficiencies before advancement to classified graduate standing.

Information pertaining to specific requirements for admission to graduate standing (classified or conditionally classified) may be obtained from the Graduate Coordinator, Electrical Engineering Department.

#### Program of Study

Graduate students in this program must file a formal study plan with their advisor, department, college and university graduate studies office by no later than the end of the second quarter in the program. The formal program of study must include a minimum of 45 units (at least 28 of which must be at the 500 level and the remainder at the 400 level).

The broad curriculum requirements for the MS in Electrical Engineering are:

1. core of 16 units;
2. a minimum of 12 units of additional electrical engineering courses;
3. at least 17 units of approved electives;
4. at least 28 units of the 45 unit program at the 500 level.

Two program options are available for MS in Electrical Engineering students: a thesis program which requires coursework, a thesis and oral defense of thesis; or a nonthesis option which involves additional coursework and a comprehensive examination. The thesis option is strongly encouraged for all students.

### Blended BS + MS Electrical Engineering Honors Program

The blended program is an honors program that provides a means for academically excellent students to complete the MS Electrical Engineering, with simultaneous conferring of both bachelor's and

master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status; embarking on their graduate coursework while they complete their undergraduate degree requirements.

#### Eligibility

Students majoring in BS Electrical Engineering or Computer Engineering may be eligible to pursue the blended program after completing all required EE/CPE 300-level courses. Participation in the program is based on prior academic performance and other measures of professional promise. Students are selected by the Graduate Committee. See Graduate Programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation/#generalpoliciesgoverninggraduatestudiestext>) for the minimum university eligibility criteria; contact the EE Department for specific program eligibility criteria.

#### Program of Study

A unique feature of the program is to allow the use of a common project for fulfillment of both the Master's Thesis (EE 599) and Senior Project (EE 461/ EE 462 or EE 463/ EE 464) degree requirement. As listed in the ABET engineering program accreditation criteria, all students must be prepared for engineering practice via a curriculum which culminates in a major design experience based on the knowledge and skills acquired in earlier coursework and incorporating engineering standards and realistic constraints. Therefore, all "Blended BS + MS program" students must have a master's thesis that specifically includes this major design experience requirement, in order to complete their undergraduate degree. A faculty advisor serves as both the thesis committee chairperson and the senior project advisor.

The unit requirements for either the BS or MS degree are unchanged in the blended program. When all requirements are met for both the undergraduate and graduate programs, both degrees are awarded at the same time. If a student fails to complete the MS program requirements, then the BS degree may be granted when all requirements for that degree are met.

## BS Electrical Engineering

#### Program Learning Outcomes

Electrical engineering students are expected to graduate with:

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning

- 10A knowledge of contemporary issues
- 11 An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- 12A knowledge of probability and statistics, including applications appropriate to the electrical engineering field
- 13A knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to analyze and design complex devices and systems containing hardware and software components; and
- 14A knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

EE 111 & EE 151	Introduction to Electrical Engineering and Introduction to Electrical Engineering Laboratory	2
EE 112	Electric Circuit Analysis I	2
Select from the following:		4
EE 129 & EE 169	Digital Design and Digital Design Laboratory	
CPE/EE 133	Digital Design	
EE 211 & EE 241	Electric Circuit Analysis II and Electric Circuit Analysis Laboratory II	4
EE 212 & EE 242	Electric Circuit Analysis III and Electric Circuit Analysis Laboratory III	4
EE 228	Continuous-Time Signals and Systems	4
Select from the following:		4
EE 229 & EE 269	Computer Design and Assembly Language Programming and Computer Design and Assembly Language Programming Laboratory	
CPE/EE 233	Computer Design and Assembly Language Programming	
EE 255 & EE 295	Energy Conversion Electromagnetics and Energy Conversion Electromagnetics Laboratory	4
EE 302 & EE 342	Classical Control Systems and Classical Control Systems Laboratory	4
EE 306 & EE 346	Semiconductor Device Electronics and Semiconductor Device Electronics Laboratory	4

EE 307 & EE 347	Digital Electronics and Integrated Circuits and Digital Electronics and Integrated Circuits Laboratory	4
EE 308 & EE 348	Analog Electronics and Integrated Circuits and Analog Electronics and Integrated Circuits Laboratory	4
EE 314	Introduction to Communication Systems	3
EE 328 & EE 368	Discrete Time Signals and Systems and Signals and Systems Laboratory	4
EE 329	Programmable Logic and Microprocessor-Based Systems Design	4
or EE 336	Microprocessor System Design	
EE 335	Electromagnetic Fields and Transmission	4
EE 375	Electromagnetic Fields and Transmission Laboratory	1
EE 402	Electromagnetic Waves	4
EE 409 & EE 449	Electronic Design and Electronic Design Laboratory	4
EE 460	Senior Project Preparation	2
EE 461	Senior Project I	3
or EE 463	Senior Project Design Laboratory I	
EE 462	Senior Project II	2
or EE 464	Senior Project Design Laboratory II	
Technical Electives <sup>1</sup>		12

Select from the following: <sup>2</sup>

### EE lecture/laboratory electives

EE 410	Power Electronics I
EE 411	Power Electronics II
EE 413	Advanced Electronic Design
EE 417	Alternating Current Machines
EE 420	Sustainable Electric Energy Conversion
EE 424	Introduction to Remote Sensing
EE 433	Introduction to Magnetic Design
EE 434	Alternative Energy Vehicles
EE 495	Cooperative Education Experience <sup>3</sup>
EE/CPE 427	Digital Computer Subsystems
EE/CPE 428	Computer Vision
EE/CPE 439	Real-Time Embedded Systems
EE/CPE 521	Computer Systems
EE/CPE 522	Advanced Real-Time Embedded Systems Design
EE/CPE 523	Digital Systems Design
EE 431/ CPE 441	Computer-Aided Design of VLSI Devices

### EE Lecture Electives

EE 400	Special Problems <sup>4</sup>
EE 403	Fiber Optic Communication
EE 405	High Frequency Amplifier Design
EE 406	Power Systems Analysis I
EE 407	Power Systems Analysis II
EE 412	Advanced Analog Circuits
EE 415	Communication Systems Design
EE 416	Digital Communication Systems

EE 418	Photonic Engineering	CPE 482	Advanced Topics in Systems for Computer Engineering
EE 419	Digital Signal Processing	CSC 341	Numerical Engineering Analysis
EE 421	Solid-state Microelectronics	CSC 342	Numerical Analysis I
EE 425	Analog Filter Design	CSC/CPE 315	Computer Architecture
EE 440	Wireless Communications	CSC/CPE 416	Autonomous Mobile Robotics
EE 470	Selected Advanced Topics	CSC/CPE 453	Introduction to Operating Systems
EE 502	Microwave Engineering	CSC/CPE 454	Implementation of Operating Systems
EE 509	Computational Intelligence	CSC/CPE 458	Current Topics in Computer Systems
EE 511	Electric Machines Theory	CSC/CPE 464	Introduction to Computer Networks
EE 513	Control Systems Theory	CSC/CPE 471	Introduction to Computer Graphics
EE 514	Advanced Topics in Automatic Control	ECON 330	International Trade Theory
EE 515	Discrete Time Filters	ECON 337	Money, Banking and Credit
EE 518	Power System Protection	ECON 403	Industrial Organization
EE 519	Advanced Analysis of Power Systems	ECON 413	Labor Economics
EE 520	Solar-Photovoltaic Systems Design	ENVE 331	Introduction to Environmental Engineering
EE 524	Solid State Electronics	IME 301	Operations Research I
EE 526	Digital Communications	IME 303	Project Organization and Management
EE 527	Advanced Topics in Power Electronics	IME 319	Human Factors Engineering
EE 528	Digital Image Processing	IME 322	Leadership and Project Management
EE 529	Microwave Device Electronics	IME 326	Engineering Test Design and Analysis
EE 530	Fourier Optics	IME 401	Sales Engineering
EE 533	Antennas	IME 405	Operations Research II
EE 570	Selected Advanced Topics	IME 407	Operations Research III
EE/CPE 432	Digital Control Systems	IME 427	Design of Experiments
EE/CPE 438	Digital Computer Systems	IME 435	Reliability for Design and Testing
<b>EE Laboratory Electives</b>		IME 457	Advanced Electronic Manufacturing
EE 400	Special Problems <sup>5</sup>	IME 458	Microelectronics and Electronics Packaging
EE 422	Polymer Electronics Laboratory	MATE 340	Electronic Materials Systems
EE 443	Fiber Optics Laboratory	MATE 430	Microfabrication
EE 444	Power Systems Laboratory	MATE 435	Microfabrication Laboratory
EE 445	High Frequency Amplifier Design Laboratory	MATH 304	Vector Analysis
EE 452	Advanced Analog Circuits Laboratory	MATH 306	Linear Algebra II
EE 455	Analog Filter Design Laboratory	MATH 406	Linear Algebra III
EE 456	Communication Systems Laboratory	MATH 408	Complex Analysis I
EE 458	Photonic Engineering Laboratory	MATH 409	Complex Analysis II
EE 459	Digital Signal Processing	MATH 412	Introduction to Analysis I
EE 471	Selected Advanced Laboratory	MATH 413	Introduction to Analysis II
EE 480	Wireless Communications Laboratory	MATH 414	Introduction to Analysis III
EE 541	Advanced Microwave Laboratory	MATH 418	Partial Differential Equations
EE 544	Solid-state Electronics Laboratory	MATH 451	Numerical Analysis I
EE/CPE 472	Digital Control Systems Laboratory	MATH 452	Numerical Analysis II
<b>Non-EE Electives</b>		MATH 453	Numerical Optimization
BMED 410	Biomechanics	ME 302	Thermodynamics I
BMED 420	Principles of Biomaterials Design	ME 318	Mechanical Vibrations
BMED 425	Biomedical Engineering Transport	ME 326	Intermediate Dynamics
BMED 430	Biomedical Modeling and Simulation		
BMED 440	Bioelectronics and Instrumentation		
BMED 445	Bipotential Instrumentation		
BUS 311	Managing Technology in the International Legal Environment		
CHEM 313	Survey of Biochemistry and Biotechnology		



ME 343	Heat Transfer	
ME 405	Mechatronics	
ME 415	Energy Conversion	
ME 423	Robotics: Fundamentals and Applications	
ME 450	Solar Power Systems	
ME 488	Wind Energy Engineering	
MU 311	Sound Design: Technologies	
MU 312	Sound Design: Recording	
MU 411	Sound Design: Synthesis	
PHYS 302	Classical Mechanics I	
PHYS 303	Classical Mechanics II	
PHYS 310	Physics of Energy	
PHYS 313	Introduction to Atmospheric Physics	
PHYS 317	Special Theory Relativity	
PHYS 322	Vibrations and Waves	
PHYS 340	Quantum Physics Laboratory I	
PHYS 341	Quantum Physics Laboratory II	
PHYS 342	Quantum Physics Laboratory III	
PHYS 403	Nuclear and Particle Physics	
PHYS 405	Quantum Mechanics I	
PHYS 406	Quantum Mechanics II	
PHYS 408	Electromagnetic Fields and Waves I	
PHYS 409	Electromagnetic Fields and Waves II	
PHYS 412	Solid State Physics	
PHYS 417	Nonlinear Dynamical Systems	
PHYS 423	Advanced Optics	
PHYS 424	Theoretical Physics	
PHYS 452	Solid State Physics Laboratory	
STAT 426	Estimation and Sampling Theory	
STAT 427	Mathematical Statistics	

**SUPPORT COURSES**

BIO 213	Life Science for Engineers	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>6</sup>	2
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>6</sup>	4
CSC 101	Fundamentals of Computer Science I	4
ENGL 149	Technical Writing for Engineers (A3) <sup>6</sup>	4
IME 156 or IME 157	Basic Electronics Manufacturing Electronics Manufacturing	2
MATH 141	Calculus I (B1) <sup>6</sup>	4
MATH 142	Calculus II (B1) <sup>6</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>6</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
PHYS 141	General Physics IA (Add'l Area B) <sup>6</sup>	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
PHYS 211	Modern Physics I	4
STAT 350	Probability and Random Processes for Engineers (B6) <sup>6</sup>	4

Approved engineering support electives <sup>1,7,8</sup>	9
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Select from the following:

BIO 111	General Biology
BMED 212	Introduction to Biomedical Engineering
BMED 310	Biomedical Engineering Measurement and Analysis
BMED 450	Contemporary Issues in Biomedical Engineering
BMED 460	Engineering Physiology
CHEM 125	General Chemistry for the Engineering Disciplines II
CHEM 212	Introduction to Organic Chemistry
CHEM 216	Organic Chemistry for Life Sciences I
CHEM 313	Survey of Biochemistry and Biotechnology
CPE 290	Selected Topics (Introduction to C++ Programming)
CSC 141	Discrete Structures I
CSC 341	Numerical Engineering Analysis
CSC 342	Numerical Analysis I
CSC/CPE 102	Fundamentals of Computer Science II
CSC/CPE 103	Fundamentals of Computer Science III
CSC/CPE 315	Computer Architecture
IME 142	Manufacturing Processes: Materials Joining
IME 143	Manufacturing Processes: Material Removal
IME 301	Operations Research I
IME 314	Engineering Economics
IME 405	Operations Research II
IME 407	Operations Research III
MATE 210	Materials Engineering
MATE 215	Materials Laboratory I
MATE 232	Materials, Ethics, and Society
MATE 340	Electronic Materials Systems
MATE 430	Microfabrication
MATE 435	Microfabrication Laboratory
MATH 206	Linear Algebra I
MATH 304	Vector Analysis
MATH 306	Linear Algebra II
MATH 406	Linear Algebra III
MATH 408	Complex Analysis I
MATH 409	Complex Analysis II
MATH 412	Introduction to Analysis I
MATH 413	Introduction to Analysis II
MATH 414	Introduction to Analysis III
MATH 418	Partial Differential Equations
MATH 451	Numerical Analysis I
MATH 452	Numerical Analysis II
MATH 453	Numerical Optimization
ME 211	Engineering Statics
ME 212	Engineering Dynamics
ME 302	Thermodynamics I
ME 341	Fluid Mechanics I

ME 343	Heat Transfer	
PHYS 212	Modern Physics II	
PHYS 310	Physics of Energy	
PHYS 313	Introduction to Atmospheric Physics	
PHYS 315	Introduction to Lasers and Laser Applications	
PHYS 317	Special Theory Relativity	
PHYS 322	Vibrations and Waves	
PHYS 323	Optics	
PHYS 340	Quantum Physics Laboratory I	
PHYS 341	Quantum Physics Laboratory II	
PHYS 342	Quantum Physics Laboratory III	
PHYS 403	Nuclear and Particle Physics	
PHYS 405	Quantum Mechanics I	
PHYS 406	Quantum Mechanics II	
PHYS 408	Electromagnetic Fields and Waves I	
PHYS 409	Electromagnetic Fields and Waves II	
PHYS 412	Solid State Physics	
PHYS 417	Nonlinear Dynamical Systems	
PHYS 423	Advanced Optics	
PHYS 424	Theoretical Physics	
PHYS 452	Solid State Physics Laboratory	
STAT 426	Estimation and Sampling Theory	
STAT 427	Mathematical Statistics	
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		40
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		194

- 1 Consultation with advisor is recommended prior to selecting technical electives or approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- 2 A minimum of 2 EE senior design laboratories and 2 EE senior design lectures
- 3 Taken Fall 2009 or later; max 4 units.
- 4 Four units max count toward technical electives
- 5 One unit max, with approval of department chair, as lab elective.
- 6 Required in Support; also satisfies GE
- 7 No course may be used to simultaneously satisfy both engineering support and technical elective requirements.
- 8 The number of units given for transfer credit will not exceed the number of units of the Cal Poly course.

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4

A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
<b>Area B Science and Mathematics</b>		
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
<b>Area C Arts and Humanities</b>		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E Society and the Individual</b>		
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		40

<sup>1</sup> Required in Support; also satisfies GE

## MS Electrical Engineering

### Program Learning Objectives

Our goal is to create a graduate degree program and a learning environment that result in graduates who possess the following:

1. Technical competency in their chosen disciplines;
2. Effective communication skills;
3. Awareness of the impacts of technology on society and the environment;
4. Understanding of ethics and responsible professional conduct;
5. Strong interpersonal and teamwork skills;
6. Appreciation of the need for life-long learning;
7. Leadership/planning/decision-making skills;
8. Critical thinking/complex problem-solving skills.

### Required Courses

EE 525	Stochastic Processes	4
or EE 513	Control Systems Theory	
EE 563	Graduate Seminar (1, 1, 1)	3
EE 599	Design Project (Thesis) (or 9 units of approved Technical Electives and a comprehensive written examination)	9

### Additional Electrical Engineering Graduate Courses

Select from the following: <sup>1</sup>		12
EE 502	Microwave Engineering	
EE 511	Electric Machines Theory	
EE 509	Computational Intelligence	
EE 513	Control Systems Theory	
EE 514	Advanced Topics in Automatic Control	

EE 515	Discrete Time Filters
EE 518	Power System Protection
EE 519	Advanced Analysis of Power Systems
EE 520	Solar-Photovoltaic Systems Design
EE 521	Computer Systems
EE 522	Advanced Real-Time Embedded Systems Design
EE 523	Digital Systems Design
EE 524	Solid State Electronics
EE 526	Digital Communications
EE 527	Advanced Topics in Power Electronics
EE 528	Digital Image Processing
EE 529	Microwave Device Electronics
EE 530	Fourier Optics
EE 533	Antennas
EE 541	Advanced Microwave Laboratory
EE 544	Solid-state Electronics Laboratory

**Approved Technical Electives (400-500 level)**

May be selected from the course list above and other advisor approved technical electives. 17

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Total units 45

<sup>1</sup> Not all courses listed are offered each academic year. Consult the EE Department for current information on course offerings.

# Industrial & Manufacturing Engineering

Engineering IV Bldg. (192), Room 223  
Phone: 805.756.2341  
www.ime.calpoly.edu

Department Chair: Jose Macedo

College of Engineering Advising Center  
Engineering South (40), Room 114  
Phone: 805.756.1461

## Academic Programs

Program name	Program type
Industrial Engineering	BS, MS
Manufacturing Engineering	BS

The mission of the Industrial Engineering and Manufacturing Engineering programs at Cal Poly is "to educate students for successful and distinguished careers in industrial engineering, manufacturing engineering, and related fields using a learn-by-doing approach that stresses integrated processes, appropriate technologies, and enterprise competitive advantage."

The Department focuses on programs that integrate engineering with a real concern for people. Our students study topics that lead to satisfying and productive careers, and also provide strong preparation for graduate work in many fields. Programs reflect the traditional strengths of Cal Poly through close interaction between students and faculty in classroom, laboratory, and other activities. The programs use a project based learning approach where students work on multiple real life projects. Students often present results to industry representatives.

Department and university laboratories and computers are integrated into coursework to investigate, test, and apply theoretical principles learned in the classroom. The descriptions below provide details of the various programs.

## Undergraduate Programs

### BS Industrial Engineering

Industrial Engineering is the profession concerned with solving integrated engineering and management problems. The definition by the Institute of Industrial Engineers is as follows: "Industrial Engineering is concerned with the design, installation, and improvement of integrated systems of people, material, information, equipment, and energy by drawing upon specialized knowledge and skills in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems." Key objectives of industrial engineering are to improve the quality and productivity of creating and delivering goods and services and to act as the interface between technology and humans. Engineering methods and practical knowledge are used in formulating decision models for the optimum application of engineering and management principles.

The Bachelor of Science program in Industrial Engineering is accredited by the Engineering Accreditation Commission of ABET,

<http://www.ABET.org>. The following objectives have been set for students completing the Industrial Engineering program:

1. *Immediate Practice* – Graduates will make immediate contributions to the practice of industrial engineering or a related field by their demonstrated knowledge of contemporary issues and direct, hands-on experience with the modern tools and techniques of the discipline.
2. *Solid Engineering Foundations* – Graduates will have successful careers based on their ability to solve problems and make improvements through engineering design, experimentation, and application of scientific principles as well as their ability to analyze and critically evaluate solutions.
3. *Broad Education* – Graduates will have careers of distinction and leadership based on their ability to communicate effectively, to contribute meaningfully to a team effort, and to understand the economic, societal, and ethical impacts of their decisions.
4. *Life-Long Learning* – Graduates will demonstrate the ability and desire to follow a life-long pursuit of personal fulfillment through education.

Our main focus is to prepare graduates for practice in professional engineering. Thus, our "learn by doing" philosophy is emphasized in the curriculum by the large number of design-centered laboratories, integrating design throughout the curriculum, and the senior design project capstone design experience. In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems. Graduates can choose from a challenging range of career activities: operations research and analysis, production planning and scheduling, plant design, management, human factors engineering design, data processing and analysis, measurement, quality control and reliability assurance, technical economic planning, resource conservation, productivity measurement, increasing productivity using computer integrated manufacturing techniques, robotics, and, in general, systems analysis and design. The physical, engineering, and social sciences form the broad base for these endeavors.

The program is oriented to provide graduates with the capability of producing results with a minimum of additional training. Computer and hi-tech firms, health care and biomedical industries, aerospace/defense, entertainment, retail chains, farms, airlines, automotive, as well as government, service firms, traditional manufacturing industries, and consulting firms all employ graduates of this discipline. Graduates also are well prepared for successful graduate study.

### BS Manufacturing Engineering

Manufacturing Engineering is the profession that applies engineering analysis and methods to the production of all manufactured goods and services. The manufacturing engineer plans, develops, and optimizes the processes of production including methods of manufacture, and designs of tools and equipment for manufacturing. The emphasis is on both development and sustained operation of manufacturing systems, including computer-aided methods, automation, design for manufacture, production tooling, and material handling, as well as the processes and ancillary support systems of modern manufacturing.

The Bachelor of Science program in Manufacturing Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.ABET.org>. The following objectives have been set for students completing the Manufacturing Engineering Program at Cal Poly:

1. *Immediate Practice*. Graduates will make immediate contributions to the practice of manufacturing engineering or a related field by their demonstrated knowledge of contemporary issues and direct, hands-on experience with the modern tools and techniques of the discipline.
2. *Solid Engineering Foundations* – Graduates will have successful careers based on their demonstrated ability to solve problems and make improvements through engineering design, experimentation, and application of scientific principles as well as their ability to analyze and critically evaluate their decisions.
3. *Broad Education* – Graduates will have careers of distinction and leadership based on their ability to communicate effectively, to contribute meaningfully to a team effort, and to understand the economic and ethical impacts of their decisions.
4. *Life-Long Learning* – Graduates will demonstrate the ability and desire to follow a life-long pursuit of personal fulfillment through education.

In the required senior design project, which is completed in a two-quarter set of capstone courses, students demonstrate their understanding of engineering knowledge and their ability to apply that knowledge creatively to practical problems.

Graduates typically work more directly with the manufacturing processes than do industrial engineers.

Emphasis is placed upon application of the basic sciences and engineering fundamentals. Knowledge of basic processes, tool design, automation, and computer-aided manufacturing are applied directly to the problems of development and sustained operation of manufacturing systems.

Graduates are prepared for job-entry at the professional level in the areas of CAD/CAM, process engineering, automation, quality assurance, and production engineering. They also are well prepared for successful graduate study.

## Graduate Program MS Industrial Engineering

[www.ime.calpoly.edu/programs/graduate/](http://www.ime.calpoly.edu/programs/graduate/)

### General Characteristics

The Master of Science program in Industrial Engineering has the following objectives:

- To help California industries in meeting their needs with respect to processes of design, optimization, and re-engineering and in competing globally, by educating and training engineers with advanced practical knowledge in the field of Industrial Engineering.
- To attract undergraduate engineers of all majors and provide education in the planning, engineering, optimization, and management of processes using the appropriate tools of Industrial Engineering.
- To further the mission and goals of the College of Engineering at Cal Poly with respect to graduate engineering education by maintaining a balance between undergraduate and graduate educational opportunities in engineering that optimally supports the health of California industry.

Each student is strongly encouraged to work with a particular faculty member in selecting a thesis topic which is of personal interest to the student and the faculty member, and to choose a substantial number

of elective courses that supports the issues addressed in the thesis or project.

### Prerequisites

Students with earned undergraduate degrees in any engineering major are eligible for admission. A minimum grade point average of 3.0 in the last 90-quarter units (60 semester units) is required for admission.

All candidates seeking admission to the MSIE program are required to secure a minimum score in the GRE - General Test, as prescribed by the IME Department.

### Program of Study

Graduate students must file a formal study plan with their advisor, department, college and the university graduate studies office by no later than the end of the quarter in which the 12th unit of approved courses is completed. The formal program of study must include a minimum of 45 units, of which a) at least 23 units must be at the 500 level; b) at least 24 units must be in the degree major with at least 18 units at the 500 level.

The broad curriculum requirements for the program are:

- a core of 25 units
- a comprehensive thesis and oral defense examination (thesis option)
- a minimum of 20 units of advisor approved electives

### Blended BS+MS Engineering Program

Students must be prepared for engineering practice via the curriculum which culminates in a major design experience based on the knowledge and skills acquired in earlier coursework and incorporating engineering standards and realistic constraints, as listed in the ABET Engineering Criteria. Therefore, "Blended BS + MS Program" students must complete a senior project with this major design experience requirement in order to complete the undergraduate degree.

Students may be eligible to pursue the blended program toward the MS in Industrial Engineering or the MS Engineering with a specialization in Integrated Technology Management. Please refer to the MS Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/#graduatestext>) section of this catalog for more information and General Policies Governing Graduate Studies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation/#generalpoliciesgoverninggraduatestudiesstext>) for eligibility criteria for blended programs.

## BS Industrial Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (includes ability to design and develop integrated systems that include people, materials, information, equipment and energy)



4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems (including the ability to improve integrated systems of people, materials, information, equipment, and energy)
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
10. A knowledge of contemporary issues
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice (includes the ability to integrate systems of people, materials, information, equipment, and energy using appropriate analytical, computational, and experimental practices as well as the ability to implement such systems)

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit. No course may be double counted within the curriculum.

### MAJOR COURSES

IME 101	Introduction to Industrial and Manufacturing Engineering	1
IME 140	Graphics Communication and Modeling	2
IME 141	Manufacturing Processes: Net Shape	1
IME 144	Introduction to Design and Manufacturing	4
IME 156	Basic Electronics Manufacturing <sup>6</sup>	2-4
or IME 157	Electronics Manufacturing	
IME 223	Process Improvement Fundamentals	4
IME 239	Industrial Costs and Controls	3
IME 301	Operations Research I	4
IME 303	Project Organization and Management	4
IME 312	Data Management and System Design	4
IME 314	Engineering Economics	3
IME 319	Human Factors Engineering	3
IME 326	Engineering Test Design and Analysis	4
IME 405	Operations Research II	4
IME 410	Production Planning and Control Systems	4
IME 417	Supply Chain and Logistics Management	4
IME 420	Simulation	4
IME 429	Ergonomics Laboratory	1
IME 430	Quality Engineering	4

IME 443	Facilities Planning and Design	4
IME 481	Senior Project Design Laboratory I	2
IME 482	Senior Project Design Laboratory II	3

### Technical Electives <sup>2, 3, 4, 5, 6</sup>

Select from the following: 9-11

CE 207	Mechanics of Materials II
BUS 310	Introduction to Entrepreneurship
BUS 311	Managing Technology in the International Legal Environment
BUS 346	Principles of Marketing
BUS 382	Organizations, People, and Technology
BUS 402	International Business Management
BUS 404	Governmental and Social Influences on Business
BUS 488	Planning and Managing New Ventures
AG/HUM/ EDES/ENGR/ SCM/UNIV 350	The Global Environment
EE 361	Electronics Laboratory
EE 434	Alternative Energy Vehicles
IME 142	Manufacturing Processes: Materials Joining
IME 313	Introduction to Information Systems Engineering
IME 335	Computer-Aided Manufacturing I
IME 336	Computer-Aided Manufacturing II
IME 351	Advanced Material Removal Process Design
IME 356	Manufacturing Automation
IME 401	Sales Engineering
IME 407	Operations Research III
IME 408	Systems Engineering
IME 409	Economic Decision Systems
IME 411	Production Systems Analysis
IME 416	Automation of Industrial Systems
IME 417	Supply Chain and Logistics Management
IME 418	Product-Process Design
IME 421	Manufacturing Organizations
IME 427	Design of Experiments
IME 428	Engineering Metrology
IME 431	Supplier Quality Engineering
IME 435	Reliability for Design and Testing
IME 437	Advanced Human Factors Engineering
IME 441	Engineering Supervision I
IME 442	Engineering Supervision II
IME 455	Manufacturing Design and Implementation I
IME 457	Advanced Electronic Manufacturing
IME 470	Selected Advanced Topics
IME 471	Selected Advanced Laboratory
IME 541	Advanced Operations Research
IME 542	Advanced Reliability Engineering
IME 543	Advanced Human Factors
IME 544	Advanced Topics in Engineering Economy
IME 545	Advanced Topics in Simulation
IME 556	Technological Project Management
IME 577	Engineering Entrepreneurship

IME/AERO 510	Systems Engineering I	
IME/AERO 511	Systems Engineering II	
IME/MATE 458/CPE 488	Microelectronics and Electronics Packaging	
IT 341	Packaging Polymers and Processing	
IT 406	Industrial Sales	
IT 428	Commercialization of New Technologies	
ME 302	Thermodynamics I	
ME 305	Introduction to Mechatronics	
ME 328	Introduction to Design	
ME 341	Fluid Mechanics I	
MATE 210	Materials Engineering	
MATE 215	Materials Laboratory I	
MATE 410	Nanoscale Engineering	
MATH 344	Linear Analysis II	
MATH 350	Mathematical Software	
PSY 350	Teamwork	

**SUPPORT COURSES**

BIO 213	Life Science for Engineers (B2) <sup>1</sup>	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>1</sup>	2
CE 204	Mechanics of Materials I	3
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
CSC 232	Computer Programming for Scientists and Engineers	3
EE 201	Electric Circuit Theory	3
EE 251	Electric Circuits Laboratory	1
EE 321	Electronics	3
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
Select from the following:		3
ME 302	Thermodynamics I	
MATE 210 & MATE 215	Materials Engineering and Materials Laboratory I	
PHYS 141	General Physics IA (Add'l Area B) <sup>1</sup>	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
PSY 201/202	General Psychology (D4) <sup>1</sup>	4
STAT 321	Probability and Statistics for Engineers and Scientists (B6) <sup>1</sup>	4

**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 36

**FREE ELECTIVES**

Free Electives	0
<b>Total units</b>	<b>190</b>

- <sup>1</sup> Required in Support; also satisfies GE
- <sup>2</sup> IME 400 and IME 500 require a course substitution form and no more than 4 total units are allowed.
- <sup>3</sup> The courses selected to satisfy this requirement may not be used to satisfy other major, support, or general education requirements (no double counting of coursework).
- <sup>4</sup> Consultation with advisor is recommended prior to selecting technical electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>5</sup> At least 6 units must be upper level (300-level or above) engineering courses (AERO, BMED, CE, EE, IME, MATE, ME)
- <sup>6</sup> Students who choose IME 157 from above take 9 units of electives while students who choose IME 156 take 11 units.

**General Education (GE) Requirements**

- 72 units required, 36 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Support) <sup>1</sup>	0
<b>Total units</b>		<b>36</b>

- <sup>1</sup> Required in Support; also satisfies GE

# BS Manufacturing Engineering

## Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering (includes proficiency in materials)
2. An ability to design and conduct experiments, as well as to analyze and interpret data (includes manufacturing laboratory or facility experience, the ability to measure manufacturing process variables and develop technical inferences about the process)
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability (includes proficiency in manufacturing processes, the ability to design manufacturing processes that result in products that meet specific material and other requirements; proficiency in process, assembly and product engineering, the ability to design products and the equipment, tooling, and environment necessary for their manufacture; and proficiency in manufacturing systems design, the ability to analyze, synthesize, and control manufacturing operations using statistical methods)
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (includes manufacturing competitiveness, of the ability to create competitive advantage through manufacturing planning, strategy, quality, and control)
9. A recognition of the need for, and an ability to engage in life-long learning
- 10A knowledge of contemporary issues
- 11An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirements (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

IME 101	Introduction to Industrial and Manufacturing Engineering	1
IME 140	Graphics Communication and Modeling	2
IME 141	Manufacturing Processes: Net Shape	1
IME 142	Manufacturing Processes: Materials Joining	2
IME 144	Introduction to Design and Manufacturing	4

IME 156	Basic Electronics Manufacturing <sup>7</sup>	2-4
or IME 157	Electronics Manufacturing	
IME 223	Process Improvement Fundamentals	4
IME 314	Engineering Economics	3
IME 327	Test Design and Analysis in Manufacturing Engineering	4
IME 330	Fundamentals of Manufacturing Engineering	4
IME 335	Computer-Aided Manufacturing I	4
IME 342	Manufacturing Systems Integration	4
IME 356	Manufacturing Automation	4
IME 417	Supply Chain and Logistics Management	4
IME 418	Product-Process Design	4
IME 430	Quality Engineering	4
IME 450	Manufacturing Process and Tool Engineering	4
IME 481	Senior Project Design Laboratory I	2
IME 482	Senior Project Design Laboratory II	3

### Technical Electives <sup>2,3,4,5</sup>

Select from the following: <sup>6, 7</sup> 12-14

AERO 300	Aerospace Engineering Analysis
AERO 301	Aerothermodynamics I
AERO 302	Aerothermodynamics II
AERO 303	Aerothermodynamics III
AERO 304	Experimental Aerothermodynamics
AERO 306	Aerodynamics and Flight Performance
AERO 320	Fundamentals of Dynamics and Control
AERO 331	Aerospace Structural Analysis I
AERO 401	Propulsion Systems
BMED 212	Introduction to Biomedical Engineering
BMED 310	Biomedical Engineering Measurement and Analysis
BMED 410	Biomechanics
BMED 420	Principles of Biomaterials Design
BMED 425	Biomedical Engineering Transport
BMED 440	Bioelectronics and Instrumentation
BUS 310	Introduction to Entrepreneurship
BUS 311	Managing Technology in the International Legal Environment
BUS 346	Principles of Marketing
BUS 488	Planning and Managing New Ventures
AG/HUM/ EDES/ENGR/ SCM/UNIV 350	The Global Environment
CE 207	Mechanics of Materials II
EE 361	Electronics Laboratory
EE 434	Alternative Energy Vehicles
IME 301	Operations Research I
IME 303	Project Organization and Management
IME 312	Data Management and System Design
IME 313	Introduction to Information Systems Engineering
IME 319	Human Factors Engineering
IME 336	Computer-Aided Manufacturing II

IME 351	Advanced Material Removal Process Design
IME 401	Sales Engineering
IME 405	Operations Research II
IME 407	Operations Research III
IME 408	Systems Engineering
IME 409	Economic Decision Systems
IME 410	Production Planning and Control Systems
IME 411	Production Systems Analysis
IME 416	Automation of Industrial Systems
IME 420	Simulation
IME 421	Manufacturing Organizations
IME 427	Design of Experiments
IME 428	Engineering Metrology
IME 429	Ergonomics Laboratory
IME 431	Supplier Quality Engineering
IME 435	Reliability for Design and Testing
IME 437	Advanced Human Factors Engineering
IME 441	Engineering Supervision I
IME 442	Engineering Supervision II
IME 443	Facilities Planning and Design
IME 455	Manufacturing Design and Implementation I
IME 457	Advanced Electronic Manufacturing
IME 470	Selected Advanced Topics
IME 471	Selected Advanced Laboratory
IME 542	Advanced Reliability Engineering
IME 545	Advanced Topics in Simulation
IME 556	Technological Project Management
IME 577	Engineering Entrepreneurship
IME 580	Manufacturing Systems
IME/MATE/ HNRS 322	Leadership and Project Management
IME/MATE 458/CPE 488	Microelectronics and Electronics Packaging
IME/AERO 510	Systems Engineering I
IME/AERO 511	Systems Engineering II
IT 326	Product Evaluation
IT 329	Industrial Materials
IT 330	Packaging Fundamentals
IT 341	Packaging Polymers and Processing
IT 371	Decision Making in Supply Chain, Services, and Project Management
IT 406	Industrial Sales
IT 407	Applied Business Operations
IT 428	Commercialization of New Technologies
MATE 310	Noncrystalline Material Systems
MATE 330	Composite Materials Systems
MATE 340	Electronic Materials Systems
MATE 350	Structural Materials Systems
MATE 360	Metallurgical Materials Systems
MATE 410	Nanoscale Engineering
MATE 430	Microfabrication

MATE 435	Microfabrication Laboratory
MATE 440	Welding Metallurgy and Joining of Advanced Materials
MATE 445	Joining of Advanced Materials Laboratory
MATE 450	Fracture and Failure Analysis
MATE 460	Materials Selection in Mechanical Design
MATH 344	Linear Analysis II
MATH 350	Mathematical Software
ME 305	Introduction to Mechatronics
ME 318	Mechanical Vibrations
ME 326	Intermediate Dynamics
ME 328	Introduction to Design
ME 329	Intermediate Design
ME 341	Fluid Mechanics I
ME 343	Heat Transfer
ME 405	Mechatronics
ME 410	Experimental Methods in Mechanical Design I
ME 412	Composite Materials Analysis and Design
ME 415	Energy Conversion
ME 416	Ground Vehicle Dynamics and Design
ME 422	Mechanical Control Systems
ME 423	Robotics: Fundamentals and Applications
ME 430	Senior Design Project III
ME 431	Mechanical Design Techniques
ME 441	Single Track Vehicle Design
ME 446	Advanced and Hybrid Vehicle Design

**SUPPORT COURSES**

BIO 213	Life Science for Engineers (B2) <sup>1</sup>	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>1</sup>	2
CE 204	Mechanics of Materials I	3
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
CHEM 125	General Chemistry for the Engineering Disciplines II	4
CSC 232	Computer Programming for Scientists and Engineers	3
EE 201	Electric Circuit Theory	3
EE 251	Electric Circuits Laboratory	1
EE 321	Electronics	3
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
MATE 210	Materials Engineering	3
MATE 215	Materials Laboratory I	1
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
ME 302	Thermodynamics I	3

PHYS 141	General Physics IA (Add'l Area B) <sup>1</sup>	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
STAT 321	Probability and Statistics for Engineers and Scientists (B6) <sup>1</sup>	4

**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 40

**FREE ELECTIVES**

Free Electives 0

**Total units** 192

- <sup>1</sup> Required in Support; also satisfies GE
- <sup>2</sup> IME 400 and IME 500 require a course substitution form and no more than 4 total units are allowed.
- <sup>3</sup> The courses selected to satisfy this requirement may not be used to satisfy other major, support, or general education requirements (no double counting of coursework).
- <sup>4</sup> A maximum of 4 units of technical electives may be taken outside of the College of Engineering.
- <sup>5</sup> Consultation with advisor is recommended prior to selecting technical electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>6</sup> At least 8 units must be upper level (300-level or above) engineering courses (AERO, BMED, CE, EE, IME, MATE, ME)
- <sup>7</sup> Students who choose IME 157 from above take 12 units, while students who choose IME 156 take 14 units.

**General Education (GE) Requirements**

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 8 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
	Additional Area B units (8 units in Support) <sup>1</sup>	0
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4

D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
<b>Total units</b>		<b>40</b>

<sup>1</sup> Required in Support; also satisfies GE**MS Industrial Engineering****Required Courses**

IME 507	Graduate Seminar (2, 2)	4
IME 503	Applied Statistical Methods in Engineering	4
IME 556	Technological Project Management	4
IME 580	Manufacturing Systems <sup>1</sup>	4
IME 599	Design Project (Thesis) (and Comprehensive Examination)	9

**Advisor Approved Electives**

Potential electives include: 20

IME 409	Economic Decision Systems
IME 411	Production Systems Analysis
IME 417	Supply Chain and Logistics Management
IME 418	Product-Process Design
IME 427	Design of Experiments
IME 430	Quality Engineering
IME 431	Supplier Quality Engineering
IME 458	Microelectronics and Electronics Packaging
IME 500	Individual Study (up to a maximum of 6 units)
IME 510	Systems Engineering I
IME 511	Systems Engineering II
IME 541	Advanced Operations Research
IME 542	Advanced Reliability Engineering
IME 543	Advanced Human Factors
IME 544	Advanced Topics in Engineering Economy
IME 545	Advanced Topics in Simulation
IME 570	Selected Advanced Topics
IME 577	Engineering Entrepreneurship

**Total units** 45<sup>1</sup> Course cannot be taken by students who have already received credit for IME 410**Materials Engineering**

Brown Engineering Bldg. (41), Rm 229  
 Phone: 805.756.2568; Fax: 805.756.2299  
[www.mate.calpoly.edu](http://www.mate.calpoly.edu)  
 Email: [matedept@calpoly.edu](mailto:matedept@calpoly.edu)

College of Engineering Advising Center  
 Engineering South (40), Room 114  
 Phone: 805.756.1461

Department Chair: Kathy Chen



## Academic Program

Program name	Program type
Materials Engineering	BS

Materials engineering is a field in which engineers use their knowledge of the relationship between a material's structure and its properties to alter the material to get the performance needed. Materials engineers contribute their expertise in virtually all areas of technology: from the nano-sized materials found in biomedical and microelectronic applications to the large-scale composites found in aerospace applications.

Because engineered products are often limited by materials issues (such as performance and manufacturability), materials engineers play a vital role on engineering design teams, working closely with other engineers. As part of these teams, they apply their knowledge of science, engineering, and state-of-the-art analytical instruments.

The majority of our graduates find employment in the biomedical, electronic, aerospace and petroleum industries. Some work as consultants for large or small organizations. Others become executives. A significant number of materials engineers are involved in research and development. Some of our graduates are entrepreneurs who have started their own consulting or manufacturing companies. Others are attorneys or physicians. Because of our broad-based curriculum, our graduates are able to excel in professions of their choosing.

The curriculum in materials engineering emphasizes practical applications as well as principles. The laboratories are constantly evolving, and our students benefit from frequent exposure to a wide variety of materials testing and analysis equipment. The program is accredited by the Engineering Accreditation Commission ABET, <http://www.ABET.org>. Our students have a reputation for being immediately productive in industry, and they are also actively sought by graduate programs throughout the country.

### Vision

To collaboratively overcome the intertwined grand challenges of sustainability and transformative learning through our materials engineering program.

### Mission

To be a vibrant, creative and effectual learning community that cultivates the unique capabilities of each individual to thrive in a complex, interconnected and ever-changing world.

### Program Education Objectives

1. Holistically address complex challenges, drawing from materials engineering understanding and life experiences;
2. Live meaningful, socially-beneficial lives, enriched by their engineering education;
3. Exemplify proactive adaptive capacity throughout their lives; and
4. Communicate effectively in different contexts

## Undergraduate Program

### BS Materials Engineering

The Materials Engineering curriculum has received national recognition for its innovative structure and will provide both breadth and depth in your understanding of science and engineering principles and practices.

### Graduate Program

Graduates of the materials engineering program are qualified for admission to Cal Poly's Master's Degree Programs in Engineering with a Specialization in Materials. The opportunity also exists for advanced students to begin graduate study in these areas prior to completion of the BS degree, via a "blended 4+1" program. This opportunity provides a number of advantages to qualified students, and makes it possible for completion of both the BS and MS degrees in as little as 5 years. Materials engineering students participating in a blended 4+1 program are permitted to fulfill the materials senior project requirement with the master's degree thesis. Because of the design emphasis of the senior project, a master's thesis used to satisfy the senior project requirement must include a major engineering design experience. The thesis supervisor assists the student in ensuring that this requirement is met. Further details are provided in the graduate study sections for each of these programs.

## BS Materials Engineering

### Program Learning Outcomes

1. An ability to apply knowledge of mathematics, science, and engineering
2. An ability to design and conduct experiments, as well as to analyze and interpret data
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. An ability to function on multidisciplinary teams
5. An ability to identify, formulate, and solve engineering problems
6. An understanding of professional and ethical responsibility
7. An ability to communicate effectively
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
9. A recognition of the need for, and an ability to engage in life-long learning
- 10A knowledge of contemporary issues
- 11 An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

MATE 110	Introduction to Materials Engineering Design I	1
MATE 120	Introduction to Materials Engineering Design II	1
MATE 130	Introduction to Materials Engineering Design III	1
MATE 210	Materials Engineering	3
MATE 215	Materials Laboratory I	1
MATE 222	Materials Selection Life Cycle	4
MATE 225	Materials Laboratory II	1
MATE 232	Materials, Ethics, and Society	4
MATE 235	Materials Laboratory III	1
MATE 310	Noncrystalline Material Systems	4
MATE 330	Composite Materials Systems	4
MATE 340	Electronic Materials Systems	4
MATE 350	Structural Materials Systems	4
MATE 360	Metallurgical Materials Systems	4
MATE 370	Kinetics of Materials and Process Design	4
MATE 380	Thermodynamics and Physical Chemistry	4
MATE 482	Senior Project I	1
MATE 483	Senior Project II	2
MATE 484	Senior Project III	2

### Technical Electives<sup>2,3</sup>

Select from the following: 12

BMED 420	Principles of Biomaterials Design
CHEM 444	Polymers & Coatings I
CHEM 447	Polymers and Coatings Laboratory I
ENVE 470	Selected Advanced Topics (Environmental Nanotechnology)
MATE 401	Materials Characterization Techniques
MATE 410	Nanoscale Engineering
MATE 425	Corrosion Engineering
MATE 430	Microfabrication
MATE 435	Microfabrication Laboratory
MATE 440	Welding Metallurgy and Joining of Advanced Materials
MATE 445	Joining of Advanced Materials Laboratory
MATE/CHEM 446	Surface Chemistry of Materials
MATE 450	Fracture and Failure Analysis
MATE/IME 458/CPE 488	Microelectronics and Electronics Packaging
MATE 460	Materials Selection in Mechanical Design
MATE 470	Selected Advanced Topics
MATE 471	Selected Advanced Laboratory
MATE 501	Advanced Engineering Materials
MATE 510	Materials Analysis
MATE 522	Advanced Ceramics

MATE/BMED 530 Biomaterials

MATE 550 Micro Systems

MATE 590 Solidification and Densification

PHYS 412 Solid State Physics

PHYS 413 Advanced Topics in Solid State Physics

PHYS/EE 422 Polymer Electronics Laboratory

### Approved Electives/Technical Breadth Electives<sup>2,3</sup>

Select from the following: 8

AERO/HNRS 310 Air and Space

BMED 310 Biomedical Engineering Measurement and Analysis

BMED 550 Current and Evolving Topics in Biomedical Engineering

BMED/MATE 530 Biomaterials

BRAE 239 Engineering Surveying

BUS 207 Legal Responsibilities of Business

BUS 212 Financial Accounting for Nonbusiness Majors

BUS 488 Planning and Managing New Ventures

CD/PSY 254 Family Psychology

CE 207 Mechanics of Materials II

CHEM 216 Organic Chemistry for Life Sciences I

CHEM 217 Organic Chemistry for Life Sciences II

CHEM 218 Organic Chemistry for Life Sciences III

CHEM 312 Survey of Organic Chemistry

CHEM 316 Organic Chemistry I

CHEM 317 Organic Chemistry II

CHEM 318 Organic Chemistry III

CHEM 319 Advanced Organic Chemistry Laboratory

CHEM 444 Polymers & Coatings I

CHEM 447 Polymers and Coatings Laboratory I

CHEM/MATE 446 Surface Chemistry of Materials

CPE 488/IME 458/MATE 458 Microelectronics and Electronics Packaging

CSC/CPE 235 Fundamentals of Computer Science for Scientists and Engineers I

EE/PHYS 422 Polymer Electronics Laboratory

ECON 221 Microeconomics

ENGR 451 Special Topics in Bioengineering

ENGR 470 Selected Advanced Topics

ENGR 471 Selected Advanced Laboratory

ENGR 322/SCM 302 The Learn By Doing Lab Teaching Practicum

ERSC/GEOG 250 Physical Geography

GEOL 201 Physical Geology

HIST 410 Recent America Since 1950: Shattering of the American Consensus

HIST 417 20th Century China

IME 223 Process Improvement Fundamentals

IME 303	Project Organization and Management	
IME 421	Manufacturing Organizations	
IME/HNRS/ MATE 322	Leadership and Project Management	
IT 341	Packaging Polymers and Processing	
MATE 401	Materials Characterization Techniques	
MATE 425	Corrosion Engineering	
MATE 430	Microfabrication	
MATE 435	Microfabrication Laboratory	
MATE 440	Welding Metallurgy and Joining of Advanced Materials	
MATE 445	Joining of Advanced Materials Laboratory	
MATE 450	Fracture and Failure Analysis	
MATE 460	Materials Selection in Mechanical Design	
MATE 470	Selected Advanced Topics	
MATE 471	Selected Advanced Laboratory	
MATE 504	Research Methods in Materials Engineering	
MATE 510	Materials Analysis	
MATE 570	Selected Advanced Topics	
MATE 571	Selected Advanced Laboratory	
ME 212	Engineering Dynamics	
ME 341	Fluid Mechanics I	
NR/RPTA 203	Resource Law Enforcement	
NR 434	Wood Properties, Products and Sustainable Uses	
PHYS 211	Modern Physics I	
PHYS 412	Solid State Physics	
PHYS 413	Advanced Topics in Solid State Physics	
PSY 256	Developmental Psychology	
PSY 305	Personality	
PSY 419	Self and Identity	
UNIV/HNRS 392	Appropriate Technology for the World's People: Design	
UNIV 424	Design of Museum Displays of Science, Engineering and Technology	
UNIV 492	Appropriate Technology for the World's People: Design	
ZOO 331	Human Anatomy and Physiology I	

**SUPPORT COURSES**

CE 204	Mechanics of Materials I	3
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
CHEM 125	General Chemistry for the Engineering Disciplines II	4
CSC 231	Programming for Engineering Students	2
EE 201	Electric Circuit Theory	3
EE 251	Electric Circuits Laboratory	1
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
IME 144	Introduction to Design and Manufacturing	4
IME 314	Engineering Economics	3-4
or IME 326	Engineering Test Design and Analysis	
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4

MATH 143	Calculus III (Add'l Area B) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
ME 211	Engineering Statics	3
ME 343	Heat Transfer <sup>4</sup>	4
PHYS 141	General Physics IA (Add'l Area B) <sup>1</sup>	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
STAT 312	Statistical Methods for Engineers (B6) <sup>1</sup>	4
<b>GENERAL EDUCATION</b>		
(See GE program requirements below.)		44
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		185-186

- <sup>1</sup> Required in Support; also satisfies GE
- <sup>2</sup> The courses selected to satisfy this requirement may not be used to satisfy other major, support, or general education requirements (no double counting of coursework).
- <sup>3</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>4</sup> MATE 471 (Transport Phenomena I, II, III) plus 1 additional unit of an upper-division technical elective or an approved technical breadth elective may substitute.

**General Education (GE) Requirements**

- 72 units required, 28 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 8 units required at the 300 level.

<b>Area A Communication</b>		
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
<b>Area B Science and Mathematics</b>		
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
<b>Area C Arts and Humanities</b>		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E Society and the Individual</b>		
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4

D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		44

<sup>1</sup> Required in Support; also satisfies GE

# Mechanical Engineering

Engineering Bldg. (13), Room 254  
Phone: 805.756.1334  
[www.me.calpoly.edu/](http://www.me.calpoly.edu/)

Department Chair: James Meagher

College of Engineering Advising Center  
Engineering South (40), Room 114  
Phone: 805.756.1461

## Academic Programs

Program name	Program type
Mechanical Engineering	BS, MS

## Mission Statement

To impart knowledge in the art and science of mechanical engineering through a comprehensive curriculum true to the traditional Cal Poly learn-by-doing philosophy that produces mechanical engineers of high ethics and skill, fully prepared for entry into industry, government, graduate school and private enterprise.

## Program Educational Objectives

A mechanical engineering alumnus will:

1. Research, design, develop, test, evaluate, or implement engineering solutions to problems that are of a complexity encountered in professional practice.
2. Communicate and perform as an effective engineering professional in both individual and team-based project environments.
3. Recognize and determine the ethical implications and societal impacts of engineering solutions.
4. Continuously improve through lifelong learning.

## Program Description

The profession of mechanical engineering is directed toward the design, manufacture, and system integration of a very wide variety of equipment ranging from manufacturing machinery and power generation equipment to consumer goods. Of central concern to mechanical engineers is the sound application of basic principles of solid mechanics, fluid mechanics and thermal sciences in the design, manufacture, and application of this equipment. Mechanical Engineering graduates obtain employment primarily with manufacturers, energy companies, consultants, and government agencies. Types of work performed by graduates include product design, mechanical design, testing, engineering management, engineering sales, design of manufacturing systems, and development of maintenance procedures. Mechanical Engineering graduates also often enhance their careers through graduate study in engineering, and some students also study engineering to build a scientific and technical foundation as a prelude to enrollment in medical, law, and business schools.

The focus of the Cal Poly Mechanical Engineering program is on education based on our "learn by doing" educational philosophy. Thus, the curriculum includes a large number of hands-on laboratories, integration of design throughout, and a senior project requirement for all students. Students are enrolled in engineering laboratories in all years of the curriculum. The program is accredited by the

Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org) (<http://www.abet.org>).

The Mechanical Engineering Department is the home of the Donald E. Bently Center for Engineering Innovation. The center provides support for faculty, students, and visiting scholars for the advancement of research, education, and practice in mechanical engineering. A \$6 million endowment to fund three professorships supports the center.

Upper division students in the **General Concentration** (Degree Requirements and Curriculum (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/generalconcentration>)) can choose professional elective courses from such courses as turbomachinery, robotics, mechatronics, composite materials, rotor dynamics, advanced mechanics, solar systems, internal combustion engines, heat and mass transfer, and courses emphasizing the petroleum, air conditioning, ventilating, and refrigeration industries. Students in the **Mechatronics Concentration** (Degree Requirements and Curriculum (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/mechatronicsconcentration>)) are prepared for professional practice in the design of "intelligent" products for use in factory automation, robotics, hybrid vehicles, alternate energy, and many other fields. The **HVAC&R Concentration** (Degree Requirements and Curriculum (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/hvacrconcentration>)) prepares students for careers in the heating, ventilating, air-conditioning and refrigeration (HVAC&R) industry, with a focus on the design of mechanical systems for commercial and industrial buildings. **Manufacturing Concentration** (Degree Requirements and Curriculum (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/manufacturingconcentration>)) graduates will be uniquely suited for career paths where the engineer blends design and manufacturing. These skills are needed at all modern product development companies.

There are six organized student clubs associated with the Mechanical Engineering Department. These are student chapters of the American Society of Mechanical Engineers, Society of Petroleum Engineers, Society of Automotive Engineers, American Society of Heating, Refrigerating and Air Conditioning Engineers, Alternative Energy Club, and the Pi Tau Sigma honorary society. All of these clubs offer students active programs in professional and leadership activities.

## Undergraduate Program

### BS Mechanical Engineering

The profession of mechanical engineering is directed toward the design, manufacture, and system integration of a very wide variety of equipment ranging from manufacturing machinery and power generation equipment to consumer goods.

### Concentrations

- General Concentration
- Heating, ventilating, Air-Conditioning and Refrigerating Concentration (HVAC&R)
- Mechatronics Concentration



- Manufacturing Concentration

## Graduate Program

### MS Mechanical Engineering

The masters program of the Mechanical Engineering department at Cal Poly is designed to prepare its graduates with skill and knowledge to be able to work as an engineer in research and development, analysis, or design of products and systems, or to continue toward PhD degree from other institutions. Due to the nature of the masters degree, students can select an area of emphasis based on their interest, or alternately, choose courses in a variety of different areas that gives them significant breadth of knowledge. At Cal Poly, masters degree candidates can also select a thesis option or a non-thesis option. The thesis option gives the candidates a more thorough knowledge in the area in which they do their research. The non-thesis option gives the candidates a more diverse knowledge from additional courses.

### General Characteristics

The Master of Science in Mechanical Engineering prepares students to design and develop advanced products and systems; to conduct research and analysis; to work in industry; or to continue study toward a Ph.D. Graduate students enjoy the same flavor of learn-by-doing as other Cal Poly students. Students may choose their technical electives in the area that interests them, including thermo-sciences, controls and robotics, mechanics and stress analysis, composite materials.

### Prerequisites

For admission as a classified graduate student, in addition to the University requirements, an applicant should hold a BS degree in Mechanical Engineering with a grade point average of 3.0. Other closely related majors may be accepted as conditionally classified graduate students until they take necessary prerequisite mechanical engineering courses as approved by the graduate advisor. For additional information on University requirements, please refer to the Graduate Programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation/>) of this catalog.

Two program options are available:

**Thesis option.** 36 units of advisor-approved coursework, 9 units of thesis research/design, and an oral thesis defense examination.

**Non-thesis option.** 45 units of advisor-approved coursework and a written comprehensive examination.

### Blended BS + MS Mechanical Engineering

The blended program provides motivated students with an accelerated route to the MS Mechanical Engineering, with simultaneous conferring of both bachelor's and master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status. Up to two technical electives can be taken as an undergraduate and counted towards the master's degree.

### Eligibility

Students majoring in BS Mechanical Engineering may be eligible to pursue the blended program toward the MS Mechanical Engineering (<http://catalog.calpoly.edu/previouscatalogs/2013-15/>

[collegesandprograms/collegeofengineering/mechanicalengineering/msmechanicalengineering/](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/msmechanicalengineering/)). Participation in the program is based on prior academic performance and other measures of professional promise, with a minimum GPA of 2.5 required, 3.0 recommended. Students are recommended for admission by a faculty committee. Please see Graduate Education (<https://nextcatalog-admin.calpoly.edu/graduateeducation/#generalpoliciesgoverninggraduatestudies>) for eligibility criteria.

Two program options are available: **Thesis option.** 36 units of advisor-approved coursework, 9 units of thesis research/design, and an oral thesis defense examination. **Non-thesis option.** 45 units of advisor-approved coursework and a written comprehensive examination.

## BS Mechanical Engineering

### Program Learning Outcomes

The general program outcomes listed below are from our accrediting body, ABET, <http://www.ABET.org>. The 3 or 4 skills listed under each outcome were defined by the faculty in the ME program. Students who demonstrate proficiency in these skills satisfy the program outcomes.

1. An ability to apply knowledge of mathematics, science, and engineering
  - a. The student will be able to evaluate basic geometrical quantities and mathematical expressions.
  - b. The student will have knowledge of basic sciences and associated analysis techniques.
  - c. The student will be proficient with basic analyses associated with other disciplines.
2. An ability to design and conduct experiments, as well as to analyze and interpret data
  - a. The student will be proficient with the selection and basic operation of common instrumentation used in engineering measurement.
  - b. The student will be able to design and conduct an experiment and compare the results to those predicted by an analytical model.
  - c. The student will be able to interpret and discuss the results.
3. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
  - a. The student will be able to recognize a need and develop appropriate design specifications.
  - b. The student will be able to develop component, system, or process concept solutions based on above specifications.
  - c. The student will be able to use analysis to refine the design of a component, a system, or a process.
  - d. The student will be able to build a functional prototype and assess if it meets performance specifications.
4. An ability to function on multidisciplinary teams
  - a. The student will recognize the value of a broad skill set resulting from a multidisciplinary team.
  - b. The student will be able to communicate effectively with colleagues in other disciplines.
  - c. The student will be able to identify when problems occur due to poor interactions among team members and identify ways to improve team dynamics.

5. An ability to identify, formulate, and solve engineering problems
  - a. The student will be able to identify faulty products or processes and develop an engineering solution.
  - b. The student will be able to select appropriate models for analyzing a system.
  - c. The student will be able to analyze their models and interpret their results.
6. An understanding of professional and ethical responsibility
  - a. The student will have knowledge of ASME code of ethics.
  - b. The student will be able to identify health and safety concerns associated with their design.
  - c. The student will be able to identify situations with ethical concerns.
7. An ability to communicate effectively
  - a. The student will be able to write an effective memorandum, letter, abstract, and project report.
  - b. The student will be able to give a coherent and effective oral presentation.
  - c. The student will be able to critique writing samples and oral presentations and identify both strong points and weak points in grammar, clarity, and organization.
8. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
  - a. The student will be aware of society's need for engineering solutions.
  - b. The student will be aware of the environmental and economic impact of their engineering solutions.
  - c. The student will be able to identify possible unintended negative global or societal consequences of proposed engineering solutions.
9. A recognition of the need for, and an ability to engage in life-long learning
  - a. The student will be able to understand the limitations of their knowledge.
  - b. The student will be able to find and use appropriate technical resources.
  - c. The student will be able to identify their need for additional education.
10. A knowledge of contemporary issues
  - a. The student will be able to identify important contemporary regional, national, or global issues.
  - b. The student will be able to discuss the historical roots of important contemporary regional, national, or local issues.
  - c. The student will be able to discuss ways engineers are contributing or might contribute to the solution of regional, national, or global problems.
11. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
  - a. The student will be proficient with computer-based design simulation and analysis tools.
  - b. The student will be able to perform parametric studies of proposed designs.
  - c. The student will be able to develop a computer algorithm to solve a numerical problem.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

ME 128	Introduction to Mechanical Engineering I <sup>1</sup>	1
ME 129	Introduction to Mechanical Engineering II <sup>1</sup>	1
ME 130	Introduction to Mechanical Engineering III <sup>1</sup>	1
ME 163	Freshmen Orientation to Mechanical Engineering <sup>1</sup>	1
ME 211	Engineering Statics	3
ME 212	Engineering Dynamics	3
ME 234	Philosophy of Design	3
ME 236	Measurements and Engineering Data Analysis	3
ME 251	Introduction to Detailed Design with Solid Modeling	2
ME 302	Thermodynamics I	3
ME 303	Thermodynamics II	3
ME 318	Mechanical Vibrations	4
ME 326	Intermediate Dynamics	4
ME 328	Introduction to Design	4
ME 329	Intermediate Design	4
ME 341	Fluid Mechanics I	3
ME 343	Heat Transfer	4
ME 346	Thermal Science Laboratory	1
ME 347	Fluid Mechanics II	4
ME 422	Mechanical Control Systems	4
ME 440	Thermal System Design	4
Concentration		21-23

### SUPPORT COURSES

BIO 213	Life Science for Engineers (B2) <sup>2</sup>	2
ENGR/BRAE 213	Bioengineering Fundamentals (B2) <sup>2</sup>	2
CE 204	Mechanics of Materials I	3
CE 207	Mechanics of Materials II	3
CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>2</sup>	4
CHEM 125	General Chemistry for the Engineering Disciplines II	4
CSC 231 or CSC 234	Programming for Engineering Students C and Unix	2-3
EE 201	Electric Circuit Theory	3

EE 251	Electric Circuits Laboratory	1
EE 321	Electronics	3
EE 361	Electronics Laboratory	1
ENGL 149	Technical Writing for Engineers (A3) <sup>2</sup>	4
IME 142	Manufacturing Processes: Materials Joining	2
IME 143	Manufacturing Processes: Material Removal	2
MATE 210 & MATE 215	Materials Engineering and Materials Laboratory I	4
MATH 141	Calculus I (B1) <sup>2</sup>	4
MATH 142	Calculus II (B1) <sup>2</sup>	4
MATH 143	Calculus III (Add'l Area B) <sup>2</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
MATH 344	Linear Analysis II (B6) <sup>2</sup>	4
PHYS 131	General Physics I (Add'l Area B) <sup>2</sup>	4
or PHYS 141	General Physics IA	
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
<b>Manufacturing Processes Elective</b>		
Select from the following:		1
IME 141	Manufacturing Processes: Net Shape	
IT 341	Packaging Polymers and Processing	
<b>GENERAL EDUCATION</b>		
(See GE program requirements below.)		40
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		198-201

<sup>1</sup> ME 228 and ME 229 are required in lieu of ME 128, ME 129, ME 130, and ME 163 for transfer students.

<sup>2</sup> Required in Support; also satisfies GE

## Concentrations (select one)

- General (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/generalconcentration>)
- Heating, Ventilating, Air-Conditioning and Refrigerating (HVAC&R) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/hvacrconcentration>)
- Mechatronics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/mechatronicsconcentration>)
- Manufacturing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/bsmechanicalengineering/manufacturingconcentration>)

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 8 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing (4 units in Support) <sup>1</sup>	0
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B6	Upper-division Area B (4 units in Support) <sup>1</sup>	0
Additional Area B units (8 units in Support) <sup>1</sup>		0
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement) (40404)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
Total units		40

<sup>1</sup> Required in Support; also satisfies GE

## Heating, Ventilating, Air-Conditioning and Refrigerating Concentration (HVAC&R)

ME 359	Fundamentals of HVAC Systems	4
ME 456	HVAC Air and Water Distribution System Design	4
ME 457	Refrigeration Principles and Design	4
ME 458	Building Heating and Cooling Loads	4
ME 459	HVAC Senior Design Project I	3
ME 460	HVAC Senior Design Project II	2
Total units		21

## ME - General Concentration

ME 428	Senior Design Project I	3
ME 429	Senior Design Project II	2
ME 430	Senior Design Project III	1
EE 255	Energy Conversion Electromagnetics	3
EE 295	Energy Conversion Electromagnetics Laboratory	1

### Technical Electives <sup>1,2</sup>

Select from the following:		12
Select at least 8 units from the following ME courses:		
ME 305	Introduction to Mechatronics	
ME 359	Fundamentals of HVAC Systems	

ME 401	Stress Analysis
ME 402	Orthopedic Biomechanics
ME 405	Mechatronics
ME 410	Experimental Methods in Mechanical Design I
ME 412	Composite Materials Analysis and Design
ME 415	Energy Conversion
ME 416	Ground Vehicle Dynamics and Design
ME 423	Robotics: Fundamentals and Applications
ME 424	Design of Piping Systems
ME 431	Mechanical Design Techniques
ME 432	Petroleum Reservoir Engineering
ME 434	Enhanced Oil Recovery
ME 435	Drilling Engineering
ME 436	Petroleum Production Engineering
ME 441	Single Track Vehicle Design
ME 443	Turbomachinery
ME 444	Combustion Engine Design
ME 446	Advanced and Hybrid Vehicle Design
ME 450	Solar Power Systems
ME 456	HVAC Air and Water Distribution System Design
ME 457	Refrigeration Principles and Design
ME 458	Building Heating and Cooling Loads
ME 488	Wind Energy Engineering
ME 506	System Dynamics
ME 507	Mechanical Control System Design
ME 517	Advanced Vibrations
ME 518	Machinery Vibration and Rotor Dynamics
ME 531	Acoustics and Noise Control
ME 540	Viscous Flow
ME 541	Advanced Thermodynamics
ME 542	Dynamics and Thermodynamics of Compressible Flow
ME 551	Mechanical Systems Analysis
ME 552	Advanced Heat Transfer I
ME 553	Advanced Heat Transfer II
ME 554	Computational Heat Transfer
ME 556	Advanced Heat Transfer III
ME 579	Fluid Power Control
ME/CE 404	Applied Finite Element Analysis
ME 501/ CE 511	Continuum Mechanics and Elasticity
ME 503/ CE 513	Inelastic Stress Analysis
ME/CE 504	Finite Element Analysis I
ME/CE 505	Finite Element Analysis II

Select up to 4 units of non-ME courses from:

Any upper division or graduate level course in the College of Engineering with the exception of GE Area F, senior project, thesis, special problems, and coop courses.

Total units 22

<sup>1</sup> Consultation with advisor is recommended prior to selecting technical electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## 2 Notes:

1. ME 470, ME 471, ME 570 and ME 571 are variable topics courses and may or may not count as ME electives. Please contact instructor for additional information.
2. ME 400 and ME 500 are independent study classes and may be acceptable for technical elective credit. A course substitution form is required.
3. Exceptions to this policy are possible through consultation with the department chair.

## Manufacturing Concentration

IME 327	Test Design and Analysis in Manufacturing Engineering	4
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Choose one of the following emphasis areas: 8-9

### Mechanical Manufacturing

IME 330	Fundamentals of Manufacturing Engineering <sup>1</sup>
IME 450	Manufacturing Process and Tool Engineering

### Electronics Manufacturing

IME/MATE 458	Microelectronics and Electronics Packaging
MATE 430 & MATE 435	Microfabrication and Microfabrication Laboratory

### Design and Manufacturing Elective

Select from the following: 4

IME 330	Fundamentals of Manufacturing Engineering
IME 335	Computer-Aided Manufacturing I
IME 356	Manufacturing Automation
IME 418	Product-Process Design
IME 427	Design of Experiments
IME 428	Engineering Metrology
IME 430	Quality Engineering
IME 457	Advanced Electronic Manufacturing
IME/MATE 458	Microelectronics and Electronics Packaging <sup>1</sup>
MATE 430 & MATE 435	Microfabrication and Microfabrication Laboratory <sup>1</sup>
MATE 440 & MATE 445	Welding Metallurgy and Joining of Advanced Materials and Joining of Advanced Materials Laboratory
ME 305	Introduction to Mechatronics
ME 412	Composite Materials Analysis and Design
ME 428 & ME 429 & ME 430	Senior Design Project I and Senior Design Project II and Senior Design Project III

Total units 22-23

<sup>1</sup> If not taken as part of the emphasis area courses cannot be double counted.

## Mechatronics Concentration

ME 305	Introduction to Mechatronics	4
ME 405	Mechatronics	4
ME 423	Robotics: Fundamentals and Applications	4
ME 428	Senior Design Project I	3
ME 429	Senior Design Project II	2

ME 430	Senior Design Project III	1
Select from the following: <sup>1</sup>		4
IME 356	Manufacturing Automation	
ME 506	System Dynamics	
ME 507	Mechanical Control System Design	
Total units		22

<sup>1</sup> Elective based on interests of students.

## MS Mechanical Engineering

### Program Learning Outcomes

Upon completing the requirements of the Master of Science in Mechanical Engineering, students should be able to:

1. Devise a plan to research issues relevant to the problem at hand and to conduct experiments or develop a computer model.
2. Formulate solutions to advanced engineering problems.
3. Analyze the collected or generated data and draw conclusions from the results.
4. Analyze and synthesize advanced engineering solutions.

#### Required Courses

ME 599	Design Project (Thesis)	9
Or 9 units of approved Technical Electives and a Comprehensive Examination		
Approved MATH/STAT/CSC Courses		8
Select from the following:		12
ME 501	Continuum Mechanics and Elasticity	
ME 503	Inelastic Stress Analysis	
ME 504	Finite Element Analysis I	
ME 506	System Dynamics	
ME 505	Finite Element Analysis II	
ME 507	Mechanical Control System Design	
ME 517	Advanced Vibrations	
ME 518	Machinery Vibration and Rotor Dynamics	
ME 531	Acoustics and Noise Control	
ME 540	Viscous Flow	
ME 541	Advanced Thermodynamics	
ME 542	Dynamics and Thermodynamics of Compressible Flow	
ME 551	Mechanical Systems Analysis	
ME 552	Advanced Heat Transfer I	
ME 553	Advanced Heat Transfer II	
ME 554	Computational Heat Transfer	
ME 556	Advanced Heat Transfer III	
ME 579	Fluid Power Control	
<b>Approved Technical Electives</b>		
400 or 500-level ME or non-ME courses; maximum of 12 units of 400-level courses allowed		16
Total units		45



## College of Liberal Arts

Faculty Office Bldg. (47), Room 31  
Phone: 805.756.2359

Dean: Douglas L. Epperson

Associate Dean: Penny K. Bennett

Associate Dean: Debra L. Valencia-Laver

### Academic Programs

Program name	Program type
Agricultural Communication	Minor
Anthropology and Geography	BS, Minor
Art and Design	BFA
Art History	Minor
Asian Studies	Minor
Child Development	BS, Minor
Communication Studies	BA, Minor
Comparative Ethnic Studies	BA
Dance	Minor
English	BA, MA, Minor
Ethnic Studies	Minor
French	Minor
German	Minor
Gerontology	Minor
Global Politics	Minor
Graphic Communication	BS, Minor
History	BA, MA, Minor
Indigenous Studies in Natural Resources and the Environment	Minor
Journalism	BS
Latin American Studies	Minor
Law and Society	Minor
Liberal Arts & Engineering Studies	BA
Linguistics	Minor
Media Arts and Technologies	Minor
Modern Languages and Literatures	BA
Music	BA, Minor
Philosophy	BA, Minor
Photography	Minor
Political Science	BA, Minor
Printed Electronics and Functional Imaging	MS
Psychology	BS, MS, Minor
Public Policy	MPP
Religious Studies	Minor
Science, Technology, and Society	Minor
Sociology	BA, Minor
Spanish	Minor
Studio Art	Minor
Theatre Arts	BA, Minor
Western Intellectual Tradition	Minor
Women's and Gender Studies	Minor

The College of Liberal Arts (CLA) provides the opportunity to study in depth the record of imaginative and reflective human experience.

Through papers, projects, research, and service, students are encouraged to develop the knowledge and skills to add to this record. As well, the college seeks to relate itself to the technological disciplines in a way that helps contribute to the solution of human problems from global and multidisciplinary perspectives. Accordingly, a wide range of courses is offered to serve every student without regard to specialized professional interests.

Four broad areas of knowledge are represented: the fine and performing arts, communications, humanities, and social sciences. While the college has great breadth and diversity, unity is found in a study of the most engaging subject of all – human endeavor. Whatever the focus, the programs in the CLA share a settled purpose: to help each student know herself or himself, to understand human values and human potential, and to understand our society and its institutions.

The CLA offers a wide variety of classes that fulfill Cal Poly's general education and USCP requirements. Foundational courses provide students with a strong grounding in critical thinking and written and oral communication. The disciplines of the liberal arts are explored at both introductory and advanced levels; students are encouraged to further pursue areas of interest through the college's many minors.

The college also offers interdisciplinary and international courses through its Humanities Program as well as its two interdisciplinary minors that explore technology and its influence. For more information, contact the Humanities Program Office (Bldg 47, Room 31, 805.756.2359).

The college's interdisciplinary major, Bachelor of Arts in Liberal Arts and Engineering Studies, allows students to combine coursework from the College of Liberal Arts and the College of Engineering to explore cutting-edge technologies and their applications to areas such as media arts, technology policy, and technical writing and communications. The degree is offered jointly by both colleges. For more information, see Interdisciplinary Degree Programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms>) .

Study abroad opportunities are strongly supported, and CLA faculty regularly offer classes in programs such as Cal Poly's Summer Study in London, Thailand Study Program, Valladolid (Spain) Program, and Australia Abroad Program. The college is also involved with the Peru Summer Study Program, which provides internships that complement the minor in Latin American Studies. These study abroad programs are administered by the Cal Poly International Center. For further information, see Cal Poly International Center (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/academicservicesandprograms/calpolyinternationalcenter>) .

The College of Liberal Arts offers a wide range of learn-by-doing opportunities. Students from all majors participate in the musical ensembles, theater productions, and dance performances. The college supports the Central Coast Center for Arts Education and the University Art Gallery. Students especially those in the social and behavioral sciences, participate in a variety of internships at the local, state, and national government level and with community, social services, and educational organizations. Students contribute to publications that showcase their accomplishments in their major, such as the English Department's *Byzantium*, the Ethnic Studies Department's *Osiyo*, and the History Department's *The Forum*. These publications are often printed by the student-run University

Graphic Systems. Students also participate in student-produced media including KCPR Radio, *Mustang Daily*, and CPTV.

The college has a major responsibility for activities that enhance the cultural and intellectual life of the University and the community. Departments regularly host speakers and present films and other programming. The college sponsors the Spanos Theatre and Cal Poly Arts, offering a full range of cultural programs, including exhibits, concerts, literary presentations, and dramatic productions, while fostering artistic development and accomplishment across the campus.

College of Liberal Arts graduates will be able to:

1. Question assumptions through critical inquiry.
2. Be innovative; think creatively and constructively.
3. Communicate effectively orally and in writing.
4. Develop scholarly depth within their disciplines.
5. Understand the value of cross-disciplinary knowledge.
6. Collaborate productively in diverse settings and with diverse others.
7. Make reasoned, ethical, and socially and ecologically responsible decisions.
8. Understand the self as product of - and participant in - global traditions of art, ideas, and values.
9. Engage in life-long learning.

## Western Intellectual Tradition Minor

Faculty Offices North (Bldg. 47), Room 26S

Phone: 805.756.2239

<http://english.calpoly.edu/wit-minor>

Professor and Director: John C. Hampsey

This minor is designed to appeal not only to majors in the College of Liberal Arts and the College of Science and Mathematics, but to a cross-section of students in major programs throughout the university community. It focuses on the major accomplishments of the Western intellectual tradition through courses that trace the development of literary expression, philosophical and scientific thought, and historical understanding from their beginnings to the modern world. Courses in the minor provide direct experience with significant works of the Western tradition, and also expose students to crucial ideas and themes that shaped Western thought and culture. Such exposure cultivates the intellectual skills of analysis and creative expression, and promotes an understanding of the inherent intellectual debate and diversity within the Western intellectual tradition.

**Prerequisites.** Students must complete the second quarter of calculus (MATH 142 or or MATH 182) or the fourth quarter of a foreign language (FR 201, GER 201, SPAN 201) or equivalent. The prerequisites reflect the centrality of both mathematics and language to the Western intellectual tradition. Mathematics pervades the modern world and has a particularly close connection with the human capacity for learning. To study a language other than English is to study English as well, and promotes insight into language in general as the articulation of experience and the discourse of reason.

## Indigenous Studies in Natural Resources and the Environment Minor

An interdisciplinary minor sponsored by the departments of Natural Resources Management and Environmental Sciences and Ethnic Studies. For more information, see

the Natural Resources Management and Environmental Sciences (<https://nextcatalog-admin.calpoly.edu/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences>) section.

## Western Intellectual Tradition Minor

Courses used to satisfy the required 12 units in Group A and 16 in Group B must be chosen outside the student's major and from at least two disciplines in each group.

### Group A

Select from the following: 12

Great Books World Literature (C1): <sup>1</sup>

ENGL 251 Great Books I: Introduction to Classical Literature

ENGL 252 Great Books II: Medieval to Enlightenment Literature

ENGL 253 Great Books III: Romanticism to Modernism Literature

Western Civilization:

HIST 110 Western Civilization: Ancient to Renaissance

or HIST 111 Western Civilization: Reformation to the Present

Philosophical Classics (C2): <sup>1</sup>

PHIL 230 Philosophical Classics: Knowledge and Reality

or PHIL 231 Philosophical Classics: Ethics and Political Philosophy

PHYS 211 Modern Physics I

POLS 230 Basic Concepts of Political Thought

### Group B

Select from the following: 16

BIO 414 Evolution

American Literature (C4): <sup>1</sup>

ENGL 340 The Literary Sources of the American Character: 1600-1865

ENGL 341 The Literary Sources of the American Character: 1865-1914

ENGL 342 The Literary Sources of the American Character: 1914-1956

British Literature (C4): <sup>1</sup>

ENGL 330 British Literature in the Age of Belief: to 1485

ENGL 331 British Literature in the Age of Discovery: 1485-1660

ENGL 332 British Literature in the Age of Enlightenment: 1660-1798

ENGL 333 British Literature in the Age of Romanticism: 1798-1832

ENGL 334 British Literature in the Age of Industrialism: 1832-1914

ENGL 335 British Literature in the Age of Modernism: 1914-Present

Shakespeare (C4): <sup>1</sup>

ENGL 338 Introduction to Shakespeare-London Study

or ENGL 339 Introduction to Shakespeare

History:

HIST 307 European Thought 1800-2000 (D5) <sup>1</sup>

HIST 350 The Scientific Revolution, c. 1500-1800

HIST 436 History of American Thought

HIST 451 Medieval Europe

HIST 452 Renaissance and Reformation Europe

HIST 453 Religious Wars and Absolutism

HIST 454 The Age of Revolution and Napoleon

MATH 419 Introduction to the History of Mathematics

Philosophy (C4): <sup>1</sup>

PHIL 311 Greek Philosophy

PHIL 312 Medieval Philosophy

PHIL 313 Early Modern Rationalism

PHIL 314 Early Modern Empiricism

PHIL 315 Kant and 19th Century European Philosophy

PHIL 332 History of Ethics

PHIL 421 Philosophy of Space, Time and Matter

Political Thought:

POLS 330 Modern Political Thought

POLS 349 Contemporary American Political Thought (D5) <sup>1</sup>

SPAN 416 Don Quixote

Total units 28

<sup>1</sup> Satisfies General Education requirement Units

## Art & Design

Dexter Bldg. (34), Room 169

Phone: 805.756.1148

<http://artdesign.calpoly.edu>

Department Chair: Giancarlo Fiorenza

### Academic Programs

Program name	Program type
Art and Design	BFA
Art History	Minor
Photography	Minor
Studio Art	Minor

Admission/acceptance to the Bachelor of Fine Arts degree program in Art and Design requires a demonstrated ability in the chosen concentration in art through the presentation of a representative portfolio, outlined in the department's submission guidelines. Submission of portfolio is by invitation only; the department will contact students with information regarding submitting the appropriate materials in a timely manner.

The department operates the University Art Gallery, located in the Dexter Building (34), room 171. The gallery is a venue that serves the University, the city of San Luis Obispo, and the surrounding areas. It showcases nationally and internationally known artists, as well as student, alumni and faculty artwork. The gallery creates an environment for learning and discussion of ideas critical to art and society.

## Undergraduate Programs

### BFA Art and Design

The Bachelor of Fine Arts degree (BFA) program in Art and Design offers a major with concentrations in graphic design, photography, and studio art. The BFA in Art and Design is accredited by the National Association of Schools of Art and Design. The department has made a commitment to cultural diversity. Wherever possible, this commitment is evidenced by the inclusion of material which identifies significant multicultural influences on the content of the courses in our curriculum. Courses are available for all students to enrich their creativity, understanding, appreciation, and practical skills in art.

### Concentrations

All three concentrations support creative and aesthetic growth and require the development of technical skills as a foundation for personal direction and enrichment. Through team projects, students have the unique opportunity to experience the interaction and relationship of graphic design, photography, and studio art.

#### Graphic Design <sup>1</sup>

Principles of basic design, typography and design history, with specialized courses in such topics as corporate identity, packaging graphics, web site design, advertising, editorial design and illustration. Emphasis is placed on the development of visual problem-solving methodology and acquisition of skills needed in the design profession. Coursework in computer imaging and interactive design allows for an exploration of new technology. The program culminates in the study of professional practices and the preparation of a professional portfolio.

<sup>1</sup> The Art and Design Department's Graphic Design concentration focuses on creative problem-solving and development of design and layout skills. The Graphic Design concentration leads to positions such as graphic designer, web designer, art director and creative director for advertising agencies, design studios and corporate design departments.

In contrast, the Graphic Communication Department's Design Reproduction Technology concentration focuses on the technical and electronic aspects of transforming design for reproduction in print and digital media. The concentration focuses on printing, web development, publishing, packaging, digital imaging, computer graphics, and related areas of mass media preparation and production.

### Photography

A diversified and commercially oriented program stressing preparation for careers in advertising and illustration, portraiture, corporate and editorial photography, digital image making, and photographic history. Creative problem solving is stressed within the context of a variety of expressive projects, including studio and location lighting, traditional photographic processes, digital image making, large format photography, video and multimedia production, and advertising illustration. The program culminates in the creation of a professional portfolio and discussion of current professional practices.

### Studio Art

A selective program designed for students seeking a broad based undergraduate education in the visual arts. The program is distinctive for its depth of required coursework in both two- and three-dimensional media. The upper division curriculum allows students to specialize in preparation for pursuit of advanced degrees and/or careers in the visual arts. With its learn-by-doing philosophy and its commitment to both the liberal arts and technology, Cal Poly provides a unique setting for studying the visual arts. Within this context, students in the Studio Art concentration are presented with an environment where imagination, intellectual rigor, self expression and skill development are expected and valued.

### Art History Minor

Courses consist of a required core and approved electives. The courses include art and architectural history. Students, working with an advisor, select their area(s) of interest.

Advisors are: Elizabeth Adan, Giancarlo Fiorenza, or Jean Wetzel.

### Photography Minor

Courses consist of a required core and approved electives. Students, working with an advisor, select their area(s) of interest. Admission to the minor is contingent upon a departmental review of a portfolio as specified on the minor curriculum sheet.

Advisors are: Sky Bergman, Robert Howell, or Eric Johnson.

### Studio Art Minor

Courses consist of a required core and approved electives. The electives include courses in 2D, 3D studio, and art history. Students, working with an advisor, select their area(s) of interest.

Advisors are: Daniel Dove, Tera Galanti, Michael Barton Miller or Diana Puntar

# BFA Art and Design

## Program Learning Objectives

1. Produce a strong body of work and/or professional portfolio
2. Establish and maintain a rigorous creative practice that is productive and professional
3. Develop an articulate, sophisticated visual, verbal, and technical vocabulary related to art and design from a broad range of styles and periods
4. Apply comparative reasoning in evaluating works of art and design
5. Contribute to diverse, cross-disciplinary, collaborative endeavors
6. Resolve problems and challenge assumptions through innovative thinking and visual expression
7. Demonstrate integrity and make ethical decisions in creative expression and professional practice
8. Perpetuate a life-long commitment to learning, inquiry, and discovery

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: Up to 4 units of major, support or concentration courses may be selected as credit/no credit.

### MAJOR COURSES

ART 101	The Fundamentals of Drawing (C3) <sup>1</sup>	4
ART 105	Foundation: Color Theory	4
ART 106	Foundation: 2-Dimensional Design	4
ART 107	Foundation: 3-Dimensional Design	4
ART 182	Photographic Manipulation and Design	4
ART 203	Art Theory and Practice	4
ART 209	Beginning Painting	4
ART 211	Art Hist - Ancient to Renaissance	4
or ART 212	Art History - Renaissance through Baroque Eras	
ART 222	Black and White Photography <sup>2</sup>	4
ART 260	Art Critique and Discourse	4
ART 312	Art History - Modern Art, 1900-1945	4
or ART 315	Art History - Art Since 1945	
Art History		8
Select from the following upper division art history courses not already required in major core or concentration:		
ART 310	Art History - American Art	
ART 311	Art History - Nineteenth Century Art	
ART 312	Art History - Modern Art, 1900-1945	
ART 313	Design History	

ART 314	History of Photography	
ART 315	Art History - Art Since 1945	
ART 316	Women as Subject and Object in Art History	
ART 317	Asian Art Survey	
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements	
ART 370	Michelangelo	
ART 371	Topics in Renaissance Art	
ART 410	Art History Methodologies and Research	
ART 360	Professional Practices	2
ART 462	Senior Portfolio Project	2
Concentration courses (see below)		60-61
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		68
<b>FREE ELECTIVES</b>		
Free Electives		0
Total units		184-185

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> Students in the Graphic Design and the Studio Art concentrations may substitute ART 122.

## Concentrations (select one)

- Graphic Design (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/artdesign/bfaartanddesign/graphicdesignconcentration>)
- Photography (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/artdesign/bfaartanddesign/photographyconcentration>)
- Studio Art (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/artdesign/bfaartanddesign/studioartconcentration>)

## General Education (GE) Requirements

- 72 units required, 4 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A Communication</b>		
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B Science and Mathematics</b>		
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C Arts and Humanities</b>		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts (4 units in major) <sup>1</sup>	0
C4	Upper-division elective (no ART course)	4



Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		68

<sup>1</sup> Required in Major; also satisfies GE

## Graphic Design Concentration

ART 183	Digital Illustration and Design	4
ART 184	Digital Book Making and Design	4
ART 201	Intermediate Drawing	4
ART 237	Graphic Design I	4
ART 238	Typography I	4
ART 313	Design History	4
ART 337	Graphic Design II	4
ART 338	Typography II	4
ART 380	Design Principles for the Web	4
ART 388	Web Design	4
ART 437	Graphic Design III	4
ART 438	Typography III	4
ART 468	Portfolio Production	1
Select from the following:		11-12
Any ART course not already required in the major core		
GRC 101	Introduction to Graphic Communication	
GRC 203	Digital File Preparation and Workflow	
GRC 337	Consumer Packaging	
(At least 3 units must be upper division)		
Total units		60-61

## Photography Concentration

ART 224	Introduction to Artificial Lighting for Photography	4
ART 227	Lifestyle Photography	4
ART 314	History of Photography	4
ART 324	Photographic Expression	4
ART 325	Advanced Camera Techniques	4
ART 329	Editorial Photography	4
ART 383	Digital Video	4
ART 427	Advertising Photography	4
ART 468	Portfolio Production	1
ART 486	Photography: Image and Idea	4
GRC 331	Color Management and Quality Analysis	4
Any ART courses not already required in the major core.		19-20
Total units		60-61

## Studio Art Concentration

ART 148	Beginning Sculpture	4
ART 201	Intermediate Drawing	4
ART 211	Art Hist - Ancient to Renaissance	4
or ART 212	Art History - Renaissance through Baroque Eras	
(whichever not taken in major core)		
ART 245	Ceramics I	4
or ART 348	Intermediate Sculpture	
ART 301	Advanced Drawing	4
ART 302	Life Drawing I	4
ART 309	Intermediate Painting	4
ART 312	Art History - Modern Art, 1900-1945	4
or ART 315	Art History - Art Since 1945	
(whichever not taken in major core)		
Select from the following:		12
(300-400 level) Studio Art courses		
ART 336	Exhibition Design/Museum Studies	
ART 341	Glassblowing	
ART 345	Ceramics II	
ART 348	Intermediate Sculpture	
ART 353	Intermedia / Art	
ART 402	Life Drawing II	
ART 406	Contemporary Issues in Painting	
ART 409	Advanced Painting	
ART 440	Advanced Selected Topics in Glass	
ART 448	Advanced Topics in Sculpture	
Any ART courses not already required in the major core.		16
(See course descriptions for repeatable units). At least 4 units must be upper division.		
Total units		60

## Art History Minor

Select one survey course in Art History:		4
ART 112	Survey of Western Art (C3)	
ART 211	Art Hist - Ancient to Renaissance	
ART 212	Art History - Renaissance through Baroque Eras	
Select one survey course in Architecture:		4
ARCH 217	History of World Architecture: Prehistory - Middle Ages (C3)	
ARCH 218	History of World Architecture: Middle Ages - 18th Century (C3)	
ARCH 219	History of World Architecture: 18th Century - Present (C3)	
Select one 300-level Non-Western Course:		4
ART 317	Asian Art Survey	
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements (C4)	
ARCH 320	Topics in Architectural History (C4) <sup>1</sup>	
Select one 300-level Western Course		4
ART 310	Art History - American Art	
ART 311	Art History - Nineteenth Century Art (C4)	

ART 312	Art History - Modern Art, 1900-1945	
ART 315	Art History - Art Since 1945	
ART/WGS 316	Women as Subject and Object in Art History	
ART 370	Michelangelo	
ART 371	Topics in Renaissance Art (C4)	
ARCH 320	Topics in Architectural History (C4) <sup>1</sup>	
Select one 400-level Art History Methods/Research Course		4
ART 410	Art History Methodologies and Research	
Approved Electives		8
Select from the following Western or non-Western, architecture or art history classes, at the 300-400 level:		
ART 310	Art History - American Art	
ART 311	Art History - Nineteenth Century Art (C4)	
ART 312	Art History - Modern Art, 1900-1945	
ART 315	Art History - Art Since 1945	
ART/WGS 316	Women as Subject and Object in Art History	
ART 317	Asian Art Survey	
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements	
ART 370	Michelangelo (C4)	
ART 371	Topics in Renaissance Art (C4)	
ARCH 320	Topics in Architectural History	
ARCH 420	Seminar in Architectural History, Theory and Criticism	
Total units		28

<sup>1</sup> Depending on topic.

## Photography Minor

Select from the following:		12
ART 122	Basic Digital Photography	
ART 182	Photographic Manipulation and Design	
ART 222	Black and White Photography	
ART 224	Introduction to Artificial Lighting for Photography	
ART 227	Lifestyle Photography	
ART 314	History of Photography (C4) <sup>1</sup>	
Select from the following:		12
ART 314	History of Photography (C4)	
ART 324	Photographic Expression	
ART 325	Advanced Camera Techniques	
ART 329	Editorial Photography	
ART 383	Digital Video	
ART 427	Advertising Photography	
ART 484	Animation, Video, and Interactive Design	
ART 486	Photography: Image and Idea	
Total units		24

<sup>1</sup> If selected, course may not be selected again below.

## Studio Art Minor

### Required Courses

ART 101	The Fundamentals of Drawing (C3)	4
ART 148	Beginning Sculpture (C3)	4
ART 312	Art History - Modern Art, 1900-1945	4
or ART 315	Art History - Art Since 1945	

### ART Approved Electives

Select from the following:		4
ART 201	Intermediate Drawing	
ART 203	Art Theory and Practice	
ART 209	Beginning Painting	
ART 222	Black and White Photography	
ART 241	Introduction to Glass Fusing and Forming	
ART 245	Ceramics I	
ART 260	Art Critique and Discourse	
Select from the following:		12
(see course descriptions for repeatable units)		
ART 301	Advanced Drawing	
ART 302	Life Drawing I	
ART 309	Intermediate Painting	
ART 311	Art History - Nineteenth Century Art (C4)	
ART 316	Women as Subject and Object in Art History	
ART 334	Illustration I: Techniques and Tools	
ART 336	Exhibition Design/Museum Studies	
ART 341	Glassblowing	
ART 345	Ceramics II	
ART 348	Intermediate Sculpture	
ART 353	Intermedia / Art	
ART 400	Special Problems for Advanced Undergraduates	
ART 402	Life Drawing II	
ART 406	Contemporary Issues in Painting	
ART 409	Advanced Painting	
ART 440	Advanced Selected Topics in Glass	
ART 448	Advanced Topics in Sculpture	
Total units		28

## Communication Studies

Faculty Office Bldg. (47), Room 33  
Phone: 805.756.2553  
<http://www.calpoly.edu/~spc/>

Department Chair: Bernard K. Duffy

### Academic Programs

Program name	Program type
Communication Studies	BA, Minor

Understanding the process of communication is no less important in today's Information Age than it was during the Golden Age of Athens, when skill in oral communication determined one's success in life. The study of the human capacity for speech as a means of influence, entertainment, and information was at the foundation of Western Civilization. A course of study in communication, always one that required knowledge of many cognate fields such as psychology and logic, remains interdisciplinary in nature. Faculty in Communication Studies teach aesthetic, historical, critical, and empirical methods for understanding communication.

The aims of the discipline are both conceptual and practical. The study of communication embodies the concerns of rhetoric, one of the three original liberal arts. In broad terms, students who enroll in a liberal arts curriculum do so to develop the ability to analyze and reason critically, write and speak effectively, and appreciate the influences of culture upon their lives. The first goal of the department is to advance these objectives.

Courses in the modern discipline of communication studies focus on the history, theory and practice of human communication. The field embraces communication in all contexts: political, organizational, debate, small group, intercultural, instructional, mass media, and performance of literature. The emphasis on developing theoretical insights unites these various fields.

The department offers fully articulated major and minor programs. Through the use of approved electives, the major can be shaped to assist students in preparing for their educational and career objectives. Students use a communication studies major to prepare for careers in business, advertising and public relations, theatre, law, education, the mass media, and the clergy. In addition to providing students with an option to select from a broad range of internships and the opportunity to participate in the Teaching Credential Program, the department houses an extensive program in competitive debate. It also offers individual and sequenced courses to develop practical skills in oral composition, critical thinking, and effective human communication.

### Mission Statement

The general mission of the Communication Studies program is to facilitate students in developing their ability to reason critically, to speak and write effectively, and to understand and appreciate the influences of culture upon their lives. The discipline specific mission of the Communication Studies curriculum is to enhance understanding of the nature, processes and effects of human communication. Multi-dimensional in its approach, the discipline uses the rich resources of both the humanities and the social sciences in exploring the human capacity for speech – when, where, why, how, and with what effect people interact through language and extra-linguistic symbols – and focuses on the theory and practice of human communication in a variety of contexts: interpersonal, intercultural, instructional,

organizational, political, in dyads, in small groups, and in the mass media.

### Undergraduate Programs

#### BA Communication Studies

The Bachelor of Arts in Communication Studies degree prepares students for careers in the various communication professions, as well as a wide variety of occupations that place a premium on excellent communication skills. In addition, many Communication Studies graduates go on to earn advanced degrees in disciplines such as communication, psychology, sociology, and law. The Communication Studies curriculum draws from the traditions of both the humanities and the social sciences, and includes a wide array of courses investigating the nature, processes and effects of human communication.

#### Communication Studies Minor

A 28-unit minor is available for students who desire documented competency in Communication Studies. After completing the core courses listed below, students may select the remainder of their courses from an approved list. Copies of the list and further information and application forms are available in the Communication Studies Department office.

### BA Communication Studies

#### Program Learning Objectives

1. Enhanced critical thinking ability.
2. Enhanced competency in written communication.
3. Enhanced competency in oral communication.
4. Enhanced conversation management skills in interpersonal settings.
5. Enhanced competency in small group settings, both as leader and participant.
6. Enhanced ability to develop effective message patterns in organizational settings.
7. Increased understanding of the importance of ethics and values in human communication.

#### Student Learning Objectives

1. Demonstrate an understanding of classical and contemporary human communication theories.
2. Demonstrate an understanding of communication from a variety of philosophical, historical, theoretical and practical perspectives.
3. Demonstrate an increased sensitivity to multicultural dimensions of communication.
4. Demonstrate an understanding of communication in diverse contexts – interpersonal, small group, public, organizational, and mass media.
5. Demonstrate enhanced analytical, critical and performance competencies that will assist students in participating effectively in a democratic society.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/>)

previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

Select from the following:	4
COMS 201 Advanced Public Speaking	
COMS 208 Performance of Literature	
COMS 226 Applied Argumentation	
COMS 212 Interpersonal Communication	4
COMS 213 Organizational Communication	4
COMS 217 Small Group Communication	4
COMS 250 Forensic Activity	2
COMS 311 Communication Theory	4
COMS 312 Communication Research Methods	4
COMS 322 Persuasion	4
COMS 330 Classical Rhetorical Theory	4
COMS 331 Contemporary Rhetorical Theory	4
or COMS 435 American Political Rhetoric	
COMS 332 Rhetorical Criticism	4
COMS 350 Advanced Forensic Activity	2
COMS 385 Media Criticism	4
or COMS 419 Media Effects	
COMS 416 Intercultural Communication (USCP)	4
COMS 460 Undergraduate Seminar	1
COMS 461 Senior Project	3
COMS electives (300-400 level) <sup>2</sup>	16

### SUPPORT COURSES

Upper division writing intensive class	
Select from the following:	4
ENGL 302 Writing: Advanced Composition	
ENGL 310 Corporate Communication	
ENGL 386 Creative Nonfiction	
Modern language 103 (FR, GER, CHIN, ITAL, JPNS, MLL, SPAN) or demonstration of comparable level of proficiency	4
HIST 110 Western Civilization: Ancient to Renaissance	4
Select from the following:	4
HIST 202 United States History Since 1865 (D1) <sup>1, 3</sup>	
HIST 223 World History, 1800 - Present (D3) <sup>1, 4</sup>	
PSY 201 General Psychology (D4) <sup>1, 5</sup>	4
or PSY 202 General Psychology	
STAT 217 Introduction to Statistical Concepts and Methods (B1) <sup>1, 6</sup>	4

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 60

### FREE ELECTIVES

Free Electives	24
Total units	180

- <sup>1</sup> Required in Support; also satisfies GE.
- <sup>2</sup> Only 4 units of supervised instruction, including COMS 400, COMS 450, and COMS 485, may be counted here.
- <sup>3</sup> HIST 202 simultaneously satisfies GE D1.
- <sup>4</sup> HIST 223 simultaneously satisfies GE D3.
- <sup>5</sup> PSY 201 and PSY 202 simultaneously satisfies GE D4.
- <sup>6</sup> STAT 217 simultaneously satisfies 4 units of GE B1.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

### Area A Communication

A1 Expository Writing	4
A2 Oral Communication	4
A3 Reasoning, Argumentation and Writing	4

### Area B Science and Mathematics

B1 Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup>	4
B2 Life Science	4
B3 Physical Science	4
B4 One lab taken with either a B2 or B3	
B5 Area B Elective (select one course from B1-B5)	4

### Area C Arts and Humanities

C1 Literature	4
C2 Philosophy	4
C3 Fine/Performing Arts	4
C4 Upper-division elective (no COMS course)	4

### Area D/E Society and the Individual

D1 The American Experience (Title 5, Section 40404 requirement) (0-4 units in Support) <sup>1</sup>	0-4
D2 Political Economy	4
D3 Comparative Social Institutes (0-4 units in Support) <sup>1</sup>	0-4
D4 Self Development (CSU Area E) (4 units in Support) <sup>1</sup>	0
D5 Upper-division elective (no COMS course)	4

### Area F Technology

F Upper-division elective	4
Total units	60

- <sup>1</sup> Required in Support; also satisfies GE.

## Communication Studies Minor

### Required Courses

COMS 212 Interpersonal Communication	4
COMS 311 Communication Theory	4
COMS 322 Persuasion	4
COMS 330 Classical Rhetorical Theory	4
or COMS 331 Contemporary Rhetorical Theory	

**Approved Electives**

12 units of Communication Studies courses, of which at least 8 units must be 300–400 level.	12
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Total units	28
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## English

Faculty Office Bldg. (47), Room 32-E

Phone: 805.756.2596

<http://cla.calpoly.edu/engl.html>

Department Chair: Kathryn Rummell

### Academic Programs

Program name	Program type
English	BA, Minor, MA
Linguistics	Minor

The English Department offers Bachelor of Arts and Master of Arts programs, minors in English and Linguistics, and certificates in Teaching English as a Second Language and Technical Communications. Additionally, in cooperation with the School of Education, the department prepares undergraduates and graduates for careers in secondary school teaching. Finally, the English Department provides a wide array of general education courses in composition, literature, film, and creative writing.

An English major or minor is valuable preparation for any career in which critical thinking, nuanced analysis, and clear communication are essential. Many of our majors pursue graduate study in English, education, creative writing, or law; the major provides an excellent foundation for all of these fields. First and foremost, however, students of English are humanists, deeply concerned about the welfare of others. Through imaginatively inhabiting the worlds writers create, English students gain empathy, tolerance, and perspective, habits of mind that will benefit them throughout their lives.

### Certificate Programs

#### Teaching English as a Second Language (TESL)

The TESL certificate program provides individuals with specialized training to teach successfully in a wide variety of ESL programs. Both undergraduate and graduate students currently enrolled in any degree program at Cal Poly may pursue this certificate.

The 30-unit TESL program provides a solid background in theoretical and applied linguistics, cross-cultural communication, second language acquisition, and methods of TESL. The program is designed for two career options:

1. The Post-Secondary/Adult option prepares individuals to teach in college level and adult education programs. Those wishing to teach at the college level are advised that an MA in English or a related field is the usual minimum requirement for full-time positions.
2. The K-12 option prepares individuals having a single or multiple subject credential to teach ESL in elementary and secondary schools.

### Technical Communication

Commercial, academic and governmental organizations employ technical communicators as writers, editors, public relations experts, information designers, documentation and project managers, and as mixed media creators. The technical communicator is, first and foremost, an accomplished writer who produces clear, precise, timely, and effective prose. However, technical communicators also are adept at integrating texts and images into cohesive creations that

exist equally well on paper and on the computer screen. Technical communicators write online and print computer documentation, create and manage complex sets of technical specifications, write overviews of scientific and technical processes, and produce a diverse range of documents that are used both by the expert and by the layperson. Technical communicators often serve as translators, interpreting the continually changing language of advanced technology into a language we can all easily understand.

### Undergraduate Programs

#### BA English

The curriculum for the Bachelor of Arts in English offers students both structure and freedom of choice. Students take a required course in world literature and one in linguistics, along with a six-course sequence of British and American literature. The other eight English courses are chosen by the student and can include creative writing, literature, film, linguistics, composition/rhetoric, and technical communications. A Senior Project in the student's field of interest provides the capstone to the English major.

English majors must also demonstrate intermediate-level proficiency in a language other than English. Cal Poly offers intermediate-level instruction in Spanish, French, and German, but students may also take Chinese and Italian. We encourage majors to study abroad, and many students choose to complete their language requirement in another country.

Though the core of the major is literature, students may choose an emphasis in fiction- or poetry-writing. The emphasis consists of one introductory workshop, two advanced workshops, one upper-division course in modern or contemporary literature in the student's chosen genre, and the senior project in that genre.

#### English Minor

An English minor complements any major, adding richness and depth to students' educations. The newly-revised curriculum boasts literature courses to help students cultivate empathy and insight; writing courses to help students practice essential communication skills; and linguistics courses to provide an understanding of the nature and power of language. Students interested in pursuing an English minor should meet with the minor advisor to review the requirements.

#### Linguistics Minor

Cal Poly's English Department offers a range of linguistics and applied linguistics courses designed for the beginning linguist or the non-linguist. Linguistics, the science of language, studies our mental capacity to produce and comprehend language, the varied patterns that the world's languages use to express meaning, and the natural facts of diversity and change within and across languages. Applied linguistics in our Department includes teaching English to speakers of other languages, applications of linguistics in the K-12 language arts classroom, history of English, language and gender, and other varied topics.

Linguistics enriches the English major's understanding of and appreciation for English and other languages, not just by acquainting them with the structure of English, but also by exploding popular myths which often lead to ill-informed personal or policy judgments.

Study of linguistics can be useful as preparation for a variety of occupations: teaching language arts, English, or other languages;

working in journalism or editing and publishing; engagement with literature in teaching, criticism or authorship; and a variety of applications in computer-mediated uses of language.

## Master of Arts Degree in English

### General Characteristics

This program includes the study of literature, literary criticism, linguistics, and theory of composition. It is designed to provide students with the knowledge and command of English that prepares them specifically for:

- teaching English at the secondary or community college levels;
- further graduate work at other institutions;
- employment in business, industry, and government service where effective communication skills are demanded;
- self-directed development in writing.

### Prerequisites

Students admitted to the English MA Program must have a major or minor in English from an accredited institution (or the equivalent, as determined by the English Graduate Committee), have maintained a grade point average of 3.0 for the last 90 quarter units (60 semester units), and a writing sample submitted to the English Graduate Advisor. Non-native speakers should also submit TOEFL scores (Test of English as a Foreign Language). Students without an English major or minor may apply and be admitted conditionally, requiring them to take certain prerequisites prior to taking English graduate classes.

### Program of Study

- 48 units of graduate work approved by the English Graduate Coordinator and the Graduate Committee;
- a grade point average of 3.0 or better in all courses taken subsequent to admission;
- two years of a foreign language (e.g., French, Spanish, German) or certification of the equivalent;
- a comprehensive examination at the end of 48 units of study.

All other requirements must be satisfied before the comprehensive examination is taken. Students elect an emphasis within the Master of Arts program: literature, linguistics, or composition.

### Application

Application for admission and requests for further information should be directed to the Admissions Office. All applications should include a writing sample (a critical essay on a work of literature) and three letters of recommendation.

## BA English

### Program Learning Objectives

#### Learning Outcomes

1. Think critically and creatively about literature and language.
2. Write clearly and effectively about literature and language in a variety of formats.
3. Explicate literary texts from the diverse range of works and traditions.
4. Incorporate scholarly research into papers.

5. Understand a wide range of historical and critical literary linguistic terms and categories.

### Learning Goals

1. Understand how literary texts reflect, critique, and produce culture.
2. Pursue deeper knowledge of particular authors and works.
3. Understand the structure of language and how language varies over time, across social situations and social groups.
4. Participate in face-to-face exchanges of ideas with faculty, fellow students, and authors in the classroom and other academic or social settings.
5. Participate in small seminars where ideas are tested and sharpened.
6. Cultivate relational thinking that encourages students to make connections between the arts and humanities and other fields of study.
7. Sustain a life-long engagement with and delight in literature, art, and culture.
8. Perpetuate an interest and involvement in aesthetic, cultural, and intellectual matters, including social and political issues.
9. Draw upon multiple literacies to interpret literary, visual, and cultural texts.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

#### MAJOR COURSES

ENGL 202	Introduction to Literary Studies	4
ENGL/HNRS 251	Great Books I: Introduction to Classical Literature (C1) <sup>1</sup>	4
ENGL 203	Core I: 450-1485	4
ENGL 204	Core II: 1485-1660	4
ENGL 205	Core III: 1660-1789	4
ENGL 290	Introduction to Linguistics	4
ENGL 303	Core IV: 1789-1861	4
ENGL 304	Core V: 1861-1914	4
ENGL 305	Core VI: 1914 - Present	4
Select from the following:		4
ENGL 345	Women Writers of the Twentieth Century (USCP)	
ENGL 346	Ethnic American Literature (USCP)	
ENGL 347	African American Literature (USCP)	
ENGL 349	Gender in Twentieth Century Literature (USCP)	
ENGL 381	Diversity in Twentieth-Century American Literature (USCP)	
ENGL 382	LGBT Literature and Media (USCP)	

ENGL 300-level electives (see Upper-Division ENGL Units, below)	8
ENGL 460 Senior Project Portfolio	4
or ENGL 461 Senior Project	

ENGL electives 400-level (see Upper-Division ENGL Units, below)  
2 20

### SUPPORT COURSES

Foreign language (201 or 202) or demonstration of a comparable level of proficiency. 4

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 68

### FREE ELECTIVES

Free Electives	36
Total units	180

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> Minimum 12 units in literature

## Upper-Division ENGL Units

English majors are encouraged to use their upper-division ENGL electives to pursue their interests, including literature, creative writing, linguistics, and/or rhetoric and writing. Students may choose and 300-level English courses they wish to satisfy the 300-level elective requirement. At the 400-level, students must take a minimum of 12 units of literature courses (430, 431, 432, 439, 449, 459).

Students interested in creative writing may use 20 of their upper-division ENGL units and their senior project to pursue a fiction- or poetry-writing emphasis. Examples are:

### Fiction Writing Emphasis:

ENGL 387	Fiction Writing (4)
ENGL 487	Advanced Creative Writing: Fiction (4, 4)
400-level ENGL literature course in modern or contemporary fiction (4)	
ENGL 461	Senior Project (4)

### Poetry Writing Emphasis:

ENGL 388	Poetry Writing (4)
ENGL 488	Advanced Creative Writing: Poetry (4, 4)
400-level ENGL literature course in modern or contemporary poetry (4)	
ENGL 461	Senior Project (4)

## General Education (GE) Requirements

- 72 units required, 4 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4

B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature (4 units in major) <sup>1</sup>	0
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective (no ENGL course)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		68

<sup>1</sup> Required in Major

## English Minor

### Required Courses

<b>Great Books (C1)</b>	
Select from the following:	4
ENGL 251	Great Books I: Introduction to Classical Literature
ENGL 252	Great Books II: Medieval to Enlightenment Literature
ENGL 253	Great Books III: Romanticism to Modernism Literature

### British Literature (C4)

Select from the following:	4
ENGL 330	British Literature in the Age of Belief: to 1485
ENGL 331	British Literature in the Age of Discovery: 1485-1660
ENGL 332	British Literature in the Age of Enlightenment: 1660-1798
ENGL 333	British Literature in the Age of Romanticism: 1798-1832
ENGL 334	British Literature in the Age of Industrialism: 1832-1914
ENGL 335	British Literature in the Age of Modernism: 1914-Present
ENGL 338	Introduction to Shakespeare-London Study
ENGL 339	Introduction to Shakespeare

### American Literature (C4)

Select from the following:	4
ENGL 340	The Literary Sources of the American Character: 1600-1865
ENGL 341	The Literary Sources of the American Character: 1865-1914
ENGL 342	The Literary Sources of the American Character: 1914-1956

ENGL 343	Multiple Voices of Contemporary American Literature	
ENGL 346	Ethnic American Literature	
ENGL 347	African American Literature	
<b>World Literature, Modern Literature and/or Film (C4)</b>		
Select from the following:		4
ENGL 345	Women Writers of the Twentieth Century	
ENGL 349	Gender in Twentieth Century Literature	
ENGL 350	The Modern Novel	
ENGL 351	Modern Poetry	
ENGL 352	Modern Drama	
ENGL 353	Drama in London	
ENGL 370	World Cinema	
ENGL 371	Film Styles and Genres	
ENGL 372	Film Directors	
ENGL 381	Diversity in Twentieth-Century American Literature	
ENGL 382	LGBT Literature and Media	
<b>Linguistics</b>		
Select from the following:		4
ENGL 390	The Linguistic Structure of Modern English	
ENGL 395	History of the English Language	
<b>Composition, Creative Writing, Technical Communications</b>		
Select from the following:		4
ENGL 302	Writing: Advanced Composition	
ENGL 310	Corporate Communication	
ENGL 317	Technical Editing	
ENGL 319	Information Design and Production	
ENGL 386	Creative Nonfiction	
ENGL 387	Fiction Writing	
ENGL 388	Poetry Writing	
ENGL 389	Creative Writing: Drama	
<b>Elective</b>		
One additional 4-unit course from the lists above		4
Total units		28

## Linguistics Minor

<b>Required Courses</b>		
ENGL 290	Introduction to Linguistics	4
ENGL 391	Topics in Applied Linguistics	4
ENGL 395	History of the English Language	4
<b>Approved Electives</b>		
May include:		16
ENGL 390	The Linguistic Structure of Modern English	
or ENGL 392	English Grammar for Writers and Teachers	
ENGL 495	Topics in Applied Language Study	
ENGL 497	Theories of Language Learning and Teaching	
COMS 416	Intercultural Communication (USCP)	
Total units		28

## MA English

### Required Courses

ENGL 501	Techniques Literary Research	4
ENGL 502	Seminar in Critical Analysis (4) (4)	8
ENGL 503	Graduate Introduction to Linguistics	4
ENGL 505	Composition Theory	4
ENGL 511	Seminar in American Literary Periods (4) (4)	8
ENGL 512	British Literary Periods (4) (4)	8

### English Electives

Additional 400-and 500-level courses, to be selected from one of the three emphasis areas: literature, composition or linguistics

Total units 48

## Ethnic Studies

Math and Science Bldg. (38), Room 136

Phone: 805.756.1707

<http://cla.calpoly.edu/es.html>

Department Chair: Denise A. Isom

### Academic Programs

Program name	Program type
Comparative Ethnic Studies	BA
Ethnic Studies	Minor

Indigenous Studies in Natural Resources and the Environment

The Ethnic Studies Department uses inter- and multidisciplinary approaches to study the lives of Indigenous, African, Latino/a, and Asian peoples in the United States within a global and postcolonial context. The Ethnic Studies curriculum provides students with unique forms of critical inquiry that advance their analysis of race, ethnicity, and cultural difference in an increasingly heterogeneous and complex world. Courses in Ethnic Studies examine how social hierarchies frame access to political power, allocate economic resources, and influence cultural expression. By critically exploring such issues, students develop not only a greater understanding of the legacy of racism, discrimination, and injustices in the United States, but also a greater appreciation for new and emerging knowledge about diverse American peoples and their global and transnational connections.

Housed in the College of Liberal Arts, the Ethnic Studies Department at Cal Poly encourages critical dialogue about race, ethnicity, postcoloniality, and transnationalism across the entire university curriculum, with special focus on concepts that integrate the arts, humanities, and social sciences, as well as the sciences and technology. The department offers a number of courses that fulfill both general education and United States Cultural Pluralism requirements. A minor in Ethnic Studies is open to all majors and provides a useful complement to the differing types of inquiry used in the wide variety of disciplines throughout the University.

### Undergraduate Programs

#### BA Comparative Ethnic Studies

It is expected that students who demonstrate the foregoing learning outcomes will be better prepared to understand the social, cultural, political, historical, and economic factors that have shaped their own social and occupational identities, as well as the social and occupational identities of others. This knowledge should better prepare students to work, collaborate, and interact more responsibly and effectively in an increasingly diverse and globalized workplace and world.

#### Ethnic Studies Minor

An Ethnic Studies minor provides students with special competence in the histories and experiences of diverse communities and the critical skills with which to understand complex social issues. Students majoring in subjects across the university curriculum find Ethnic Studies useful, particularly when their interests require a deeper understanding of race, ethnicity, and diversity in the United States and beyond. The minor prepares students for careers in education, government, and community organizations; for entrance to

professional schools in areas such as law, social work, and health; and for graduate studies in all areas of the arts and sciences.

### Indigenous Studies in Natural Resources and the Environment Minor

An interdisciplinary minor sponsored by the departments of Natural Resources Management and Environmental Sciences and Ethnic Studies. For more information, see the Natural Resources Management and Environmental Sciences (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences>) section.

### BA Comparative Ethnic Studies

#### Program Learning Objectives

It is expected that students who demonstrate the foregoing learning outcomes will be better prepared to understand the social, cultural, political, historical, and economic factors that have shaped their own social and occupational identities, as well as the social and occupational identities of others. This knowledge should better prepare students to work, collaborate, and interact more responsibly and effectively in an increasingly diverse and globalized workplace and world.

1. Demonstrate an ability to define key concepts, terms, and scholarship in the Ethnic Studies discipline today, including a critical understanding of the ways in which social, cultural, political, and economic factors construct historical and contemporary meanings of race, class, gender, and sexuality in the United States, as well as the ways in which these meanings shape and are shaped by scientific and technical knowledge production and educational and professional practices.
2. Employ these key concepts and terms to conduct independent analyses of historical and contemporary texts, the arts, popular culture, and social and occupational interactions.
3. Critically analyze discourses, ideologies, and practices that maintain or increase economic, social, political, legal, educational, environmental, scientific and technological inequality.
4. Engage with and create new knowledge that explores and promotes the expression of new social or cultural identities and cultural literacy in a multi-racial, multi-cultural society.
5. Engage with and create new knowledge that explores and promotes cultural, social, political, and economic self-determination and self-representation of underrepresented groups, the expansion of human rights in a national and global context, and the diversity of cultural and social practices that promote social, economic, and environmental sustainability.

#### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)



- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

ES 112	Race, Culture and Politics in the United States (D1) (USCP) <sup>1</sup>	4
Select from the following:		12
ES 241	Survey of Indigenous Studies (D3) (USCP) <sup>1</sup>	
ES 242	Survey of Africana Studies (D3) (USCP) <sup>1</sup>	
ES 243	Survey of Latino/a Studies (D3) (USCP) <sup>1</sup>	
ES 244	Survey of Asian American Studies (D3) (USCP) <sup>1</sup>	
ES 350	Gender, Race, Science and Technology (Area F) (USCP) <sup>1</sup>	4
ES 390	Research Methodology in Comparative Ethnic Studies	4
ES 450	Fieldwork in Comparative Ethnic Studies	4
ES 461	Senior Project	4
ES electives		20
Minimum 12 units must be 300-400 level courses offered by Ethnic Studies Department		
Approved Electives <sup>2, 3, 4, 5</sup>		24
See approved electives list below		
<b>SUPPORT COURSES</b>		
Language other than English (all 8 units must be in the same language)		8
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		56
<b>FREE ELECTIVES</b>		
Free Electives		36
Some free electives may need to be 300-400 level to ensure completion of the required minimum of 60 units upper division. Consult college advisor for additional information.		
Total units		180

## Approved Electives

Select from the following: <sup>2, 3, 4, 5</sup>		24
AG/EDES/ ENGR/HUM/ SCM/UNIV 350	The Global Environment	
AGB 370	World Food Economy	
AGB 401	Managing Cultural Diversity in Agricultural Labor Relations	
ANT 201	Cultural Anthropology	
ANT 325	Pre-Columbian Mesoamerica	
ANT 415	Native American Cultures	
ARCH 320	Topics in Architectural History	
ART 317	Asian Art Survey	
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements	

BUS 402	International Business Management	
BUS 403	Advanced Seminar in International Management	
BUS 407	Managing People in Global Markets	
BUS 433	International Finance	
BUS 446	International Marketing	
CD/EDUC 207	The Learner's Development, Culture and Identity in Educational Settings	
COMS 416	Intercultural Communication	
CRP 334	Cities in a Global World	
DANC 321	Cultural Influence on Dance in America	
ECON 330	International Trade Theory	
ECON/HNRS 303	Economics of Poverty, Discrimination and Immigration	
EDES 406	Sustainable Environments	
ENGL 345	Women Writers of the Twentieth Century	
ENGL 346	Ethnic American Literature	
ENGL 349	Gender in Twentieth Century Literature	
ENGL 347	African American Literature	
ERSC/GEOG 325	Climate and Humanity	
ES/HNRS 212	Global Origins of United States Cultures	
ES/NR 308	Fire and Society	
ES/NR 360	Ethnicity and the Land	
ES/NR 406	Indigenous Peoples and International Law and Policy	
GEOG 150	Introduction to Cultural Geography	
GEOG 300	Geography of United States	
GEOG 308	Global Geography	
GEOG 340	Geography of California	
GEOG 370	Geography of Latin America	
HIST 206	American Cultures	
HIST 214	Political Economy of Latin America and the Middle East	
HIST 310	East Asian Culture and Civilization	
HIST 314	Middle East	
HIST 339	Colonial Latin America	
HIST 340	Modern Latin America	
HIST 341	Modern Central America	
HIST 405	African-American History to 1865	
HIST 406	African-American History from 1865	
HIST 410	Recent America Since 1950: Shattering of the American Consensus	
HIST 414	The Fall of Imperial China	
HIST 416	Modern Japan	
HIST 417	20th Century China	
HIST 418	Chinese Film and History	
HIST 429	Precolonial African History	
HIST 430	Modern African History	
HIST 443	Topics and Issues in Asian History	
HIST/HNRS 207	Freedom and Equality in American History	
HIST/HNRS 223	World History, 1800 - Present	

HIST/WGS 434	American Women's History to 1870
HIST/WGS 435	American Women's History from 1870
HUM 312	Humanities in Chicano/a Culture
JOUR 401	Global Communication
KINE 255	Personal Health: A Multicultural Approach
MU 121	Introduction to Non-Western Musics
MU 221	Jazz Styles
MU 229	Music of the 60's: War and Peace
MU 325	America's Music
MU 336	Jazz History and Theory
PHIL 320	Asian Philosophy
POLS 225	Introduction to International Relations
POLS 229	Introduction to Comparative Politics
POLS 310	Politics of Ethnicity and Gender
POLS 320	Comparative Political Analysis
POLS 324	International Relations Theory
POLS 325	Global Political Issues
POLS 328	Politics of Developing Areas
POLS 339	Authoritarian and Democratic Rule
POLS 343	Civil Rights in America
POLS 419	Social Movements and Political Protest
POLS 420	Contemporary U.S. Foreign Policy
POLS 427	Politics of the Global Economy
POLS/UNIV 333	World Food Systems
PSY 303	Intergroup Dialogues
PSY 465	Cross-Cultural Issues in Psychology
RELS 302	Monotheisms: Judaism, Christianity, and Islam
RELS 306	Hinduism
RELS 307	Buddhism
RELS/WGS 370	Religion, Gender, and Society
SOC 110	Comparative Societies
SOC 218	International Political Economy
SOC 309	The World System and Its Problems
SOC 315	Global Race and Ethnic Relations
SOC 316	American Ethnic Minorities
SOC 323	Social Stratification
SOC 350	Social Organization of Modern Japan
SPAN 233	Introduction to Hispanic Readings
SPAN 305	Significant Works in Spanish
SPAN 340	Chicano/a Authors
SPAN 350	Hispanic Literature in English Translation
SPAN 351	Chicano/Latino Writers in the United States
SPAN 410	Advanced Literature in Spanish
TH 320	Black Theatre
TH 390	Global Theatre and Performance
WGS 301	Contemporary Issues in Women's and Gender Studies
WGS 320	Women in Global Perspective
WGS 450	Feminist Theory

- <sup>1</sup> Required in Major/Support; also satisfies GE
- Be aware that some courses on this list may have prerequisites and that these prerequisites may need to be used as free electives.
- Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- Minimum 12 elective units must be 300-400 level. These 24 elective units can be chosen from any unused ES prefix or from the Approved Electives listed above. Courses not on the approved elective list may still be chosen, but are subject to department approval.
- If GE courses are taken for a letter grade and used as Approved Electives to satisfy Major requirements, additional free elective units may be required to complete the 180 total unit requirement. Consult college advisor for additional information.

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

### Area A Communication

A1 Expository Writing	4
A2 Oral Communication	4
A3 Reasoning, Argumentation and Writing	4

### Area B Science and Mathematics

B1 Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup>	4
B2 Life Science	4
B3 Physical Science	4
B4 One lab taken with either a B2 or B3 course	
B5 Area B elective (select one course from B1-B5)	4

### Area C Arts and Humanities

C1 Literature	4
C2 Philosophy	4
C3 Fine/Performing Arts	4
C4 Upper-division elective (no ES course except ARCH/ES 326 or ES/NR 360)	4

### Area D/E Society and the Individual

D1 The American Experience (Title 5, Section 40404 requirement) (4 units in Major) <sup>1</sup>	0
D2 Political Economy	4
D3 Comparative Social Institutions (4 units in Major) <sup>1</sup>	0
D4 Self Development (CSU Area E)	4
D5 Upper-division elective (no ES course except ES/NR 308)	4

### Area F Technology

F Upper-division elective (4 units in Major)	0
<b>Total units</b>	<b>56</b>

- <sup>1</sup> Required in Major/Support; also satisfies GE

## Ethnic Studies Minor

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### Required Courses

ES 112	Race, Culture and Politics in the United States (D1) (USCP)	4
ES 212	Global Origins of United States Cultures (D3) (USCP)	4
ES 320	African American Cultural Images (D5) (USCP)	4
or ES 321	Native American Cultural Images	
or ES 322	Asian American Cultural Images	
or ES 323	Mexican American Cultural Images	

### Approved Electives<sup>1, 2</sup>

Electives	12
Total units	24

<sup>1</sup> Electives reinforce and enhance student understanding of issues of culture, race, and gender.  
A minimum of 8 units must be 300–400 level.

<sup>2</sup> See list of approved electives for Comparative Ethnic Studies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/ethnicstudies/bacomparativeethnicstudies>) majors.

# Graphic Communication

Graphic Arts Bldg. (26), Room 201  
Phone: 805.756.1108; Fax: 805.756.7118  
<http://www.grc.calpoly.edu/>

Department Chair: Kenneth L. Macro

## Academic Programs

Program name	Program type
Graphic Communication	BS, Minor
Printed Electronics and Functional Imaging	MS

The Graphic Communication Department offers a curriculum leading to the Bachelor of Science degree, yet the discipline is both an art and a science. It appeals to students having an interest in creativity, science, technology, and management.

The Graphic Communication Department occupies approximately 33,000 square feet of laboratories in the Graphic Arts Building and in the adjacent web press building. Theory and practice are taught in modern classrooms incorporating the latest in teaching techniques. Fourteen well-equipped laboratories provide students with diverse experiences in the practical aspects of graphic media development and functional printing. The department also houses the Graphic Communication Institute at Cal Poly, providing students with the opportunity to participate in industry research and testing while interacting with industry professionals.

The Graphic Communication Department receives support from an advisory board comprised of industry leaders representing major graphic communication companies.

## Undergraduate Programs

### BS Graphic Communication

The graphic communication discipline is both an art and a science. It appeals to students having an interest in creativity, science, technology, and management.

The field of graphic communication represents a large profession, one of the largest in the world. The profession embraces change, requiring those pursuing graphic communication careers to learn new and diverse skills. Graphic communication includes digital and conventional printing, publishing, packaging, digital imaging, computer graphics, web development, digital photography, printable electronics, and related areas. The discipline includes media and mass communication involving the creation, production, management, and distribution of advertising, marketing, websites, books, magazines, newspapers, catalogs, packages, novel printed electronics, and other media in printed and digital form. Graduates are in high demand by leading national and international corporations in the graphic communication field.

The Bachelor of Science program in Graphic Communication is accredited by the Accreditation Council for Collegiate Graphic Communications, Inc. (ACCGC), an independent body dedicated to the improvement and recognition of collegiate level curricula in graphic communication.

Beyond acquiring a foundation in graphic communication, students select a specialization among the department's concentrations of design reproduction technology, web and digital media, graphic

communication management, packaging graphics, and individualized study in graphic communication.

## Concentrations

BS Majors select one of the following concentrations based upon their interests and career goals.

### Design Reproduction Technology <sup>1</sup>

Emphasis on design and technology for print and web publishing. Coursework includes typography, branding, color theory, and design for packaging and for the publication of books, magazines, and web sites.

### Web and Digital Media

Emphasis on the latest trends in web development and the production and distribution of digital media. In addition to major requirements, course-work includes the study of web technology and design, digital audio, animation, photography, interactive entertainment, and video. The concentration leads to careers in web development, digital media production and management, and opportunities with hardware and software manufacturers that service the graphic communication industry.

### Graphics for Packaging

Designed for students who desire a career in the growing field of package graphics and printing. This program provides students with the opportunity to learn all components of graphic preparation for packaging, print reproduction and conversion, while also providing aspects of structural design and food safety. Consumer and industrial print packaging is addressed.

### Graphic Communication Management

A flexible program for students interested in management careers in the graphic communication industry. In addition to the major requirements in graphic communication, coursework includes multiple business management related disciplines. Graduates are in high demand throughout the country from publishing, design, printing, packaging, and web-based commerce firms, including their customers and suppliers.

### Individualized Course of Study

An opportunity to pursue a course of study that meets a student's individual needs and interests.

<sup>1</sup> The Graphic Communication Department's Design Reproduction Technology concentration focuses on the technical and electronic aspects of transforming design for reproduction in print and digital media. The concentration focuses on printing, web development, publishing, packaging, digital imaging, computer graphics, and related areas of mass media preparation and production. The Art and Design Department's Graphic Design concentration focuses on creative problem-solving and development of design and layout skills. The concentration leads to positions such as graphic designer, web designer, art director and creative director for advertising agencies, design studios and corporate design departments.

## Graphic Communication Minor

A minor in Graphic Communication benefits students interested in pursuing careers in graphic communication or who anticipate using graphic communication in another career. Students in the minor have a competitive edge when applying for many jobs by understanding

concepts, and gaining knowledge and skills in web and print media. Additionally, students develop an understanding of the interface between design and technology, web site and document preparation, typography, and specifying the processes and materials for a broad range of printing, web, digital media, and publishing applications. Information and application forms for this minor are available in the Graphic Communication Department office.

## Graduate Programs

### MBA, Graphic Communication Document Systems Management Specialization

In cooperation with the Orfalea College of Business, a student can earn an MBA with a graphic communication emphasis in document systems management. This program is designed to prepare professionals having diverse backgrounds with a strong and advanced business orientation along with a grounding in graphic communication.

### MS Printed Electronics and Functional Imaging

#### *New Program, effective Winter 2014*

#### General Characteristics

Master of Science Degree in Printed Electronics and Functional Imaging – Solution-based printing and coating applications for printed electronics, active and intelligent packaging, and security printing. Advanced research related to design, market and technology development, integration, and applications for mass-scale printing and coating technologies used in functional and novel electronics, anti-counterfeiting, and packaging.

Printed Electronics and Functional Imaging encompasses academic coursework related to three emerging graphic communication applications: Printed Electronics, which Das and Harrop (2011) project to grow from a \$2.2 billion today into a \$44.25 billion industry over the next decade; Active and Intelligent Packaging, projected by Research and Markets (2011) to grow to \$23 billion per year over the next decade; and Security Printing. The European research institute PIRA predicts the global market for brand protection to reach a value of more than \$11.4 billion by 2014 (Mc Loone, 2010).

These fields involve the application of specialty inks to produce functional and optical devices including a number of high-tech new printing applications. Active packaging focuses on printed packaging that improves shelf life or enhances supply-chain tracking. Anti-counterfeit is critical for brand protection. Using both conductive and insulating inks, printed electronics and functional imaging offers low-cost production of displays, lighting and energy harvesting devices on flexible substrates. This degree is offered as a self-support program under CSU Executive Order No. 1047.

#### Program Goals

The goals of the Master of Science Degree in Printed Electronics and Functional Imaging are to:

- Educate students in commercialization strategies and technologies used in functional printing and manufacturing businesses.
- Educate students in funding models, business strategies, printing and coating technologies, imaging systems, material development,

electronic fundamentals, novel applications, design integration, and product development.

- Prepare students for employment in private and public companies, research labs, and government agencies involved in three disciplines: Printed Electronics, Active and Intelligent Packaging, and Security Printing.

## Admission Requirements

- Completed application
- GRE
- Two letters of recommendation.
- For admission as a classified graduate student, an applicant must hold a bachelor's degree or diploma in a related field to graphic communication, science, or engineering from a regionally accredited institution, college or university.
- An undergraduate grade point average of 3.0 is required in the last 60 semester or 90 quarter units of their undergraduate degree. On occasion, where other credentials are exceptionally strong, a GPA of 2.5-2.99 or alternate Bachelor degree with relevant work-experience may be considered for admission.
- Completion of an undergraduate or graduate statistics course with a "C" or better.

## Prerequisites

Completed coursework or equivalent experience to GRC courses.

GRC 201 Digital Publishing System

GRC 316 Flexographic Printing Technology

GRC 329 Web Offset and Gravure Printing Technologies

GRC 357 Specialty Printing Technologies

All graduate applicants, regardless of citizenship, whose native language is not English and whose preparatory education was principally in a language other than English must demonstrate competence in English. Those who do not possess a bachelor's degree from a postsecondary institution where English is the principal language of instruction must take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing system (IELTS) exam.

- The TOEFL must have been taken within the last two years with a minimum score of 550 (paper version), 213 (computerized version) or 80 (internet based). The minimum score for the IELTS is 6.0, although individual programs may require higher scores. Applicants are advised to review program-specific information.
- The TOEFL or IELTS requirement is waived for applicants whose native language is English. Applicants from countries listed on the following website will be considered native English speakers. [http://admissions.calpoly.edu/applicants/international/toefl\\_ielts.html](http://admissions.calpoly.edu/applicants/international/toefl_ielts.html)

## Culminating Experience Requirements

A comprehensive culminating experience is required. The experience will be comprised of successful completion of GRC 560, GRC 596, and both written and oral comprehensive exams. The culminating experience will synthesize many of the program learning outcomes through a written and presented research project.



# BS Graphic Communication

## Program Learning Objectives

1. Knowledge of the graphic communication industry
2. Ability to think creatively and visually
3. Understanding digital creation, manipulation, and management
4. Understanding of printing and packaging technologies
5. Understanding business management and quality control practices
6. Critical thinking, effective writing, and clear verbal communication
7. Accepting change as a rule
8. Analytical thinking and understanding systems
9. Understanding the relationship between people and technology
10. Understanding contingency management
11. Developing cognitive skills as opposed to physical craft skills
12. Organizational communication skills
13. Marketing, sales, and customer service skills
14. Skills in practicing professional ethics
15. Understanding laws and policies concerning intellectual property
16. Overall communication skills
17. The ability to minimize waste
18. The ability to improve and maintain quality
19. The ability to control electronic devices
20. Knowledge of computer management and workflow systems
21. Knowing how to repurpose multimedia
22. The ability to improve job handling practices and productivity

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

GRC 101	Introduction to Graphic Communication	3
GRC 201	Digital Publishing System	3
GRC 202	Digital Photography	3
GRC 203	Digital File Preparation and Workflow	3
GRC 204	Introduction to Contemporary Print Management and Manufacturing	4
GRC 211	Substrates, Inks and Toners	4
GRC 218	Digital Typography	4
GRC 316	Flexographic Printing Technology	3
GRC 320	Managing Quality in Graphic Communication	4
GRC 324	Binding, Finishing and Distribution Processes	3

GRC 328	Sheetfed Printing Technology	4
GRC 329	Web Offset and Gravure Printing Technologies	3
GRC 338	Digital Content Management and Variable Data Publishing	4
GRC 361	Marketing and Sales Management for Print and Digital Media	4
GRC 402	Digital Printing and Emerging Technologies in Graphic Communication	3
GRC 403	Estimating for Print and Digital Media	4
GRC 411	Strategic Trends and Profitability Issues in Print and Digital Media	4
GRC 422	Human Resource Management Issues for Print and Digital Media	4
GRC 460	Research Methods in Graphic Communication	2
GRC 461	Senior Project	3
Select from the following:		4
GRC 472	Applied Graphic Communication Practices	29-30
or GRC 473	Applied Graphic Communication Management Practices	
or GRC 485	Cooperative Education Experience	
Concentration Courses		29-30
<b>SUPPORT COURSES</b>		
PSC 101	Matter and Energy (Area B) <sup>1</sup>	4
or PHYS 104	Introductory Physics	4-5
or PHYS 121	College Physics I	
CHEM 110	World of Chemistry (B3&B4) <sup>1</sup>	4
or CHEM 111	Survey of Chemistry	
MATH 118	Precalculus Algebra (B1) <sup>1,2</sup>	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		56
<b>FREE ELECTIVES</b>		
Free Electives		4-6
Total units		180

<sup>1</sup> Required in Support; also satisfies GE

<sup>2</sup> MATH 116 and MATH 117 substitute

## Concentrations

- Design Reproduction Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/graphiccommunication/bsgraphiccommunication/designreproductiontechnologyconcentration>)
- Graphic Communication Management (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/graphiccommunication/bsgraphiccommunication/graphiccommunicationmanagementconcentration>)
- Graphics for Packaging (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/graphiccommunication/bsgraphiccommunication/graphicsforpackagingconcentration>)
- Web and Digital Media (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/>)

graphiccommunication/bsgraphiccommunication/  
webanddigitalmediaconcentration)

### Individualized Course of Study

This concentration consists of 29 units; a minimum of 18 units must be upper division and a minimum of 8 units must be Graphic Communication. The student selects the courses in consultation with the concentration coordinator and department head, and provide written justification for the courses and the way they constitute a cohesive, integrated program of study. The list of courses serves as a contract between the student and the Graphic Communication Department.

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support)	0
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5) (4 units in Support) <sup>1</sup>	0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective (no GRC course)	4
Total units		56

<sup>1</sup> Required in Support; also satisfies GE

## Design Reproduction Technology Concentration

ART 105	Foundation: Color Theory	4
ART 106	Foundation: 2-Dimensional Design	4
GRC 337	Consumer Packaging	3

GRC 339	Web Design and Production	4
GRC 439	Book Design Technology	4
GRC 440	Magazine Design Technology	4
Select from the following:		6
GRC 322	Advanced Digital Typography	
GRC 331	Color Management and Quality Analysis	
GRC 451	Management Topics in Graphic Communication	
GRC 452	Emerging Technologies in Graphic Communication	
GRC 453	Design Reproduction Topics in Graphic Communication	
Other courses as approved by academic advisor		
Total units		29

## Graphic Communication Management Concentration

GRC 421	Production Management for Print and Digital Media	4
BUS 207	Legal Responsibilities of Business	4
BUS 212	Financial Accounting for Nonbusiness Majors	4
BUS 382	Organizations, People, and Technology	4
COMS 213	Organizational Communication	4
Select from the following:		9
GRC 337	Consumer Packaging	
GRC 451	Management Topics in Graphic Communication	
GRC 452	Emerging Technologies in Graphic Communication	
BUS 303	Introduction to International Business	
BUS 310	Introduction to Entrepreneurship	
Other courses as approved by academic advisor		
Total units		29

## Graphics for Packaging Concentration

GRC 331	Color Management and Quality Analysis	4
GRC 337	Consumer Packaging	3
GRC 357	Specialty Printing Technologies	3
GRC 421	Production Management for Print and Digital Media	4
FSN 230	Elements of Food Processing	4
IT 330	Packaging Fundamentals	4

### Approved Electives

Select from the following:		7-8
FSN 335	Food Quality Assurance	
FSN 354	Packaging Function in Food Processing	
IT 341	Packaging Polymers and Processing	
IT 408	Paper and Paperboard Packaging	
IT 409	Packaging Machinery and Processes	
IT 435	Packaging Development	
IT 457	Radio Frequency Identification in Supply Chain Management	

IT 475	Packaging Performance Testing	
Other courses as approved by academic advisor		
Total units		29-30

## Web and Digital Media Concentration

CSC/CPE 101	Fundamentals of Computer Science I	4
GRC 331	Color Management and Quality Analysis	4
GRC 339	Web Design and Production	4
GRC 429	Digital Media	3

### Approved Electives Set 1

Select from the following: 6

CSC courses (any, up to 6 units)

CSC 171	Introduction to Interactive Entertainment	
GRC 400	Special Problems for Advanced Undergraduates	
GRC 451	Management Topics in Graphic Communication	
GRC 452	Emerging Technologies in Graphic Communication	
GRC 453	Design Reproduction Topics in Graphic Communication	

### Approved Electives Set 2

Select from the following: 8

ART 122	Basic Digital Photography	
ART 383	Digital Video	
ART 388	Web Design	
ART 484	Animation, Video, and Interactive Design	
ART 488	Advanced Web Design	
ENGL 411	New Media Arts I	
ENGL 412	New Media Arts II	
MU 311	Sound Design: Technologies	
MU 312	Sound Design: Recording	

Total units 29

## Graphic Communication Minor

### Required Courses

GRC 101	Introduction to Graphic Communication	3
GRC 202	Digital Photography	3
GRC 212	Substrates, Inks and Toners: Theory	3
GRC 218	Digital Typography	4
GRC 325	Binding and Finishing Processes: Theory	2
GRC 328	Sheetfed Printing Technology	4
GRC 377	Web and Print Publishing	4

### Approved Electives

Select from the following: 3

GRC 331	Color Management and Quality Analysis	
GRC 337	Consumer Packaging	
GRC 357	Specialty Printing Technologies	
GRC 388	Sustainable Communication Media	
GRC 451	Management Topics in Graphic Communication	
GRC 452	Emerging Technologies in Graphic Communication	

GRC 453 Design Reproduction Topics in Graphic Communication

GRC 472 Applied Graphic Communication Practices (repeatable)

Total units 26

## History

Faculty Office Bldg. (47), Room 27C

Phone: 805.756.2543

<http://cla.calpoly.edu/hist.html>

Department Chair: Lewis Call

## Academic Programs

Program name	Program type
Asian Studies	Minor
History	BA, MA, Minor

Historians study the past in its variety and complexity. With such an analysis, students of history gain multiple perspectives on the present and an aptitude to plan intelligently for the future. Although the lessons to be learned from the past are rarely simple, solutions to present-day problems rest on comprehension of historical forces and events. History deepens our understanding of other peoples and cultures. All courses offered in the History Department seek to examine the issues of race, gender, class, and cultural diversity.

The study of history and its method prepares students for a wide range of careers while also sensitizing them to the complexity and diversity of the past and present. History is an excellent foundation for a broadly based education in the liberal arts.

## Undergraduate Programs

### BA History

A degree in history is excellent preparation for students interested in a teaching career, the legal profession, or advanced work in the discipline. Students wishing to become business executives, administrators, and public servants profit immensely by gaining the methodological skills of the historian. Historians learn to gather, synthesize, analyze, and interpret evidence; they become skilled in presenting their conclusions to a general audience in a lucid and logical manner.

### Asian Studies Minor

Provides interdisciplinary understanding of Asia – particularly its rich and varied histories, arts, languages, philosophies, religions and social patterns. Details and application forms are available from the History Department.

### History Minor

Students choosing to add a strong historical dimension to their major field may enroll in the minor program in history. The curriculum stresses reading and writing skills as well as the ability to weigh evidence and think critically. Details and application forms are available from the History Department.

## Master of Arts Degree in History

### General Characteristics

The program in history emphasizes concentrated study in area specialties, with students gaining a thorough grounding in the latest historiography. In addition, the program maintains that historical study must be predicated upon sustained research, engagement with historical problems, and written communication. Completion of the MA program in history will allow students the following options:

- Teach history at the elementary, secondary, or community college level.
- Give students the critical skills and knowledge to enter into the worldwide information economy.
- Allow community members to expand their historical knowledge.
- Prepare students for transfer to Ph.D. programs at other universities.

### Prerequisites

Admission to the MA program requires:

1. Possession of an undergraduate degree from an accredited college or university.
2. An overall grade point average of 3.0 for the last 90 units of their undergraduate work.
3. Submission of a writing sample, in the form of a senior project or upper division paper.
4. Related undergraduate coursework. Students without an undergraduate degree in history are required to demonstrate adequate preparation for graduate study in history, as determined by the Graduate Coordinator.

### Program of Study

- 48 units of graduate work in areas specified (49 units for those students writing a MA Thesis).
- a grade point average of at least 3.0 after 12 units of graduate coursework.
- MA Thesis or Comprehensive Examinations in two distinct areas of study.

### Foreign Language Study

Students are encouraged to learn and use foreign languages in the MA program. Students who plan further graduate study in history are particularly encouraged in this direction since proficiency in two foreign languages is usually required in doctoral programs.

### Applications

Applications for admission and requests for further information should be directed to the Admissions Office or the Graduate Coordinator of the MA History program. All applications should include a writing sample (preferably an extended research paper) and undergraduate transcripts.

## BA History

### Program Learning Objectives

1. Understand and analyze the sources used by historians.
2. Understand how to synthesize historical information.

3. Understand how to design, research, and produce an original research paper.
4. Understand multiple perspectives.
5. Understand chronological and spatial thinking.
6. Understand historiography / historical interpretations.
7. Understand content knowledge.
8. Understand historical change, understand themselves and their lives in historical context, and develop a sense of the past that can sustain them today.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

#### MAJOR COURSES

HIST 100	Introduction to the Study of History	2
HIST 110	Western Civilization: Ancient to Renaissance	4
HIST 111	Western Civilization: Reformation to the Present	4
HIST 201	United States History to 1865 (D1) (USCP) <sup>1</sup>	4
HIST 202	United States History Since 1865 (D1) (USCP) <sup>1</sup>	4
HIST 213	Modern Political Economy (D2) <sup>1</sup>	4
or HIST 214	Political Economy of Latin America and the Middle East	

#### World History

HIST 221	World History, Beginnings to 1000 (D3) <sup>1</sup>	4
or HIST 222	World History, 1000 - 1800	
or HIST 223	World History, 1800 - Present	
HIST 303	Research and Writing Seminar in History	5
HIST 304	Historiography	4
HIST 460	Senior Project I	2
HIST 461	Senior Project II	2

#### History Electives

Select upper division HIST courses		24
Select a minimum of 12 units at the 400 level <sup>2</sup>		
Select a minimum of 12 units from the following Non-U.S., Non-European courses		
HIST 308	The Trans-Atlantic Slave Trade	
HIST 309	Cultures of West Africa and the African Diaspora	
HIST 310	East Asian Culture and Civilization	
HIST 314	Middle East	
HIST 316	Modern East Asia	
HIST 317	The Lure of the Sea	
HIST 319	Modern South and Southeast Asia	
HIST 339	Colonial Latin America	

HIST 340	Modern Latin America
HIST 341	Modern Central America
HIST 409	Vietnam War at Home and Abroad
HIST 414	The Fall of Imperial China
HIST 416	Modern Japan
HIST 417	20th Century China
HIST 418	Chinese Film and History
HIST 419	Modern Southeast Asia
HIST 420	History of Modern South Asia
HIST 421	The History of Prostitution
HIST 422	Japanese Postwar Film and History
HIST 423	The History of Vietnam
HIST 429	Precolonial African History
HIST 430	Modern African History
HIST 442	Topics and Issues in Latin American History
HIST 443	Topics and Issues in Asian History
HIST 444	Topics and Issues in African History
HIST 445	Topics and Issues in Comparative History
HIST 459	Imperialism and Postcolonial Studies

**Foreign Language Requirement**

Select from the following: 4

CHIN 201	Intermediate Mandarin Chinese I
FR 201	Intermediate French I
GER 201	Intermediate German I
ITAL 201	Intermediate Italian I
JPNS 201	Intermediate Japanese I
MLL 201	Intermediate Modern Language I
SPAN 201	Intermediate Spanish I
or equivalent course	

**SUPPORT COURSES**Any upper division courses (300-400, including History) <sup>3</sup> 24**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 60

**FREE ELECTIVES**Free Electives <sup>3, 4</sup> 29

Total units 180

<sup>1</sup> Required in Major; also satisfies GE<sup>2</sup> Excluding HIST 400, HIST 467, HIST 485, HIST 495.<sup>3</sup> If upper-division GE courses are used to satisfy Major or Support requirements, additional units may be required to complete the 180 total unit requirement.<sup>4</sup> Upper division GE courses taken for a letter grade satisfy support course requirements which would cause free electives to become 41 rather than 29 units. Consult college advisor for additional information.**General Education (GE) Requirements**

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement) (4 units in Major) <sup>1</sup>	0
D2	Political Economy (4 units in Major) <sup>1</sup>	0
D3	Comparative Social Institutions (4 units in Major) <sup>1</sup>	0
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no HIST course)	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Major; also satisfies GE.**Asian Studies Minor****Required Courses**

HIST 310	East Asian Culture and Civilization (D5)	4
or HIST 316	Modern East Asia	
or HIST 319	Modern South and Southeast Asia	
PHIL 320	Asian Philosophy (C4)	4
or RELS 301	Religions of Asia	
CHIN 103	Elementary Mandarin Chinese III	4
or JPNS 103	Elementary Japanese III	

**Approved Electives**

(minimum 8 units upper-division) 16

**Lower Division:**

ANT 201	Cultural Anthropology (D3)	
CHIN 201	Intermediate Mandarin Chinese I	
CHIN 202	Intermediate Mandarin Chinese II	
CHIN 203	Intermediate Mandarin Chinese III	
ES 244	Survey of Asian American Studies (D3)	
GEOG 150	Introduction to Cultural Geography (D3)	
HIST 221	World History, Beginnings to 1000 (D3)	
HIST 222	World History, 1000 - 1800 (D3)	
HIST 223	World History, 1800 - Present (D3)	
JPNS 201	Intermediate Japanese I	



LA 211	History of Landscape Architecture: Ancient Civilizations through Colonial America (C3)	
POLS 225	Introduction to International Relations	
<b>Upper Division:</b>		
ARCH 320	Topics in Architectural History (C4)	
ART 317	Asian Art Survey	
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements (C4)	
BUS 304	Establishing International Supply Chains	
(Topic: China)		
ES 322	Asian American Cultural Images (D5)	
HIST 416	Modern Japan	
HIST 417	20th Century China	
HIST 418	Chinese Film and History	
HIST 419	Modern Southeast Asia	
HIST 422	Japanese Postwar Film and History	
HIST 423	The History of Vietnam	
HIST 443	Topics and Issues in Asian History	
HUM 310	Humanities in World Cultures (C4)	
(Topics: China, Japan, Thailand)		
POLS 328	Politics of Developing Areas	
(Topic: East Asia)		
RELS 306	Hinduism (C4)	
RELS 307	Buddhism (C4)	
SOC 350	Social Organization of Modern Japan	
Total units		28

## History Minor

### Required Courses

HIST 303	Research and Writing Seminar in History	5
Select from the following lower-division courses:		12
HIST 110	Western Civilization: Ancient to Renaissance	
HIST 111	Western Civilization: Reformation to the Present	
HIST 201	United States History to 1865	
HIST 202	United States History Since 1865	
HIST 206	American Cultures (D1)	
HIST 207	Freedom and Equality in American History (D1)	
HIST 210	World History I (D3)	
HIST 213	Modern Political Economy (D2)	
HIST 214	Political Economy of Latin America and the Middle East (D2)	
HIST 221	World History, Beginnings to 1000 (D3)	
HIST 222	World History, 1000 - 1800 (D3)	
HIST 223	World History, 1800 - Present (D3)	

### History Electives

Select from 300-400 level History courses	12
Total units	29

## MA History

There are two options for the MA degree in History, Comprehensive Exam or Thesis.

### Required Courses

HIST 504	Graduate Study in History	4
History Seminars		

Select from the following: 20

Each course is repeatable up to 12 units.

HIST 505	Graduate Seminar in United States History	
HIST 506	Graduate Seminar in European History	
HIST 507	Graduate Seminar in East Asian History	
HIST 508	Graduate Seminar in Latin American History	
HIST 509	Graduate Seminar in African History	
HIST 510	Graduate Seminar in Comparative History	

### History Electives

HIST Electives (400-500 level) <sup>1</sup> 16

### Culminating Experience

Select from the following: 8-9

Comprehensive Exam Option (total 48 units)

HIST 512 Supervised Reading for Comprehensive Exams  
(2) (2)

400-500 HIST electives (4)

Thesis Option (total 49 units)

HIST 599 Thesis (3) (3) (3)

Total units 48-49

<sup>1</sup> 400-level courses include extra work for graduate students.  
(All courses must be taken after undergraduate degree has been awarded. Undergraduate courses or their equivalent may not be repeated.)

## Humanities

Faculty Office Building (Bldg. 47), Room 31

Phone: 805.756.2359

<http://humanities.calpoly.edu/>

Interim Coordinator: Jane Lehr

### Academic Programs

Program name	Program type
Media Arts and Technologies	Minor
Science, Technology and Society	Minor

The Humanities Program offers interdisciplinary and international classes in a wide variety of subject areas, from applied practice in media arts and technologies; to the study of social, cultural, political, and ethical issues involved in science and technology; to courses that examine various cultures such as China, Japan, and South Africa. International courses complement Cal Poly-sponsored study abroad programs in London, Spain, Thailand, Australia, and Latin America. Many humanities classes satisfy University general education and breadth requirements.

The program also offers two interdisciplinary minors that allow students to actively engage in the study of technology: the Media Arts and Technologies Minor and the Science, Technology and Society Minor. Both minors are available to students throughout the University, regardless of students' technical backgrounds.

### Media Arts and Technologies Minor

The Media Arts and Technologies Minor recognizes that today's students are citizens of the information age. The purpose of the minor is to introduce and develop ways students can analyze, critique, historicize, invent, think, and use various electronic media, thus encouraging a bridge between theory and practice. By taking a multidisciplinary approach, Cal Poly students learn to analyze, construct, and understand media; acquire teamwork skills across disciplines; and practice the leadership, problem solving, collaboration, critical thinking, and communication skills that help prepare them for a broad range of academic or professional careers.

The minor allows students to select from among courses that emphasize technical design and narrative construction. The minor includes a three-course core; within that core is a two-course capstone experience that builds upon students' foundational knowledge and skills, providing them with the opportunity to collaborate on the creation of a project in both pre-production and production phases. Students practice professional techniques for building an interactive narrative designed for different forms of presentation. Students also learn how to succeed in professional collaborative, results-based development and production processes.

### Science, Technology and Society Minor

The purpose of the Science, Technology and Society (STS) Minor is to provide students with an opportunity to explore how science and technology shape and are shaped by social, cultural, political, ethical, economic, and legal factors and institutions in both historical and contemporary contexts.

Focusing on topics such as education, work, knowledge production, design, and public policy from interdisciplinary perspectives, students who complete the STS minor will be prepared to engage with and

respond to the profound challenges and choices we face related to science and technology in the 21st century, including efforts to create more socially responsible and sustainable scientific and technical knowledge production and decision-making practices. The STS minor will prepare students to work, collaborate, and interact responsibly and effectively in an increasingly diverse and globalized workplace and world.

Students are able to tailor their minor program through the selection of electives to focus on specific issues of interest. For more information about the STS minor, please contact the interim coordinator or minor advisors:

Dr. Jane Lehr (805.756.6442; [jlehr@calpoly.edu](mailto:jlehr@calpoly.edu)) or

Dr. Kate Murphy (805.756.2839; [ksmurphy@calpoly.edu](mailto:ksmurphy@calpoly.edu))

## Media Arts and Technologies Minor

### Required Courses

HUM 240	Introduction to Media Arts and Technologies	4
HUM 340	Media Arts and Technologies: Storytelling	4
HUM 341	Media Arts and Technologies: Cinematic Process	4

### Approved Electives

Select 16 units from one or more of the following categories: (at least 8 units must be upper division) 16

#### Technical Design

ARCH 460	Computer Graphics Applications III
ART 101	The Fundamentals of Drawing (C3)
ART 105	Foundation: Color Theory
ART 106	Foundation: 2-Dimensional Design
ART 122	Basic Digital Photography
ART 182	Photographic Manipulation and Design
ART 183	Digital Illustration and Design
ART 324	Photographic Expression
ART 380	Design Principles for the Web
ART 383	Digital Video
ART 388	Web Design
ART 439	Type in Motion
ART 484	Animation, Video, and Interactive Design
ART 489	Advanced Interactive Media Art
CSC 171	Introduction to Interactive Entertainment
or CSC/CPE 123	Introduction to Computing
CSC/CPE 471	Introduction to Computer Graphics
CSC/CPE 473	Advanced Rendering Techniques
CSC/CPE 476	Real-Time 3D Computer Graphics Software
CSC/CPE 478	Current Topics in Computer Graphics
GRC 202	Digital Photography
GRC 218	Digital Typography

GRC 338	Digital Content Management and Variable Data Publishing	
GRC 339	Web Design and Production	
GRC 429	Digital Media	
GRC 452	Emerging Technologies in Graphic Communication	
ENGL 210	New Media Technology	
ENGL 411	New Media Arts I	
ENGL 412	New Media Arts II	
MU 311	Sound Design: Technologies	
MU 312	Sound Design: Recording	
MU 352	Orchestration	
TH 230	Stagecraft I	
TH 430	Scenic Design	
TH 434	Lighting Design	
<b>Narrative Construction/Film &amp; Media Studies</b>		
ART 314	History of Photography (C4)	
COMS 317	Technology and Human Communication	
COMS 385	Media Criticism	
COMS 419	Media Effects	
ENGL 370	World Cinema (C4)	
ENGL 371	Film Styles and Genres (C4)	
ENGL 372	Film Directors (C4)	
ENGL 411	New Media Arts I	
ENGL 412	New Media Arts II	
ES 340	Cultural Production and Ethnicity (C4)	
HIST 418	Chinese Film and History	
HIST 422	Japanese Postwar Film and History	
HUM 320	Values, Media, and Culture (C4)	
JOUR 203	News Reporting and Writing	
JOUR 285	Intro to Multimedia Journalism	
JOUR 302	Mass Media Law	
JOUR 303	Multimedia Reporting and Production	
JOUR 390	Visual Communication for the Mass Media	
MLL 470	Selected Advanced Topics (Film Subtopics)	
FR 470	Selected Advanced Topics	
GER 470	Selected Advanced Topics	
SPAN 307	Spanish and Latin American Film	
SPAN 470	Selected Advanced Topics	
POLS 347	Politics and Popular Culture	
TH 210	Introduction to Theatre (C3)	
WGS/ART 316	Women as Subject and Object in Art History	
Total units		28

## Science, Technology and Society Minor

### Required Courses

ES/WGS 350	Gender, Race, Science and Technology (Area F) (USCP)	4
HUM 303/ HNRS 304	Values and Technology (C4)	4

IME 320	Human Factors and Technology (Area F)	4
Select from the following:		4
HIST 350	The Scientific Revolution, c. 1500-1800 (D5)	
PHIL 321	Philosophy of Science (C4)	

### Approved Electives

Select 12 units, with at least one course from two different categories 12

### Science, Technology, and Practice

AERO/HNRS 310	Air and Space	
BRAE 348	Energy for a Sustainable Society (Area F)	
CRP 339	Disaster-Resistant Sustainable Communities (Area F)	
CSC 302	Computers and Society (Area F)	
ENGR 302	Transportation and Manufacturing in the Twenty-First Century	
ENGR 322/ SCM 302	The Learn By Doing Lab Teaching Practicum <sup>1</sup>	
ENVE 330	Environmental Quality Control	
HIST/MATE 359	Living in a Material World (Area F)	
LAES 301	Project-Based Learning in Liberal Arts and Engineering Studies	
PSC 307	Nuclear Weapons in the Post-9/11 World (Area F)	
PSC 320	Energy, Society and the Environment (Area F)	
SCM 325	Genetic Engineering Technology (Area F)	
SCM 335	Nuclear Science and Society	
UNIV/HNRS 392	Appropriate Technology for the World's People: Design (Area F)	
UNIV/HNRS 424	Design of Museum Displays of Science, Engineering and Technology	

### Society, Politics, and Policy

AG/HUM/ UNIV 330	Cal Poly Land: Nature, Technology, and Society (Area F)	
AG/EDES/ ENGR/HUM/ SCM/UNIV 350	The Global Environment (Area F)	
ANT 360	Human Cultural Adaptations (D5)	
COMS 317	Technology and Human Communication	
COMS 390	Environmental Communication	
ERSC/GEOG 325	Climate and Humanity	
ES/NR 308	Fire and Society (D5)	
ES/NR 360	Ethnicity and the Land (C4) (USCP)	
ES/WGS 351	Global Engineering: Gender, Race, Class, Nation (D5)	
POLS/UNIV 333	World Food Systems (Area F)	
POLS 451	Technology and Public Policy	
PSY 311	Environmental Psychology (D5)	
SCM 320	Technology in London	
UNIV/HNRS 391	Appropriate Technology for the World's People: Development (D5)	

**History, Philosophy and Ethics**

HIST 350	The Scientific Revolution, c. 1500-1800 (D5) <sup>2</sup>
HIST 354	History of Network Technology (Area F)
HUM 302	Human Values in Agriculture (Area F)
PHIL 321	Philosophy of Science (C4) <sup>2</sup>
PHIL 322	Philosophy of Technology (C4)
PHIL 339	Biomedical Ethics (C4)
PHIL 340	Environmental Ethics (C4)
PHIL 420	Philosophy of Biology
PHIL 421	Philosophy of Space, Time and Matter
PHIL 422	Philosophy of Mind
<hr/>	
Total units	28

<sup>1</sup> 2 units, may be repeated

<sup>2</sup> If not taken above

## Journalism

Graphic Arts Bldg. (26), Room 228

Phone: 805.756.2508

<http://cla.calpoly.edu/jour.html>

Department Chair: Mary Glick

### Academic Program

Program name	Program type
Journalism	BS

The Journalism Department offers a professional program leading to the Bachelor of Science degree in Journalism. All majors must complete the basic journalism core courses in addition to a sequence of courses selected from an identified track and a list of electives from which they must choose in consultation with an academic advisor.

Of the 180 units required for a bachelor's degree, 104 quarter units must be taken in courses outside the major area of journalism/media/mass communication. Each student is strongly encouraged to take a modern language to satisfy his or her elective units. For media-related courses offered outside the major, students are required to consult with their academic advisor before enrolling in these classes.

All journalism majors are expected to serve as staff members of departmental communications media, including *Mustang Daily*, CCPR, the student-run public relations firm; KCPR, the FM-stereo radio station; or the news and programming operations of CPTV, Cal Poly's TV station. They are also expected to participate in professional and scholarly organizations in their areas of interest, in addition to applying acquired skills and developing professional abilities in an approved media internship.

### Undergraduate Program

#### BS Journalism

The Journalism Department offers a professional program leading to the Bachelor of Science degree in Journalism. All majors must complete the basic journalism core courses in addition to a sequence of courses selected from an identified track and a list of electives from which they must choose in consultation with an academic advisor.

## BS Journalism

### Program Learning Objectives

Graduates with a BS in Journalism will:

1. Understand the media in a global context, including the historical and current roles of media.
2. Have a broad understanding of cultural, social, economic, and political practices and systems, including those other than one's own, and be able to communicate information about these accurately and effectively.
3. Be prepared for the rapidly changing nature of media and have the ability to adapt to new career paths.
4. Demonstrate and uphold the personal and professional ethics and values of journalism.
5. Have the drive to pursue the truth without regard to personal gain or loss.

6. Understand concepts and apply theories of communication beyond those involving the written word.
7. Be able to perform editing functions and practice self-editing of one's own work to ensure the highest quality.
8. Be able to effectively tell stories.
9. Challenge conventional wisdom and opinion.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: Up to 4 units of major or support courses may be selected as credit/no credit.

#### MAJOR COURSES

Journalism Core		
JOUR 101	Introduction to Mass Media and Visual Communication	2
JOUR 203	News Reporting and Writing	4
JOUR 219	Multicultural Society and the Mass Media (USCP)	4
JOUR 285	Intro to Multimedia Journalism	4
JOUR 302	Mass Media Law	4
JOUR 402	Journalism Ethics	4
JOUR 444	Media Internship	3
JOUR 460	Senior Project	3
or JOUR 462	Advanced Media Practicum	
Journalism Track		
Select 20 units of Area-Specific Electives or follow the Public Relations track:		20

#### Area-Specific Electives

Select 12 units from the following:

JOUR 233	Editing
JOUR 304	Public Affairs Reporting
JOUR 333	Broadcast News
JOUR 346	Broadcast Announcing and Production
JOUR 348	Electronic News Gathering
JOUR 407	Feature Writing

Select 8 units from the following (may be repeated):

JOUR 352	Advanced Newspaper Reporting Practicum: Mustang Daily
JOUR 353	Advanced Broadcast Journalism Practicum

#### Public Relations Track

JOUR 233	Editing
or JOUR 333	Broadcast News
JOUR 312	Public Relations
JOUR 342	Public Relations Writing and Editing
JOUR 413	Public Relations Campaigns



JOUR 415	Advanced Public Relations Practice: CCPR	
<b>JOUR Electives</b>		
a. Media Technologies		
Select from the following:		8
JOUR 303	Multimedia Reporting and Production	
JOUR 390	Visual Communication for the Mass Media	
JOUR 410	Advanced Multimedia	
b. Select 8 units from any other JOUR course not already used elsewhere in the major. A maximum of 4 units may be lower division. Courses may include:		8
JOUR 201	Journalism History	
JOUR 205	Agricultural Communications	
JOUR 331	Contemporary Advertising	
JOUR 401	Global Communication	
JOUR 470	Selected Advanced Topics	
<b>SUPPORT COURSES</b>		
Approved Electives		44
Students are encouraged to pursue minors or develop other areas of interest outside of Journalism, Media, and Mass Communication through Approved Electives and with the following restrictions:		
At least 24 units must be upper-division courses with a lecture or seminar component. (This excludes activity-only, lab-only, or supervision courses such as internships.)		
Of the 24 upper-division units, at least 12 must be in the College of Liberal Arts and/or College of Science and Mathematics.		
A maximum of 12 units may be taken in the area of Journalism/Media/Mass Communication.		
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		72
<b>FREE ELECTIVES <sup>1</sup></b>		
Free Electives		0
Total units		180

<sup>1</sup> If GE courses are used to satisfy Support requirements, additional units may be required to complete the 180 total unit requirement.

## General Education (GE) Requirements

- 72 units required.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4

C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		72

## Modern Languages and Literatures

Faculty Office Bldg. (47), Room 28  
Phone: 805.756.1205  
<http://cla.calpoly.edu/mlt.html>

Department Chair: John Thompson

### Academic Programs

Program name	Program type
French	Minor
German	Minor
Modern Languages and Literatures	BA
Spanish	Minor

The Modern Languages and Literatures Department offers coursework in beginning, intermediate, and advanced French, German, and Spanish, as well as coursework in beginning and intermediate Mandarin Chinese, Italian, and Japanese. Instruction at all levels emphasizes communicative competence and the use of authentic media to prepare students for cultural, educational, literary and professional needs in California, throughout the United States, and abroad.

Students who wish to enroll in language courses for the first time at Cal Poly, numbered 101 through 203, must take the requisite Placement Examination prior to enrolling. Students who have never studied the desired language must begin at 101. Students should contact the Modern Languages and Literatures Department for test dates and procedures.

The department supports the concept of international education and encourages students to investigate opportunities for meaningful international study, internships, and educational experiences. The department works with Cal Poly's and the CSU's International Programs to ensure that courses taken in an experience abroad count toward either major, support, minor, general education and/or free electives, as appropriate. Students interested in studying abroad should consult with the Cal Poly International Center Office and their assigned academic advisor well in advance.

The department collaborates with Cal Poly's School of Education in training students who wish to obtain a bilingual teaching credential.

The department also supports such student clubs as the Cal Poly Language Club, the Chinese Cultural Club, and MEXA (Movimiento Estudiantil Xicano de Aztlán), as well as sponsoring a quarterly film series and other cultural events such as the Chinese New Year celebration and the German Winter Festival.

The PolyLingual International Resource Center (PIRC) is the department's digital language laboratory and multimedia teaching facility. Students and faculty members use the Center for class activities and presentations, and for drop-in language practice and curriculum development.

### Undergraduate Programs

#### BA Modern Languages and Literatures

Modern Languages and Literatures majors and minors have been successful in careers in education, international business, finance,

non-profit agencies, the viticulture industry, and government service. Others have attended graduate and professional schools in various fields, including languages and literatures, linguistics, speech pathology, law, medicine, and engineering. Our graduates have also been selected to teach in secondary schools in Spain (North American Language and Culture Assistants and France (Teaching Assistant Program in France).

#### French Minor

#### German Minor

#### Spanish Minor

## BA Modern Languages and Literatures

### Program Learning Objectives

The MLL program provides students opportunities to:

1. Learn to communicate effectively through speaking, listening, reading, and writing in authentic target-language situations.
2. Develop communicative and intercultural competency so that they can work productively both as individuals and in collaboration with others.
3. Gain perspective on cultural and historical achievements in the target-language cultures as well as on relevant issues of diversity.
4. Cultivate awareness of ethical and professional perspectives that reflect linguistic and cultural heritage.
5. Think critically and creatively using the target languages and negotiate meaning between the target languages and English.
6. Develop the life-long ability to evaluate ways in which language and culture provide perspective on the larger world of the arts, sciences, and technology.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

#### MAJOR COURSES

Primary Language		
SPAN 201	Intermediate Spanish I	4
SPAN 202	Intermediate Spanish II	4
SPAN 203	Intermediate Spanish III	4
or SPAN 206	Spanish for Heritage Speakers	
SPAN 207	Introduction to Spanish Linguistics	4
SPAN 233	Introduction to Hispanic Readings (C1) <sup>1</sup>	4
SPAN 301	Advanced Composition in Spanish	4

SPAN 302	Advanced Conversation and Composition in Spanish	4
SPAN 305	Significant Works in Spanish	4
SPAN 402	Advanced Linguistics in Spanish	4
SPAN 410	Advanced Literature in Spanish	4
SPAN 416	Don Quixote	4
MLL 360	Research Methods in Modern Languages	4
MLL 460	Senior Project	4
<b>Approved language/culture electives (300-400 level)</b>		
(See Approved Language/Culture Elective list below)		12
<b>Secondary Language Concentration</b>		
Select secondary language in either French, German, or other language approved by Department Chair <sup>2</sup>		
Elementary courses (101, 102, 103)		12
Intermediate courses (201, 202, 203)		12
Critical Reading course (233)		4
Advanced language course (300-400 level) <sup>3</sup>		4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		68
<b>FREE ELECTIVES <sup>4</sup></b>		
Free Electives		16
Total units		180

## Approved Language/Culture Electives (300-400 level)

Select from the following: 12

AG/EDES/ ENGR/HUM/ SCM/UNIV 350	The Global Environment
AGB 318	Global Agricultural Marketing and Trade
ANT 325	Pre-Columbian Mesoamerica
ANT 330	Indigenous South Americans
ANT 360	Human Cultural Adaptations
ANT 401	Culture and Health
ANT 415	Native American Cultures
ART 311	Art History - Nineteenth Century Art
ART 312	Art History - Modern Art, 1900-1945
ART 313	Design History
ART 315	Art History - Art Since 1945
ART 318	Asian Art Topics: National, Religious, and Intellectual Movements
ART/WGS 316	Women as Subject and Object in Art History
BUS 402	International Business Management
BUS 403	Advanced Seminar in International Management
BUS 410	The Legal Environment of International Business
CD 350	Developmental Issues in Education
CD/PSY 306	Adolescence
COMS 308	Group Performance of Literature
COMS 311	Communication Theory
COMS 315	Intergroup Communication

COMS 416	Intercultural Communication
COMS 421	Gender and Communication
DANC 321	Cultural Influence on Dance in America
ECON 330	International Trade Theory
ECON/HNRS 303	Economics of Poverty, Discrimination and Immigration
EDUC 423	Bilingual Literacy
EDUC 433	Foundations of Bilingual Education
ENGL 301	Advanced Composition - ESL
ENGL 302	Writing: Advanced Composition
ENGL 326	Literary Criticism
ENGL 346	Ethnic American Literature
ENGL 390	The Linguistic Structure of Modern English
ENGL 391	Topics in Applied Linguistics
ENGL 459	Significant World Writers
ENGL 495	Topics in Applied Language Study
ENGL 497	Theories of Language Learning and Teaching
ENGL 498	Approaches to Teaching English as a Second Language/Dialect
ENGL 499	Practicum in Teaching English as a Second Language/Dialect
ENGL 503	Graduate Introduction to Linguistics
ENGL/HNRS 380	Literary Themes
ES 300	Chicano/a Non-Fiction Literature
ES 321	Native American Cultural Images
ES 322	Asian American Cultural Images
ES 323	Mexican American Cultural Images
ES 326	Native American Architecture and Place
ES 330	The Chinese American Experience
ES 340	Cultural Production and Ethnicity
ES 380	Critical Race Theory
ES/NR 360	Ethnicity and the Land
FR 301	Advanced French Composition and Grammar <sup>5</sup>
FR 302	Advanced French Conversation and Grammar <sup>5</sup>
FR 305	Significant Works in French <sup>6</sup>
FR 350	French Literature in English Translation <sup>6</sup>
FR 470	Selected Advanced Topics <sup>6</sup>
FR/FSN 322	French Foods in French
GEOG 308	Global Geography
GEOG 370	Geography of Latin America
GER 301	Advanced German Composition and Grammar <sup>5</sup>
GER 302	Advanced German Conversation and Grammar <sup>5</sup>
GER 305	Significant Works in German <sup>6</sup>
GER 350	German Literature in English Translation <sup>6</sup>
GER 470	Selected Advanced Topics <sup>6</sup>
HIST 306	The Witch-Hunt in Europe, 1400-1800
HIST 310	East Asian Culture and Civilization
HIST 314	Middle East
HIST 316	Modern East Asia
HIST 319	Modern South and Southeast Asia

HIST 323	Versions of the Past: Novels, Comics and Movies
HIST 339	Colonial Latin America
HIST 340	Modern Latin America
HIST 341	Modern Central America
HIST 416	Modern Japan
HIST 417	20th Century China
HIST 418	Chinese Film and History
HIST 420	History of Modern South Asia
HIST 437	Nazi Germany
HIST 451	Medieval Europe
HIST 452	Renaissance and Reformation Europe
HIST 454	The Age of Revolution and Napoleon
HUM 310	Humanities in World Cultures <sup>6</sup>
HUM 312	Humanities in Chicano/a Culture
HUM 318	Culture of Spain: Activities
HUM/UNIV 361	Modernism
LS 310	Storytelling: Modern Applications of Traditional Narrative
MLL 470	Selected Advanced Topics <sup>6</sup>
PHIL 312	Medieval Philosophy
PHIL 313	Early Modern Rationalism
PHIL 315	Kant and 19th Century European Philosophy
PHIL 320	Asian Philosophy
PHIL 336	Feminist Ethics, Gender and Society
PHIL 350	Aesthetics
PHIL 423	Philosophy of Language
POLS 310	Politics of Ethnicity and Gender
POLS 322	International Political Activism
POLS 324	International Relations Theory
POLS 325	Global Political Issues
POLS 339	Authoritarian and Democratic Rule
POLS 346	Politics in Literature
POLS 429	Issues and Topics in International Relations
PSY 458	Learning
RELS 304	Judaism
RELS 306	Hinduism
RELS 307	Buddhism
RELS 310	Christianity
RELS 311	Islam
RELS/WGS 370	Religion, Gender, and Society
RPTA 314	Sustainable Travel and Tourism Planning
SOC 309	The World System and Its Problems
SOC 313	Urban Sociology
SOC 315	Global Race and Ethnic Relations
SOC 316	American Ethnic Minorities
SOC 350	Social Organization of Modern Japan
SOC/WGS 311	Sociology of Gender
SPAN 303	Introduction to English-Spanish Translation

SPAN 305	Significant Works in Spanish <sup>6</sup>
SPAN 307	Spanish and Latin American Film <sup>6</sup>
SPAN 340	Chicano/a Authors (USCP)
SPAN 350	Hispanic Literature in English Translation <sup>6</sup>
SPAN 351	Chicano/Latino Writers in the United States
SPAN 410	Advanced Literature in Spanish <sup>6</sup>
SPAN 470	Selected Advanced Topics <sup>6</sup>
TH 350	Seminar in Playwriting
TH 390	Global Theatre and Performance
WGS 320	Women in Global Perspective
WGS 450	Feminist Theory
WGS/ES 350	Gender, Race, Science and Technology

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> If a language other than French or German is approved as a student's Secondary Language Concentration, required coursework for that language that is not available at Cal Poly must be fulfilled through approved transfer credit.

<sup>3</sup> FR, GER (300-400 level), HUM 310 "Culture of France" or "Culture of Germany", or upper-division work in other language approved by Department Chair.

<sup>4</sup> If upper-division GE courses are used to satisfy Major or Support requirements, additional upper-division coursework may be required to satisfy the University's 60-units upper-division requirement.

<sup>5</sup> May be used as an elective, if not being used as part of required courses. May not be counted twice.

<sup>6</sup> May be counted multiple times if taken with different subtitles.

## General Education (GE) Requirements

- 72 units required, 4 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
Area C	Arts and Humanities	
C1	Literature (4 units in Major) <sup>1</sup>	0
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective (no SPAN, FR, GER courses)	4
Area D/E	Society and the Individual	

D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F Technology</b>		
F	Upper-division elective	4
Total units		68

<sup>1</sup> Required in Major; also satisfies GE

## French Minor

### Required Courses

FR 202	Intermediate French II	4
FR 203	Intermediate French III	4
FR 233	Critical Reading in French Literature (C1)	4

### Approved Electives

Select from the following: 12

FR 301	Advanced French Composition and Grammar	
FR 302	Advanced French Conversation and Grammar	
FR 305	Significant Works in French (C4) <sup>1</sup>	
FR 350	French Literature in English Translation (C4)	
FR 470	Selected Advanced Topics <sup>1</sup>	
FR/FSN 322	French Foods in French	
HUM 310	Humanities in World Cultures (Culture of France) (C4)	
MLL 400	Special Problems for Advanced Undergraduates <sup>1</sup>	
MLL 470	Selected Advanced Topics	

Total units 24

<sup>1</sup> Repeatable to 8 units.

## German Minor

### Required Courses

GER 202	Intermediate German II	4
GER 203	Intermediate German III	4
GER 233	Critical Reading in German Literature (C1)	4

### Approved Electives

Select from the following: 12

GER 301	Advanced German Composition and Grammar	
GER 302	Advanced German Conversation and Grammar	
GER 305	Significant Works in German (C4) <sup>1</sup>	
GER 350	German Literature in English Translation (C4)	
GER 470	Selected Advanced Topics <sup>1</sup>	
HUM 310	Humanities in World Cultures (Culture of Germany) (C4)	
MLL 400	Special Problems for Advanced Undergraduates <sup>1</sup>	

MLL 470	Selected Advanced Topics	
Total units		24

<sup>1</sup> Repeatable to 8 units.

## Spanish Minor

### Required Courses

SPAN 202	Intermediate Spanish II	4
SPAN 203	Intermediate Spanish III	4
or SPAN 206	Spanish for Heritage Speakers	
SPAN 233	Introduction to Hispanic Readings (C1)	4

### Approved Electives

Select from the following: 12

SPAN 301	Advanced Composition in Spanish	
SPAN 302	Advanced Conversation and Composition in Spanish	
SPAN 303	Introduction to English-Spanish Translation	
SPAN 305	Significant Works in Spanish (C4) <sup>1</sup>	
SPAN 307	Spanish and Latin American Film (C4) <sup>1</sup>	
SPAN 340	Chicano/a Authors (C4) (USCP)	
SPAN 350	Hispanic Literature in English Translation (C4)	
SPAN 351	Chicano/Latino Writers in the United States (C4) (USCP)	
SPAN 390	Introduction to Creative Writing in Spanish	
SPAN 402	Advanced Linguistics in Spanish	
SPAN 410	Advanced Literature in Spanish	
SPAN 416	Don Quixote	
SPAN 470	Selected Advanced Topics <sup>1</sup>	
HUM 310	Humanities in World Cultures (Culture of Spain, Mexico or Latin America) (C4)	
HUM 312	Humanities in Chicano/a Culture (C4) (USCP)	
MLL 400	Special Problems for Advanced Undergraduates <sup>1</sup>	
MLL 470	Selected Advanced Topics	

Total units 24

<sup>1</sup> Repeatable to 8 units.



## Music

Davidson Music Center (45), Room 129  
 Phone: 805.756.2406; Fax: 805.756.7464  
 Email: [music@calpoly.edu](mailto:music@calpoly.edu)  
<http://www.music.calpoly.edu>

Department Chair: W. Terrence Spiller

### Academic Programs

Program name	Program type
Music	BA, Minor

The Bachelor of Arts in Music introduces a student to the role of music in today's world, helps form personal goals, and provides the discipline, skills and knowledge to accomplish those goals. The program develops musical skills, encourages creativity, and cultivates vision for the future. The University's polytechnic emphasis also provides an excellent opportunity to explore music in conjunction with a wide range of other fields. Graduates are prepared to begin specialized study at the graduate level and to enter a wide variety of professional careers.

The Music Department is a valuable resource for the non-music major. Its courses and performing ensembles are open to all students who wish to enrich their lives through music. Qualified students may explore the subject in depth by minoring in music.

The Music Department also serves as a cultural center for both the university and the community through a program of public performances by student and faculty groups and through clinics, workshops, concerts, and lectures by outstanding individuals from outside the university.

Acceptance into the music major program requires a demonstrated ability on an instrument, in voice, or talent through other musical media, plus the ability to read music at a fundamental level.

### Undergraduate Programs

#### BA Music

Designed for the student who wants a broad education in music, the Bachelor of Arts degree offers a balanced program of study in a wide range of subjects. In addition to the traditional emphasis on music theory, history and performance, Cal Poly's program includes American music, music of non-Western cultures, and the application of sound design. The program provides a large number of elective courses which allows the student to concentrate in a particular area or combine music with other subjects.

#### Bachelor of Arts Degree Requirements

1. All new students will take placement examinations in piano skills, music theory, and musicianship. Students who audition in person for the major will take the placement exams at the time of their audition. Students who submit a recording with their application will need to contact the Music Department to schedule the placement examinations before their first term of enrollment. Separate auditions are required for assignment to performing ensembles. Students who wish to take piano, theory, or musicianship courses beyond the beginning level must pass the appropriate placement test. Regardless of courses taken prior to coming to Cal Poly, students are required to remedy

deficiencies before enrolling in advanced music theory or music history courses.

2. Each music major enrolled in at least 6 units of music courses must include a performance ensemble each quarter in order to qualify for applied study of voice or instruments. (See the Department for details regarding appropriate ensembles and applied study policies.) Each student enrolled in private instruction must take an applied music jury at the end of Spring Quarter.
3. Each student is required to attend a minimum of 6 concerts per quarter.
4. At the end of the sixth quarter of enrollment (third quarter of enrollment for transfer students) a student must take a mid-point evaluation to verify progress and potential in music. This test includes the following:
  - a. private performance skills (should be at the MU 250 level; tested through a jury)
  - b. musicianship skills up through the level of Musicianship III
  - c. knowledge of music theory up through the level of Theory II
  - d. piano proficiency (see No. 5 below)
5. Each student must pass examinations in six areas of piano proficiency (repertoire, sightreading, transposition, harmonization of a melody, accompanying, score-reading) as part of the mid-point evaluation.
6. Use of Music Department instruments, scheduled practice rooms, electronic studio, or lockers requires a Music Use Fee. See the Music Department Office for details.
7. It is important that each student stay closely in touch with his/her advisor in order to progress through the music major program in the most efficient manner.
8. The Music Department is not able to offer the full complement of performing ensembles and private instruction during the Summer Quarter; it is important to take this into consideration when planning coursework for completion of the major.

A music major handbook giving complete details of the program, policies and forms is available from the Music Department.

#### Music Minor

A minor is available to students who desire documented competency in music. An individualized curriculum (incorporating theory, history, and performance) based on the following guidelines is developed in consultation with a member of the music faculty. Students must complete one academic music lecture course at Cal Poly, such as MU 101 or MU 120, before applying for the minor. Information and application forms for the declaration of a Music minor are available in the Music Department Office, as well as online at [www.music.calpoly.edu](http://www.music.calpoly.edu).

### BA Music

#### Program Learning Objectives

1. Understand the role of music in today's world
2. Understand the applications of technology to musical activities
3. Form personal goals in the field of music and complete a capstone project related to those goals
4. Demonstrate understanding of music theory
5. Demonstrate understanding of music history

6. Demonstrate competence in musical performance
7. Demonstrate competence in musicianship skills
8. Communicate effectively

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

MU 103	Music Theory I: Diatonic Materials	4
MU 104	Musicianship I	2
MU 105	Music Theory II: Chromatic Materials	4
MU 106	Musicianship II	2
MU 108	Musicianship III	2
MU 121	Introduction to Non-Western Musics	4
MU 303	Music Theory III: Advanced Chromaticism	4
MU 305	Music Theory IV: Contemporary Practices	4
MU 311	Sound Design: Technologies	4
MU 320	Music Research and Writing	4
MU 325	America's Music (USCP)	4
or MU 326	Cultural Concepts and Structures in Music	
or MU 336	Jazz History and Theory	
or MU 470	Music History: Selected Advanced Topics	
MU 331	Music of the Middle Ages and Renaissance	4
MU 332	Music of the Baroque and Early Classic Eras	4
MU 431	Music of the Classic and Romantic Eras	4
MU 432	Music of the Modern Era	4
MU 461	Senior Project	3

### Approved music lecture courses (300-400 level) <sup>1</sup>

Select from the following:	12
MU 301	Counterpoint
MU 312	Sound Design: Recording
MU 324	Music and Society
MU 325	America's Music
MU 326	Cultural Concepts and Structures in Music
MU 328	Women in Music
MU 336	Jazz History and Theory
MU 340	Conducting: Fundamentals
MU 341	Conducting: Choral
MU 342	Conducting: Instrumental
MU 352	Orchestration
MU 360	Music for Classroom Teachers
MU 411	Sound Design: Synthesis
MU 412	Sound Design: Composition and Production

MU 465	Choral Literature and Rehearsal Techniques
MU 466	Instrumental Literature and Rehearsal Techniques
MU 470	Music History: Selected Advanced Topics

### Major Ensemble 100-level

Select from the following:	6
MU 168	Piano Accompanying
MU 170	University Jazz Band
MU 171	Instrumental Ensembles
MU 172	Wind Orchestra
MU 173	Wind Ensemble
MU 174	Symphony Orchestra
MU 177	Chamber Winds
MU 181	Polyphonics
MU 183	Vocal Ensemble
MU 185	University Singers
MU 186	Early Music Ensemble
MU 187	Vocal Jazz Ensemble
MU 188	Arab Music Ensemble

### Major Ensemble at 300-level

Select from the following:	3
MU 368	Piano Accompanying
MU 370	University Jazz Band
MU 371	Instrumental Ensemble
MU 372	Wind Orchestra
MU 373	Wind Ensemble
MU 374	Symphony Orchestra
MU 377	Chamber Winds
MU 381	Polyphonics
MU 383	Vocal Ensemble
MU 385	University Singers
MU 386	Early Music Ensemble
MU 387	Vocal Jazz Ensemble
MU 388	Arab Music Ensemble

### Applied Study

Select from the following:	9
MU 150	Applied Music
MU 250	Applied Music
MU 350	Applied Music
MU 450	Applied Music

### GENERAL EDUCATION (GE)

(See GE program requirements below. ) 72

### FREE ELECTIVES

Free Electives	21
Total units	180

<sup>1</sup> MU 325, MU 326, MU 336, MU 470 can satisfy this requirement if not previously used to satisfy another required music course.

## General Education (GE) Requirements

- 72 units required.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective (no MU course)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		72

## Music Minor

### Required Courses

Select from the following music theory courses: 4

MU 101 Introduction to Music Theory (C3)

MU 103 Music Theory I: Diatonic Materials

Select from the following music theory or music history courses: 4

#### Theory Courses

MU 103 Music Theory I: Diatonic Materials

MU 105 Music Theory II: Chromatic Materials

MU 114 Introduction to Composing

#### History Courses

MU 120 Music Appreciation (C3)

MU 121 Introduction to Non-Western Musics

MU 221 Jazz Styles (C3) (USCP)

MU 227 Popular Music of the USA (C3) (USCP)

MU 229 Music of the 60's: War and Peace (C3) (USCP)

Select from the following theory or history or performance courses: 4

#### Theory Courses

MU 105 Music Theory II: Chromatic Materials

MU 114 Introduction to Composing

#### History Courses

MU 120 Music Appreciation (C3)

MU 121 Introduction to Non-Western Musics

MU 221 Jazz Styles (C3) (USCP)

MU 227 Popular Music of the USA (C3) (USCP)

MU 229 Music of the 60's: War and Peace (C3) (USCP)

#### Performance Courses

##### Musicianship

MU 104 Musicianship I

MU 106 Musicianship II

MU 108 Musicianship III

##### Beginning Jazz Improvisation

MU 259 Beginning Jazz Improvisation

##### Class Voice

MU 154 Beginning Voice

MU 252 Intermediate Voice

##### Class Piano

MU 151 Beginning Class Piano

MU 152 Elementary Class Piano

MU 153 Intermediate Class Piano

MU 253 Advanced Class Piano

##### Class Guitar

MU 155 Beginning Guitar

MU 255 Intermediate Guitar

##### Any lower-division ensemble

MU 168 Piano Accompanying

MU 170 University Jazz Band

MU 171 Instrumental Ensembles

MU 172 Wind Orchestra

MU 173 Wind Ensemble

MU 174 Symphony Orchestra

MU 176 Mustang Band

MU 177 Chamber Winds

MU 178 Field Show Marching Skills

MU 181 Polyphonics

MU 183 Vocal Ensemble

MU 185 University Singers

MU 186 Early Music Ensemble

MU 187 Vocal Jazz Ensemble

MU 188 Arab Music Ensemble

#### Upper Division Electives

Electives: 12

Choose from 300-400 level Music course, with the following stipulations:

1) If NO lower-division units were in history, then at least 4 units must be in an upper-division history course (MU 324, MU 325, MU 328)

2) If NO lower-division units were in performance, then at least 2 units must be in upper-division ensembles (up to a maximum of 4 units)

3) No more than 2 units in the minor may be satisfied by MU 400

4) No more than 4 units in the minor may be satisfied by upper-division performance courses

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Total units

24

## Philosophy

Faculty Office Bldg. (47), Room 37

Phone: 805.756.2041

<http://cla.calpoly.edu/phil.html>

Department Chair: Tal Scriven

### Academic Programs

Program name	Program type
Philosophy	BA, Minor
Religious Studies	Minor

The Philosophy department at Cal Poly is one of the largest in the CSU system. It prides itself on excellence in teaching and the high standards met by its students. A degree in philosophy is one of the best preparations for graduate or professional school and the evidence for this is substantial. Nationally, philosophy majors outscore everyone but majors in mathematics and physics on the Law School Admissions Test (LSAT). Similar trends are also seen for scores in all sections of the Graduate Record Exam (GRE) and on the Graduate Management Admission Test (GMAT), the exam required by most MBA programs.

The reason for this is unsurprising. The study of philosophy requires the meticulous development of general analytical reasoning skills. Even students not planning to go on to graduate or professional school are well served by the analytical and verbal skills developed by the study of philosophy. The ability to communicate clearly and forcefully is increasingly rare and, as a result, increasingly sought after in the job market.

### Undergraduate Programs

#### BA Philosophy

Students can pursue a curriculum leading to a Bachelor of Arts degree in Philosophy, including an optional concentration in Ethics and Society, and a curriculum leading to a minor in Philosophy. The department also offers courses and a minor in Religious Studies. An unusually large number of courses is offered in the history of philosophy, as well as courses in specific areas of philosophy (logic, ethics, metaphysics, epistemology), and courses that deal with the philosophical issues arising in other disciplines (e.g., philosophy of art and philosophy of science).

#### Concentrations

Students may choose to complete 20 units of 300-400 level philosophy courses or the concentration.

#### Ethics and Society

Designed for students with an interest in pursuing professional careers in which they will need to address practical ethical issues, especially careers in business, medicine, politics and law.

#### Philosophy Minor

The minor program in Philosophy is designed for students who want to add to their education an understanding of the history of philosophy, of contemporary trends in philosophy, and of philosophical issues relevant to their major field of study. It consists of 24 units (8 specified, 8 chosen from an approved list, 8 additional PHIL electives). Interested

students are invited to contact the Philosophy Department Office or website for more information and application forms.

### Religious Studies Minor

The Religious Studies minor program is designed for students who want to enhance their understanding of the great religious traditions of the contemporary world and some of the social issues involving these religions. The minor consists of 24 units. Interested students are invited to contact the Philosophy Department Office for more information and application forms.

## BA Philosophy

### Program Learning Objectives

1. Significant critical skill
2. Sound command of logic
3. Competence at philosophical writing
4. Good, general knowledge of the history of philosophy
5. Grasp of main currents in contemporary philosophy
6. Familiarity with methods of contemporary philosophical inquiry

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism

Note: No major, support or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

PHIL 101	Introduction to Philosophy	4
PHIL 230	Philosophical Classics: Knowledge and Reality (C2) <sup>1</sup>	4
PHIL 231	Philosophical Classics: Ethics and Political Philosophy	4
PHIL 241	Symbolic Logic I	4
PHIL 242	Symbolic Logic II <sup>3</sup>	4
PHIL 321	Philosophy of Science	4
PHIL 331	Ethics	4
PHIL 411	Metaphysics	4
PHIL 412	Epistemology	4
PHIL 460	Senior Project I	2
PHIL 461	Senior Project II	2

#### History of philosophy electives

Select from the following:		16
PHIL 311	Greek Philosophy	
PHIL 312	Medieval Philosophy	
PHIL 313	Early Modern Rationalism	
PHIL 314	Early Modern Empiricism	



PHIL 315	Kant and 19th Century European Philosophy	
PHIL 316	20th Century European Philosophy	
PHIL 317	History of Analytic Philosophy	
Concentration (see below) or 300-400 level PHIL electives <sup>2</sup>		20
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		68
<b>FREE ELECTIVES</b>		
Free Electives		36
Total units		180

<sup>1</sup> Required in Major; also satisfies GE.

<sup>2</sup> At least 12 units must be 400 level.

<sup>3</sup> An additional 4 units of free electives may substitute.

## Concentration or Electives

Select either the following concentration or 20 units of 300-400 level PHIL electives. If the concentration is not chosen then at least 12 units of the electives chosen must be 400 level.

- Ethics and Society (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/philosophy/baphilosophy/ethicsandsocietyconcentration>)

## General Education (GE) Requirements

- 72 units required, 4 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy (4 units in Major) <sup>1</sup>	0
C3	Fine/Performing Arts	4
C4	Upper-division elective (no PHIL course)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no PHIL course)	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		68

<sup>1</sup> Required in Major; also satisfies GE

## Ethics and Society Concentration

Select from the following:		20
PHIL 322	Philosophy of Technology	
PHIL 332	History of Ethics	
PHIL 333	Political Philosophy	
PHIL 334	Philosophy of Law	
PHIL 335	Social Ethics (USCP)	
PHIL 336	Feminist Ethics, Gender and Society (USCP)	
PHIL 337	Business Ethics	
PHIL 339	Biomedical Ethics	
PHIL 340	Environmental Ethics	
PHIL 341	Professional Ethics	
PHIL 439	Selected Problems in Ethics and Political Philosophy	
Total units		20

## Philosophy Minor

### Required Courses

PHIL 101	Introduction to Philosophy	4
Select from the following:		4
PHIL 230	Philosophical Classics: Knowledge and Reality (C2)	
PHIL 231	Philosophical Classics: Ethics and Political Philosophy (C2)	

### Approved Electives

Select from the following:		4
PHIL 311	Greek Philosophy (C4)	
PHIL 313	Early Modern Rationalism (C4)	
PHIL 314	Early Modern Empiricism (C4)	
PHIL 315	Kant and 19th Century European Philosophy (C4)	
Select from the following:		4
PHIL 321	Philosophy of Science (C4)	
PHIL 331	Ethics (C4)	
PHIL 411	Metaphysics	
PHIL 412	Epistemology	

### Additional Electives

PHIL elective	4
PHIL elective 400-level	4
<hr/>	
Total units	24

## Religious Studies Minor

### Required Courses

Select from the following:		8
ENGL 354	The Bible as Literature and in Literature and the Arts (C4)	
RELS 205	Jesus	

RELS 301	Religions of Asia (C4)	
RELS 302	Monotheisms: Judaism, Christianity, and Islam (C4)	
RELS 304	Judaism (C4)	
RELS 306	Hinduism (C4)	
RELS 307	Buddhism (C4)	
RELS 310	Christianity (C4)	
RELS 311	Islam (C4)	
Select from the following:		4
PHIL 320	Asian Philosophy (C4)	
PHIL 342	Philosophy of Religion (C4)	
PSY 339	Psychology of Religion	
RELS 344	Approaches to Religion and Spirituality (D5)	
SOC 377	Sociology of Religion (D5)	
Select from the following:		4
RELS 201	Religion, Dialogue, and Society (D3)	
RELS/WGS 370	Religion, Gender, and Society (C4) (USCP)	
RELS 372	Spiritual Extremism: Asceticism, Mysticism, and Madness (C4)	
RELS 374	Religion and Violence (C4)	
RELS 378	Religion and Contemporary Values (C4)	
RELS/POLS 380	Religion and Politics in the Israeli-Palestinian Conflict	
RELS 400	Special Problems for Advanced Undergraduates	
RELS 470	Selected Advanced Topics	
Approved Electives (any additional RELS course)		8
Total units		24

## Political Science

Faculty Office Bldg. (47), Room 14-A

Phone: 805.756.2984

<http://politicalscience.calpoly.edu/>

Department Chair: Jean Williams

### Academic Programs

Program name	Program type
Global Politics	Minor
Law and Society	Minor
Political Science	Minor, BA
Public Policy	MPP

The Political Science Department offers instruction leading to the Bachelor of Arts degree in Political Science and a Master of Public Policy degree. Through the required and elective courses, the department prepares students to become informed, active citizens. Undergraduate and graduate programs emphasize the comprehension of political thinking, the application of communication, and analytical skills, and prepare students for careers in research and survey analysis, administration, teaching, business, graduate studies, or leadership positions in the public, private, and nonprofit sectors.

In addition to the undergraduate major and the graduate program, the department offers minors in Political Science, Global Politics and Law and Society. General Education courses in the department expose students to political thought, the fundamentals of U.S. politics, global issues, and the politics of foreign countries. The department supports internship opportunities in local, state, and federal agencies in addition to applied public policy research opportunities through the Center for Public Policy at Cal Poly.

### Undergraduate Programs

#### BA Political Science

The major provides students with insights into the behavior of countries, individuals, and groups as they pursue their interests. Students considering work in related fields such as law, education, administration, government, and business gain basic knowledge of principles and practices in those areas. Additionally, students who are planning graduate work can establish a sound foundation for advanced studies in political science, law, public administration, business administration, urban planning, and other related fields.

### Concentrations

#### American Politics

Study of American governmental institutions, campaigns and elections, parties, public policy, and social movements. Provides students with a broad knowledge of the American political system that can prepare them for careers in government employment at the local, state, or national level, campaign advising, policy analysis, urban and regional planning, or leadership positions in advocacy groups.

#### Global Politics

Study of international and comparative politics, politics of developing areas, and U.S. foreign policy. Prepares students for careers in the diplomatic corps, foreign policy analysis, transnational

nongovernmental organizations, intelligence analysis, or international business.

### Pre-Law

Study of American constitutional law, civil liberties, civil rights, jurisprudence and judicial process. Prepares students for careers in law. Some students may apply to law school to continue their preparation for the legal profession. Others may seek careers in law-related professions such as law enforcement, judicial administration and legal assistance.

### Individualized Course of Study

As an alternative option to one of the concentrations, students with varying backgrounds and interests may pursue a course of study that meets their individual needs and interests.

### Global Politics Minor

The minor consists of required coursework and approved electives. Details are available from the Political Science Department.

### Law and Society Minor

The minor consists of required coursework and approved electives. Details are available from the Political Science Department.

### Political Science Minor

The minor consists of required coursework and approved electives. Details are available from the Political Science Department.

### Master of Public Policy

#### General Characteristics

The Master of Public Policy degree program (MPP) is professionally oriented, and open to students who wish to pursue analytic careers in government, nonprofit organizations, consulting, advocacy and related policy occupations. The program is structured to prepare graduates with competence and creativity to excel in careers in the ever-changing world of public policy. The core courses cover public policy, public policy analysis, economic and regulator policy, research design, quantitative methods, leadership, policy internships, and graduate seminar.

The MPP program is designed to meet the needs of those who have earned baccalaureate degrees in a variety of disciplines, including, but not limited to, economics, history, political science, social sciences, psychology, city and regional planning, business administration, education, environmental studies, and natural resource management.

The program is two years in duration for students taking 8 or more units per term. It consists of 60 approved units (not including courses necessary to compensate for deficiencies). Because of the sequencing of courses, students admitted to the program are expected to begin study in the fall quarter. In their second year, students undertake the development, presentation, and discussion of individual research projects in a two-term seminar (POLS 590). After the completion of POLS 590, students are required to pass a comprehensive exam. The program offers students opportunities to develop close working relationships with faculty. Self-directed study, tailored to student interest and needs, is encouraged.

## Prerequisites

Students entering the program are expected to bring with them backgrounds in certain basic subject areas or to make up deficiencies in these areas after admission. These include the following Cal Poly course or its equivalent: STAT 217 Introduction to Statistical Concepts and Methods.

## Admission Requirements

1. Possession of a baccalaureate degree from an accredited college or university;
2. A grade point average of not less than 3.00 in all undergraduate coursework;
3. Related undergraduate coursework or work experience;
4. The quality of previous educational and professional experiences measured by:
  - a. Biographical and career data (resumes, examples of reports, letters of recommendation, etc.),
  - b. Professional training in fields such as budgeting, management, and supervision in the public, health, or nonprofit sectors, and
  - c. A personal statement describing a student's experience and reasons for applying to the program
  - d. GRE scores are recommended, but not required, for admission.
5. For applicants whose preparatory education is principally in a language other than English, a TOEFL score of 550 or higher (or 213 on the new conversation scale for the computer-based TOEFL exam).
6. To increase recognition of the major problems, the leading policies, and the legal issues confronting contemporary political systems, particularly in the U.S.
7. To increase acquisition of citizenship skills, ethical values, and the ability to understand and appreciate human diversity; and to engage in community life as active citizens.
8. To increase understanding of political science research and analytical skills, including the ability to think critically; to construct logical arguments; to collect, analyze, and interpret evidence and data; and to formulate reasoned conclusions.
9. To increase development of writing skills through research papers, essay exams, senior projects in political science topics, and collaborative research/writing opportunities with faculty.
10. To provide opportunities to undergraduate and graduate students to link theory and practice and to apply political science knowledge and skills to actual problem-solving and community service.
10. To increase awareness of career options available with an undergraduate degree in political science; its utility in the public and private sectors; and its value as entry into a range of graduate programs, teaching positions, and legal education.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

POLS 112	American and California Government (D1) <sup>1</sup>	4
POLS 180	Political Inquiry	4
POLS 225	Introduction to International Relations	4
POLS 229	Introduction to Comparative Politics	4
POLS 230	Basic Concepts of Political Thought	4
POLS 359	Research Design	4
POLS 361	Quantitative Methodology	4
POLS 461	Senior Project I	4
& POLS 462	and Senior Project II	
Political Science electives (300-400 level) <sup>2</sup>		20
Concentration courses or individualized course of study		28

### Support Courses

Select from the following:		4
HIST 110	Western Civilization: Ancient to Renaissance	
HIST 111	Western Civilization: Reformation to the Present	
HIST 222	World History, 1000 - 1800	
HIST 223	World History, 1800 - Present	

## Program of Study

Graduate students must file a formal study plan with their major professor, graduate committee, department, college and university graduate studies office no later than the end of the quarter in which the twelfth unit of approved courses is completed. The formal program of study must include a minimum of 60 units. Core courses in the Political Science Department must be taken on a graded basis unless specified in the course catalog as credit/no credit (CR/NC).

## BA Political Science

### Program Learning Objectives

1. To increase knowledge of the political science discipline; its principal theoretical frameworks and applications, conceptual vocabulary, and methods of inquiry; its major subfields of study; and its interrelationships with the other social science fields.
2. To increase understanding of basic facts and concepts about the American political system, including its history, philosophical, constitutional and legal foundations, leading political values and ideas, governing institutions, and policy making processes.
3. To increase knowledge of diverse political systems around the world, including empirical area-based knowledge; broader theoretical understanding of different political systems, institutions and processes; and the changing domestic and global contexts within which they operate.
4. To increase knowledge of the history of classical and modern political thought; of the fundamental values and ethical issues contested in politics over time; and of alternative moral and

ANT 201	Cultural Anthropology	
GEOG 150	Introduction to Cultural Geography	
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		64
<b>FREE ELECTIVES</b>		
Free Electives		28
Total units		180

<sup>1</sup> Required in Major/Support; also satisfies GE

<sup>2</sup> 4 units maximum of POLS 386

## Concentrations or Individualized Course of Study (select one)

- American Politics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/politicalscience/bapoliticalscience/americanpoliticsconcentration>)
- Global Politics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/politicalscience/bapoliticalscience/globalpoliticsconcentration>)
- Pre-Law (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/politicalscience/bapoliticalscience/prelawconcentration>)

### Individualized Course of Study

A minimum of 28 units of coursework are selected by the student and approved by the student's academic advisor. 20 of these must be at the 300–400 level and 16 units must carry a POLS prefix.

## General Education (GE) Requirements

- 72 units required, 8 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup>	4
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	

D1	The American Experience (Title 5, Section 40404 requirement) (4 units in Major) <sup>1</sup>	0
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no POLS course)	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		64

<sup>1</sup> Required in Support; also satisfies GE

## American Politics Concentration

POLS 315	The American Presidency	4
POLS 319	United States Congress	4
POLS 341	American Constitutional Law	4
Select from the following:		12
POLS 316	Political Participation	
POLS 317	Campaigns and Elections	
POLS 348	Early American Political Thought	
or POLS 349	Contemporary American Political Thought	
POLS 375	California Politics	
POLS 419	Social Movements and Political Protest	
POLS 431	Issues and Topics in American Politics	
POLS 471	Urban Politics	

### Approved Elective <sup>1</sup>

Select from the following:		4
POLS 386	Government Internship (4 units maximum)	
POLS 451	Technology and Public Policy	
POLS 456	Politics and Economic Policy	
POLS 459	The Politics of Poverty	
Any unused course in this concentration		
Total units		28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Global Politics Concentration

POLS 308	Political Violence and Conflict Resolution	4
or POLS 381	Peace and War	
POLS 320	Comparative Political Analysis	4
or POLS 324	International Relations Theory	
POLS 328	Politics of Developing Areas	4
or POLS 383	Politics of the European Union	
POLS 382	Comparative Foreign Policy	4
or POLS 420	Contemporary U.S. Foreign Policy	
POLS 322	International Political Activism	4
or POLS 426	International Organizations and Law	
or POLS 427	Politics of the Global Economy	
POLS 428	Issues and Topics in Comparative Politics	4
or POLS 429	Issues and Topics in International Relations	



**Approved Elective<sup>1</sup>**

Select from the following:	4
POLS 285 Model United Nations	
POLS 321 Comparative Political Culture	
POLS 380 Religion and Politics in the Israeli-Palestinian Conflict	
POLS 386 Government Internship	
Any unused course in this concentration	
Total units	28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

**Pre-Law Concentration**

POLS 245	Judicial Process	4
POLS 334	Jurisprudence	4
POLS 340	American Judicial Politics	4
POLS 341	American Constitutional Law	4
POLS 343	Civil Rights in America	4
POLS 344	Civil Liberties	4

**Approved electives<sup>1</sup>**

Select from the following:	4
BUS 207 Legal Responsibilities of Business	
BUS 308 Business Law II	
BUS 409 Law of Real Property	
BUS 410 The Legal Environment of International Business	
BUS 473 Employment Law	
ES 380 Critical Race Theory	
JOUR 302 Mass Media Law	
LS 214 Constitutional Issues in the History of U.S. and California Education	
NR 404 Environmental Law	
PHIL 334 Philosophy of Law	
POLS 295 Foundations of Mock Trial	
POLS 386 Government Internship	
POLS 426 International Organizations and Law	
PSY 375 Forensic Psychology	
SOC 402 Crime and Violence	
SOC 406 Juvenile Delinquency	
SOC 412 Criminal Justice	
Total units	28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

**Global Politics Minor****Required Courses**

POLS 225	Introduction to International Relations	4
POLS 229	Introduction to Comparative Politics	4
Select from the following:		16
POLS 308	Political Violence and Conflict Resolution	

POLS 320	Comparative Political Analysis	
POLS 321	Comparative Political Culture	
POLS 322	International Political Activism	
POLS 324	International Relations Theory	
POLS 328	Politics of Developing Areas	
POLS 381	Peace and War	
POLS 382	Comparative Foreign Policy	
POLS 383	Politics of the European Union	
POLS 426	International Organizations and Law	
POLS 427	Politics of the Global Economy	
POLS 428	Issues and Topics in Comparative Politics	
POLS 429	Issues and Topics in International Relations	

**Approved Electives**

Electives	4
Total units	28

**Law and Society Minor****Required Courses**

POLS 245	Judicial Process	4
POLS 341	American Constitutional Law	4

Select from the following: 8

POLS 334	Jurisprudence	
POLS 340	American Judicial Politics	
POLS 343	Civil Rights in America	
POLS 344	Civil Liberties	

**Approved Electives**

Select from the following:		12
ES 380	Critical Race Theory	
JOUR 302	Mass Media Law	
LS 214	Constitutional Issues in the History of U.S. and California Education	
NR 404	Environmental Law	
PHIL 334	Philosophy of Law	
POLS 295	Foundations of Mock Trial	
POLS 340	American Judicial Politics	
POLS 386	Government Internship (4 units maximum)	
POLS 426	International Organizations and Law	
PSY 375	Forensic Psychology	
SOC 402	Crime and Violence	
SOC 406	Juvenile Delinquency	
SOC 412	Criminal Justice	

Total units 28

**Political Science Minor****Required Courses**

Select from the following:		12
POLS 112	American and California Government	
POLS 225	Introduction to International Relations	
POLS 229	Introduction to Comparative Politics	
POLS 230	Basic Concepts of Political Thought	

Any four 300-400 level POLS courses	16
Total units	28

## Master of Public Policy

### Program Learning Objectives

1. MPP students will be able to think critically and creatively about public policy theory, analysis and application. In particular, students will develop knowledge and skills in quantitative and qualitative analysis, argumentation, and the process and practice of research in general and as applied to a substantive policy area.
2. MPP students will develop skills for the clear, concise, and effective communication of ideas. This includes the communication of evidence, analysis, and arguments via written, visual, and oral methods.
3. MPP students will demonstrate expertise in the field of public policy, including an appreciation of the connections between a particular substantive area and the social, political, economic, and technological context in which it exists.
4. MPP students will develop leadership capacities that will prepare them to work productively as individuals and in groups.
5. MPP students will develop tools that prepare them to participate constructively in the process of creating, implementing and evaluating public policy.
6. MPP students will learn to recognize and reconcile diverse perspectives, and the tradeoffs they entail, in pursuit of the public interest.
7. MPP students will utilize internship experiences and course knowledge to prepare them for dynamic and professional careers in the ever-changing field of public policy.

#### Required Courses

POLS 510	Research Design	4
POLS 515	Public Policy	4
POLS 518	Public Policy Analysis	5
POLS 540	Leadership and Management in Public Policy	4
POLS 550	Regulatory and Economic Policy	4
POLS 560	Quantitative Methods	5
POLS 586	Policy Internship	4-8
POLS 590	Graduate Seminar	8
POLS 595	Directed Readings for MPP Comprehensive Exams	2

#### Approved Electives

Additional 400 and 500-level courses, to be selected with graduate advisor's approval.

At least 4 units must be at the 500 level.

Total units	60
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## Psychology and Child Development

Faculty Office Bldg. (47), Room 24  
Phone: 805.756.2033  
<http://psycd.calpoly.edu/>

Department Chair: Jasna Jovanovic

### Academic Programs

Program name	Program type
Child Development	BS, Minor
Gerontology	Minor
Psychology	BS, MS, Minor

The department consists of faculty with degrees in psychology, family studies, human development and education who direct programs leading to BS Child Development, BS Psychology, MS Psychology, and minors in Child Development, Psychology and Gerontology.

In addition, courses are offered which fulfill general education requirements, support other programs and serve as a personal development resource for all university students. These courses are designed to acquaint students with the facts, theories and contemporary trends in psychology and child development and how these principles can be incorporated into a more meaningful understanding of oneself and of one's interactions with others. The department supports the concept of international education and encourages students to investigate opportunities for overseas study. For further information, see the Study Abroad programs (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/academicservicesandprograms/calpolyinternationalcenter>).

### Undergraduate Programs

#### BS Child Development

The Child Development major is designed for students who are interested in professions involving children and adolescents in a variety of settings. The major provides the scientific base for understanding development from birth through adolescence. The program emphasizes the ecological contexts in which development occurs, including family, school, technology, community, and culture. Graduates often continue studies in graduate and credential programs, and pursue a range of careers in education, intervention programs and human services.

The Child Development major is designed to enable students to develop a program of study suited to their individual needs and become part of a learning community of faculty and students. After completing core courses in child development, they will, with the assistance of an advisor, develop a personal program of study by selecting advisor approved electives, free electives, two internships, and a senior project. Each student graduates with a BS in Child Development, and a minor in Psychology with the filing of a minor application form.

Goals of the Child Development major are for students to:

- Learn about theories and research that have helped us to understand how children and adolescents develop physically, emotionally, socially, and intellectually.

- Study how children affect and are affected by the formal and informal environments in which they grow.
- Gain experience working with children of different ages and backgrounds in various settings.
- Develop expertise in the use of digital technologies to access, create, and disseminate information related to children's learning and development.
- Develop an understanding of multicultural and anti-discrimination issues and how to lead children into an appreciation of diversity.
- Develop skills in research, leadership, effective communication, and community building.

### BS Psychology

The Psychology major offers a broad preparation in the science of psychology, with concentrations in Applied Social Psychology, Counseling and Family Psychology, and Developmental Psychology. Theoretical approaches, research techniques, laboratory experiences and internships are hallmarks of the psychology program.

Graduates often pursue careers in mental health programs, social services agencies, public health settings, education institutions, and personnel-related settings. Many majors go on to graduate work in such fields of psychology as: counseling, developmental, family, social, clinical or experimental.

### Concentrations

#### Applied Social Psychology

The application of social-psychological theory and methodology to business, the environment, health, conflict resolution, and law. Prepares for careers in government, business and social activism. Many students go on to pursue graduate study in social psychology, human resource management, public health, law, and related disciplines.

#### Counseling and Family Psychology

Interdisciplinary study that provides knowledge and experience necessary for a variety of careers in family, social, educational, clinical, and other health-related service agencies in the public and private sectors. Appropriate for students who wish to work in such settings, and who desire an applied approach to understanding and modifying individual, inter-personal, and family systems. Students are prepared for graduate study in clinical psychology, counseling psychology, social work, and marriage and family counseling.

#### Developmental Psychology

Prepares students for careers in human service agencies, health care settings, and special needs programs. Students study the nature of human development throughout the life span and learn to use psychological and developmental principles to assess and analyze behavior and to implement behavior change. Students are prepared for graduate study in psychology and related fields.

#### Individualized Course of Study

Permits students to pursue a course of study which meets their individual needs and interests. Courses are selected by the student with the advice and approval of the student's academic advisor and department chair.

## Child Development Minor

The minor is designed to provide students a broad knowledge base in child and adolescent development. Biological, cognitive, social, and emotional development are examined in context (e.g., family, school, culture). The minor builds upon students' critical thinking skills by approaching child development as a scientific area of study. This minor complements one's background in majors such as Liberal Studies, Psychology, or Recreation Administration. An application form must be approved by a Child Development Minor advisor.

## Gerontology Minor and Certificate Program

An interdisciplinary minor that prepares students in various majors whose careers will be directly or indirectly related to gerontology. The certificate program is available to upgrade the skills and increase the knowledge of persons already in the field of gerontology. Coursework includes the psychological, biological, and social aspects of aging; changing roles; stress-related problems; and an understanding of the impact of an aging population on social, economic, and political institutions. *Among the requirements for admission to the program is a minimum GPA of 3.00. All applicants are reviewed by the program coordinator.*

## Psychology Minor

The minor provides students with a broad background in the principles of psychology in order to develop an appreciation of the human element in the world around them, complement their professional training, and enhance their personal development and interpersonal effectiveness.

Students whose primary job responsibilities will require dealing with people should find employment opportunities increased and career advancement enhanced. Interested students are encouraged to contact the Psychology and Child Development Department for information and application forms. An application form must be approved by a Psychology Minor advisor.

## Graduate Program

### MS in Psychology

#### General Characteristics

The Master of Science in Psychology is a 90-quarter unit professional degree program designed to provide the state of California with highly competent master-level clinicians who are academically prepared to obtain the marriage and family therapy (MFT) license. The program places a heavy emphasis on clinical skill training and applied experience that begins early in the program and culminates with an intensive supervised internship in a community mental health setting.

#### Admission to the Program

In addition to the general requirements of the University, specific requirements for admission to classified graduate standing are:

- an acceptable baccalaureate degree from an institution accredited by a regional association;
- a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted;

- satisfactory performance on the General Tests (Verbal, Quantitative, Analytical) of the Graduate Record Examination (GRE); the GRE Advanced Test in Psychology is not required;
- three letters of recommendation;
- autobiographical information;

Related work or volunteer experience is highly desirable as is having received professional counseling.

#### Prerequisites

Coursework in abnormal psychology, lifespan theories, personality, introductory statistics, and research methods in psychology (or related discipline). Completion of these prerequisites is necessary for admission to the program.

#### Classified Standing

For admission as a classified graduate student, a student shall have a minimum grade point average of 3.0 in the last 90 quarter units (60 semester units) attempted and shall have earned an acceptable baccalaureate degree from an institution accredited by a regional association. Additionally, the student must have satisfactorily met the professional, personal, scholastic, and other standards for graduate study, including qualifying examinations, as the appropriate university authorities may prescribe. Only those applicants who show promise of success and fitness are admitted, and only those who continue to demonstrate a satisfactory level of scholastic competence and who possess appropriate personal qualities are eligible to continue in the program.

#### Conditionally Classified Standing

The student may enroll in a graduate degree curriculum if in the opinion of the M.S. Program Committee the student can remedy any deficiencies by additional preparation.

#### Advancement to Candidacy

Advancement to master's degree candidacy requires completion of a minimum of 30 quarter units of required courses in residence, specified in a formal program of study, with a minimum grade point average of 3.0, fulfillment of the Graduation Writing Requirement, and the formal recommendation of the M.S. Program Committee. Students must maintain a minimum GPA of 3.0 in all coursework completed subsequent to admission to the program.

#### Program of Study

The student must maintain a grade point average of 3.0 (B) or better in all courses taken subsequent to program admission. Calculation of the grade point average includes all grades, though only the units in courses with grades of A, B, or C are counted to satisfy requirements for the degree. Required courses with a grade of D or F must be repeated.

All candidates must meet the current Graduation Writing Requirement.

Sixty-four quarter units must be completed in residence. Transfer credits are allowed if acceptable for master's degree credit at the offering institution and approved by the M.S. Program Committee.

The Master of Science degree in Psychology requires a culminating experience that includes either the completion of a thesis or passing a comprehensive exam. Each candidate must file a formal program of study by the end of the first quarter as a classified graduate student. The professional and personal growth of each graduate student is of major importance; consequently, candidates are encouraged to seek

the experience of personal therapy. Students must be very aware of course prerequisites and check the catalog carefully to assure enrollment in required courses.

## MFT Licensing

The Master of Science in Psychology is designed to meet the educational requirements for the Marriage and Family Therapist license (MFT) in the State of California. Students are advised to acquire and read the laws governing MFT licensure from the Board of Behavioral Science Examiners, 1625 North Market Blvd., Suite S-200, Sacramento, CA 95834. State documents must be filed by the applicant within 30 days of program graduation. See the program coordinator for the procedure required for application for this license. State documents must be filed by the applicant within 30 days of program graduation.

## Grades

If a candidate for University recommendation for MFT licensure has more than one grade of C or lower among the courses to be verified for the Board of Behavioral Sciences, that form will not be approved by the Chief Academic Officer Designee of Cal Poly.

## Practicum and Traineeship

Practicum and traineeship courses represent the student's demonstration of the clinical skills basic to marriage, family and child counseling. A student who receives a grade of NC in practicum or traineeship is on probation regarding continuation in the program. A second grade of NC disqualifies the student from the program and University recommendation for the license. Also, candidates may be disqualified from this program for academic-related actions judged by the M.S. Program Committee to reflect unethical and/or unprofessional conduct.

## BS Child Development

### Program Learning Objectives

1. Appreciation of the importance of scientific research for addressing human concerns
2. Develop skills as critical consumers of research
3. Knowledge of various theoretical perspectives on development from conception through adolescence
4. Ability to think critically and problem solve regarding important issues in the child development field
5. Ability to use various methods appropriate for child study and assessment
6. Understanding of the role of technology in developmental science
7. Development of professional skills (e.g., interpersonal, oral and written communication, leadership) and awareness of ethical standards
8. Appreciation of human diversity and multicultural perspectives

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

CD 102	Orientation to the Child Development Major	2
CD 131	Observing and Interacting with Children	4
CD 230	Preschool Laboratory	4
CD/PSY 254	Family Psychology	4
PSY 256	Developmental Psychology	4
CD 304	Infant and Toddler Development	4
CD 305	Early and Middle Childhood Development	4
CD/PSY 306	Adolescence	4
PSY 323	The Helping Relationship	4
CD 329	Research Methods in Child Development	4
CD 330	Supervised Internship	4
CD 350	Developmental Issues in Education	4
CD 401	Perspectives on Child and Adolescent Development	4
CD 413	Children, Adolescents & Technology	6
CD 424	Children's Learning in Families and Communities	4
CD 430	Advanced Internship	4
or CD 432	Research Internship	
CD/PSY 431	Assessing Children's Development and Environments	4
CD 461	Senior Project Seminar	2
CD 462	Senior Project	2

### SUPPORT COURSES

BIO 302	Human Genetics (B5) <sup>1</sup>	4
PSY 201	General Psychology (D4) <sup>1</sup>	4
or PSY 202	General Psychology	
Select from the following:		4
PSY 413	Parent-Child Relationships	
PSY 419	Self and Identity	
PSY 420	Social and Emotional Development	
PSY 421	Language and Cognitive Development	
PSY 456	Behavioral Disorders in Childhood	
PSY 460	Child Abuse and Neglect	
Select from the following:		4
PSY 350	Teamwork	
PSY 351	Group Dynamics	
PSY 372	Multicultural Psychology	
PSY 465	Cross-Cultural Issues in Psychology	
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4

Approved Electives 16

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 60

### FREE ELECTIVES



Free Electives	12
Total units	180

<sup>1</sup> Required in Support; also satisfies GE

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup>	4
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5) (4 units in Support) <sup>1</sup>	0
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Support) <sup>1</sup>	0
D5	Upper-division elective (not PSY courses)	4
Area F	Technology	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Support; also satisfies GE

## BS Psychology

### Program Learning Objectives

1. Appreciation of human diversity and multicultural perspectives
2. Critical thinking and problem solving skills as applied to psychological issues
3. Appreciation of psychology as science
4. Understanding how attitudes, attributions, and social psychological principles explain behavior
5. Knowledge of maturation processes and stages of individual development across the lifespan

6. Understanding how conditioning, reinforcement, discrimination, and aversion affect behavior
7. Knowledge of cognitive processes such as perception, memory, problem solving
8. Knowledge of psychological disorders, their causes, and approaches to treatment

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

PSY 201	General Psychology (D4) <sup>1</sup>	4
or PSY 202	General Psychology	
PSY 252	Social Psychology	4
PSY 256	Developmental Psychology	4
PSY 305	Personality	4
PSY 323	The Helping Relationship	4
PSY 329	Research Methods in Psychology	4
PSY 333	Quantitative Research Methods for the Behavioral Sciences	3
PSY 340	Biopsychology (B5) <sup>1</sup>	4
PSY 372	Multicultural Psychology (USCP)	4
PSY 405	Abnormal Psychology	4

### Supervised Fieldwork and/or Research Internship

Select from the following:		10
PSY 448	Research Internship I	
PSY 449	Research Internship II	
PSY 453	Supervised Fieldwork I	
PSY 454	Supervised Field Work II	
PSY 457	Memory and Cognition	4
PSY 458	Learning	4
PSY 461	Senior Project Seminar	1
PSY 462	Senior Project	3
PSY electives (300-400 level)		12
Concentration or individualized course of study (see list below)		28

### SUPPORT COURSES

BIO 302	Human Genetics	4
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4-5
or STAT 251	Statistical Inference for Management I	
or STAT 252	Statistical Inference for Management II	

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 60

### FREE ELECTIVES

Free Electives	10-11
Total units	180

<sup>1</sup> Required in Major/Support; also satisfies GE

## Concentrations

- Applied Social Psychology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/psychologychilddevelopment/bspsychology/appliedsocialpsychologyconcentration>)
- Counseling and Family Psychology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/psychologychilddevelopment/bspsychology/counselingandfamilypsychologyconcentration>)
- Developmental Psychology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/psychologychilddevelopment/bspsychology/developmentalpsychologyconcentration>)

### Individualized Course of Study

Courses are selected by the student with the approval of the student's academic advisor and the department chair. The ICS consists of 28 units; include a Cal Poly minor, course prerequisites for graduate study, foreign language courses, and/or a coherent group of courses including a minimum of two upper division psychology courses and no more than nine units of lower division courses.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (4 units in Support plus 4 units in GE) <sup>1</sup>	4
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5) (4 units in Major) <sup>1</sup>	0
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4

D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective (no PSY course)	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Major/Support; also satisfies GE

## Applied Social Psychology Concentration

PSY 360	Applied Social Psychology	4
Select from the following:		8
PSY 302	Behavior in Organizations	
PSY 311	Environmental Psychology	
PSY 317	Psychology of Stress	
PSY 350	Teamwork	
or PSY 351	Group Dynamics	
PSY 352	Conflict Resolution: Violent and Nonviolent	
Select from the following:		4
PSY 318	Psychology of Aging	
PSY 320	Health Psychology	
PSY 324	Psychology of Gender	
PSY 465	Cross-Cultural Issues in Psychology	
ES 320	African American Cultural Images	
ES 321	Native American Cultural Images	
ES 322	Asian American Cultural Images	
ES 323	Mexican American Cultural Images	
ES 380	Critical Race Theory	
ES 381	The Social Construction of Whiteness	
WGS 301	Contemporary Issues in Women's and Gender Studies	
WGS 320	Women in Global Perspective	
WGS 350	Gender, Race, Science and Technology	
WGS 370	Religion, Gender, and Society	
Approved concentration electives		12
Total units		28

## Counseling and Family Psychology Concentration

PSY 370	Introduction to Clinical and Counseling Psychology	4
Select from the following:		8
PSY 325	Introduction to Positive Psychology	
PSY 330	Behavioral Effects of Psychoactive Drugs	
PSY 350	Teamwork	
or PSY 351	Group Dynamics	
PSY 375	Forensic Psychology	
PSY 413	Parent-Child Relationships	
PSY 432	Psychological Testing	

PSY 450	Family Intervention	
PSY 456	Behavioral Disorders in Childhood	
PSY 460	Child Abuse and Neglect	
Select from the following:		4
PSY 318	Psychology of Aging	
PSY 324	Psychology of Gender	
PSY 465	Cross-Cultural Issues in Psychology	
ES 320	African American Cultural Images	
ES 321	Native American Cultural Images	
ES 322	Asian American Cultural Images	
ES 323	Mexican American Cultural Images	
ES 380	Critical Race Theory	
ES 381	The Social Construction of Whiteness	
WGS 301	Contemporary Issues in Women's and Gender Studies	
WGS 320	Women in Global Perspective	
WGS 340	Sexuality Studies	
WGS 370	Religion, Gender, and Society	
Approved concentration electives		12
Total units		28

## Developmental Psychology Concentration

PSY 419	Self and Identity	4
PSY 420	Social and Emotional Development	4
PSY 421	Language and Cognitive Development	4
Select from the following:		4
PSY/CD 431	Assessing Children's Development and Environments	
PSY 310	Psychology of Death	
PSY 318	Psychology of Aging	
PSY 413	Parent-Child Relationships	
PSY 422	Lifespan Sexuality	
PSY 456	Behavioral Disorders in Childhood	
PSY 459	Lifespan Theories	
PSY 460	Child Abuse and Neglect	
Approved concentration electives		12
Total units		28

## Child Development Minor

### Required Courses

Select from the following: <sup>1</sup>		4
PSY 256	Developmental Psychology	
CD/EDUC 207	The Learner's Development, Culture and Identity in Educational Settings	
Select from the following:		8
CD 304	Infant and Toddler Development	
CD 305	Early and Middle Childhood Development	
CD/PSY 306	Adolescence	
CD 350	Developmental Issues in Education	4
CD 424	Children's Learning in Families and Communities	4

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PSY 201	General Psychology (D4)	4
or PSY 202	General Psychology	

### Approved Electives

Select from the following:		4
PSY 413	Parent-Child Relationships	
PSY 419	Self and Identity	
PSY 420	Social and Emotional Development	
PSY 421	Language and Cognitive Development	
PSY 456	Behavioral Disorders in Childhood	
PSY 460	Child Abuse and Neglect	
Total units		28

<sup>1</sup> CD 207 / EDUC 207 is intended for Liberal Studies Majors

## Gerontology Minor and Certificate Program

### Required Courses

KINE 408	Exercise and Health Gerontology	4
PSY 318	Psychology of Aging (D5)	4
SOC 326	Sociology of the Life Cycle	4
FSN 315	Nutrition in Aging	4

### Approved Electives

Select from the following:		8
ANT 344	Sex, Death, and Human Nature	
BIO 302	Human Genetics	
BIO 305	Biology of Cancer	
COMS 418	Health Communication	
FSN 210	Nutrition	
or PSY 256	Developmental Psychology	
PHIL 339	Biomedical Ethics	
PSY 310	Psychology of Death	
PSY 317	Psychology of Stress	
PSY 459	Lifespan Theories	

### Gerontology-related Fieldwork <sup>1</sup>

Select from the following:		4
PSY 401	Special Problems: Experiential Learning	
or advisor approved course		
Total units		28

<sup>1</sup> May be fulfilled as an elective in the student's major or may be challenged due to previous work.

## Psychology Minor

Minimum of 16 units 300-400 level courses required

### Required Courses

PSY 201	General Psychology (D4)	4
or PSY 202	General Psychology	
Select from the following:		4
STAT 217	Introduction to Statistical Concepts and Methods (B1)	
STAT 251	Statistical Inference for Management I (B1)	

STAT 321	Probability and Statistics for Engineers and Scientists (B6)	
Select from the following:		8
PSY 252	Social Psychology <sup>1</sup>	
or PSY 254	Family Psychology	
or PSY 256	Developmental Psychology	
or PSY 260	African American Psychology	
PSY 305	Personality	
PSY 340	Biopsychology (B5)	
PSY 405	Abnormal Psychology	
<b>Approved PSY Electives (300-400 level)</b>		
Select from the following:		12
PSY 301	Psychology of Personal Development	
PSY 302	Behavior in Organizations	
PSY 305	Personality <sup>2</sup>	
PSY 306	Adolescence	
PSY 309	Psychology of Consciousness	
PSY 310	Psychology of Death	
PSY 311	Environmental Psychology	
PSY 317	Psychology of Stress	
PSY 318	Psychology of Aging	
PSY 324	Psychology of Gender	
PSY 325	Introduction to Positive Psychology	
PSY 329	Research Methods in Psychology	
PSY 330	Behavioral Effects of Psychoactive Drugs	
PSY 340	Biopsychology <sup>2</sup>	
PSY 350	Teamwork	
PSY 351	Group Dynamics	
PSY 352	Conflict Resolution: Violent and Nonviolent	
PSY 360	Applied Social Psychology	
PSY 370	Introduction to Clinical and Counseling Psychology	
PSY 372	Multicultural Psychology	
PSY 375	Forensic Psychology	
PSY 405	Abnormal Psychology <sup>2</sup>	
PSY 413	Parent-Child Relationships	
PSY 419	Self and Identity	
PSY 420	Social and Emotional Development	
PSY 421	Language and Cognitive Development	
PSY 422	Lifespan Sexuality	
PSY 432	Psychological Testing	
PSY 450	Family Intervention	
PSY 456	Behavioral Disorders in Childhood	
PSY 457	Memory and Cognition	
PSY 458	Learning	
PSY 459	Lifespan Theories	
PSY 460	Child Abuse and Neglect	
PSY 465	Cross-Cultural Issues in Psychology	
Total units		28

<sup>1</sup> Only one course can be counted in the minor.

<sup>2</sup> If a course is taken to meet a requirement, it cannot be double-counted as an approved elective for the minor.

## MS Psychology

### Required Courses

PSY 450	Family Intervention	4
PSY 456	Behavioral Disorders in Childhood	4
PSY 504	Psychopharmacology	4
PSY 555	Counseling & Communication	4
PSY 556	Multicultural Counseling and Psychology	4
PSY 560	Individual Therapy: Theory and Application	4
PSY 564	Ethics and the Law: MF Therapy	4
PSY 565	Diagnosis and Treatment: Psychopathology	4
PSY 566	Group Therapy: Theory and Application	4
PSY 569	Counseling Clinic Practicum (3) (3)	6
PSY 571	Advanced Family Therapy: Theory and Application	4
PSY 572	Child and Adolescent Therapy: Theory and Application	4
PSY 574	Psychological Assessment	4
PSY 575	Gender, Couple and Sexual Dysfunction Therapy	4
PSY 576	Traineeship: Marital and Family Therapy (4) (4) (4) (4)	16
PSY 577	Community Mental Health: Issues and Practices	4
PSY 585	Research Methods for Counseling Psychology	4
PSY 588	Substance Abuse: Assessment and Treatment	4
Select from the following: <sup>1</sup>		4
PSY 599	Thesis (4)	
OR		
Written comprehensive exam and one of the following:		
PSY 568	Advanced Psychotherapies (4)	
or an approved 400-level PSY course		
Total units		90

<sup>1</sup> Must register for thesis credit each quarter of advisement.

## Social Sciences

Faculty Office Bldg. (47), Room 13-C

Phone: 805.756.2260

<http://cla.calpoly.edu/socs.html>

Department Chair: Terry L. Jones

### Academic Programs

Program name	Program type
Anthropology and Geography	BS, Minor
Latin American Studies	Minor
Sociology	BA, Minor

The Social Sciences Department offers bachelor's degrees and minors in Anthropology-Geography and Sociology, as well as a minor in Latin American studies.

Within each major, students are required to choose a concentration relevant to their future career endeavors. The Anthropology-Geography major concentrations include cross-cultural studies and international development, environmental studies and sustainability, and human ecology. Sociology majors can choose a concentration in criminal justice, organizations, or social services.

The strength of our department lies in its focus on practical training, critical thinking, and "Learn by Doing" experiences. Students are trained in applied technical skills including GIS, remote sensing, research design, social data collection, and qualitative/quantitative methodology.

Alongside these skills, students are encouraged to critically investigate contemporary issues, asking hard questions about society, behavior, and the environment in an increasingly diverse and global world. Finally, students are required to bridge classroom learning with the real world through hands-on practical experience such as internships, service learning, study abroad, and senior projects.

### Undergraduate Programs

#### BS Anthropology and Geography

The Anthropology and Geography major provides students with the skills for understanding and examining patterns of human activity and resource utilization across space and time, as well as the interactions between humans and the natural environment. Interdisciplinary in nature, this program focuses on the applied areas of cross-cultural studies, international development, ecological research design and method, the evolution of humans, environmental assessment, and sustainability. Courses in Anthropology and Geography train students to examine human ecology from the ancient past to the modern present through courses in biological evolution, cultural adaptations, behavioral ecology, environmental impacts, and the ecology of human health and disease. In addition, students gain an understanding of the physical environment in which humans are placed, through courses in physical geography, resource management, biogeography, and climatology. Students are trained in relevant skills, including Geographic Information Systems, remote sensing, and quantitative methods.

Students interested in this major should be curious about the relationships between humans and the environment (including biology, behavior, climate and landscapes) from a broad hands-on perspective.

Our students typically have particular interest in study abroad and involvement in international opportunities.

The program offers a four-year curriculum leading to a BS degree that prepares students for careers in environmental and regional planning, cultural resources management, archaeology, international development, climatology, science education, international health research, and federal government work in behavioral analysis.

#### Internship or Study Abroad Requirement

As a means of promoting relevant job skills, hands-on learning, and field experience, majors are required to complete either an approved internship or study abroad program. Students who do an internship will receive a minimum of 4 units of credit (ANT 465 or GEOG 465). The department will assist students in identifying suitable internships. However, students are encouraged to explore options for themselves based on their interests. In place of an internship, students may choose to participate in a study abroad program. Four units of approved coursework taken while studying abroad will be substituted for the internship course.

### Concentrations

Students may select one of the following concentrations or the individualized course of study.

#### Cross-Cultural Studies and International Development

Provides students with the theoretical knowledge and applied skills necessary for the study and practice of inter-national development in cross-cultural settings. Students attain an in-depth knowledge of the social, political, economic, and ecological dimensions of international develop-ment and gain practical skills through research projects, international study, and applied internships. The concentration provides expertise and training for internationally-focused careers including public and private development institutions, the Peace Corps, the public health field, education, and numerous careers where cross-cultural under-standing is essential.

#### Environmental Studies and Sustainability

Provides students with an understanding of human environmental relationships, resource utilization, and the human impact on the Earth. Current environmental issues are explained and evaluated in a global and historical context. Students learn the importance of sustainable land use practices and techniques for their successful implementation. Applied and technical skills important to assessing the environment and promoting sustainability are emphasized.

#### Human Ecology

Students learn about the natural environment, human behavioral and cultural systems, and the complex interrelationships between the three. Major concepts and practice emphasize broad spatial and temporal perspectives. Students acquire knowledge and skills related to global and regional climate and physical geography, human evolution, cultural ecology, behavioral ecology, prehistoric and recent environmental change, indigenous cultures of the new world, methods for analyzing climate change and related human responses in the past and present.

### Teaching

With additional coursework as prescribed by the College of Education, students may pursue the Multiple Subject Credential (for elementary school teachers) or the Single Subject Credential (for secondary school social science teachers of anthropology, economics, geography, government, history, political science, psychology, or



sociology). This concentration prepares a candidate for Subtest I of the CSET Multiple subjects exam and strengthens a candidate's knowledge in all 16 History-Social Science Content Standards established by the California State Board of Education. For more information regarding teacher credential programs, please see the College of Education section.

### Other Concentration Options

With prior approval of the Social Sciences Department and the Political Science Department, students may select one of the following concentrations: Pre-Law, or Global Politics.

### Individualized Course of Study

One of the two opportunities to pursue a course of study which meets a student's individual needs and interests. As their course of study, students may pursue an academic minor or create a program, with faculty approval, based upon their interests and career goals. The coursework may be specifically tailored for a career in industry, education, government, or as preparation for graduate school.

## BA Sociology

Sociology explores the nature and dynamics of human society and the interrelationship between individuals and their social groups. The goal of sociological study at Cal Poly is twofold. The first objective is to develop a sociological imagination that enables students to see their personal circumstances and problems in context of the broader, local, national, and global forces that shape their lives. The second objective is to prepare students for graduate studies and careers in such fields as criminal justice, law, social services, complex organizations, and teaching. Sociology also offers general education courses that provide an understanding of the complexity and diversity of the world's peoples and their problems. Some courses focus on American society, emphasizing issues of class, race, ethnicity and gender. Other courses have a global orientation dealing with both the past and present diversity of the world's societies, economies, politics and religions.

### Internship Requirement

As a means of promoting relevant job skills, hands-on learning, and field experience, majors who select the criminal justice or social services concentrations are required to complete an approved internship. Majors who select the organizations concentration will be encouraged to complete an internship, but will not be required to do so. These internships in criminal justice or social services will be up to one year, but with a minimum of two quarters, and count for 8 to 12 units of credit (SOC 440). The department will assist students in identifying suitable internships. However, students are encouraged to explore options for themselves based upon their interests.

## Concentrations

Students are required to take one of the following concentrations or the individualized course of study.

### Criminal Justice

Prepares students for careers in law, law enforcement, corrections, detention, probation, parole and other criminal justice agencies.

### Organizations

Students learn to apply the general principles of human behavior to the understanding of modern organizations. It prepares them for careers in business, government or non-governmental organizations.

## Social Services

Provides the general principles of human social behavior and specialized professional courses to prepare for careers in the helping professions such as social work and counseling.

### Other Concentration Options

With prior approval of the Social Sciences Department and the Political Science Department, students may select one of the following concentrations: Pre-Law, or Global Politics.

### Individualized Course of Study

One of two opportunities to pursue a course of study which meets a student's individual needs and interests. As their course of study, students may pursue an academic minor or create a program, with faculty approval, based upon their interests and career goals. The course of study may be specifically tailored for a career in industry, education, government, or as preparation for graduate school. When creating an individual program, it should consist of 28 units, with 16 of the 28 at the 300-400 level. Courses are selected by the student in consultation with an advising faculty member. The student must also provide a written justification for the courses and the way they constitute a cohesive, integrated course of study. The list of courses is a contract between the student and the Department.

## Anthropology and Geography Minor

The minor develops broad spatial and cultural knowledge of our world. The program consists of foundation courses and directed electives that allow flexibility for students to tailor the program to meet their individual interests and goals. The objectives of the minor are to increase student awareness of the: (1) cultural and ecological diversity of the Earth's surface; (2) inter-relationships between peoples of varying cultures; (3) interactions of different cultures with their resource habitats and environmental alteration; and (4) methodologies and technologies used to evaluate cultures and environments. The goal is to instill a respect for cultural diversity and environmental sustainability. A minimum of 14 units must be upper division and taken at Cal Poly.

## Latin American Studies Minor

Latin America is a region of critical importance to the United States, and California in particular. Students gain an interdisciplinary understanding of Latin America, as well as its cultural, political, and economic connections to California and the United States. This knowledge is increasingly important for a number of careers. The minor also promotes critical thinking skills and enhances the appreciation of diversity as students confront issues relevant to Latin America and US-Latin American relations.

## Sociology Minor

The minor provides students with a broad understanding of contemporary society with a focus on the analysis of social change. The objectives of the program are to increase awareness of the: (1) nature of international social, economic and political structures and their consequences; (2) social results of emerging technology; (3) changes in family life, especially the role of women; and (4) changing ethnic mix in California and the United States and its implications. Coursework includes the study of the shifting demographic patterns in society, emerging life styles, the increase in the percentage of elderly in the population, and the nature of specific subculture influences.

# BS Anthropology and Geography

## Program Learning Objectives

1. Understand and appreciate the cultural and physical attributes of major world regions, key regional issues and linkages between regions, the processes that shape cultural change and interaction, and international development issues.
2. Demonstrate an in-depth knowledge of human ecology with specific emphasis on the ecological, demographic, genetic, developmental, and epidemiological dimensions of modern human adaptations and their evolutionary foundations over time and space.
3. Comprehend the historical place of humans around the globe and apply acquired skills for cultural resource management and conservation.
4. Analyze the processes that shape the earth's physical environment (e.g. climate, landforms, water, soils, biota, and ecosystems), the distributions of natural resources, and the ways in which humans utilize natural resources and impact the environment with an emphasis on sustainability.
5. Apply scientific research methodology and design, including the ability to collect, synthesize, and interpret qualitative and quantitative cultural and ecological data using a variety of methods including the utilization of geospatial technologies (GIS, remote sensing, and GPS).
6. Critically analyze issues from multiple perspectives and communicate results effectively.
7. Synthesize information and utilize acquired skills locally and globally to improve the state of the environment and the human condition by applying cultural, ecological, and spatial knowledge, methods, and techniques.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

ANT 201	Cultural Anthropology (D3) <sup>1</sup>	4
ANT 202	World Prehistory	4
ANT 250	Biological Anthropology (B2) <sup>1</sup>	4
ANT 360	Human Cultural Adaptations	4
GEOG 150	Introduction to Cultural Geography	4
GEOG 250	Physical Geography	4
GEOG 308	Global Geography	4

GEOG 318	Applications in GIS	4
GEOG 333	Human Impact on the Earth	4
ANT/GEOG 455	Anthropology-Geography Research Design and Methods	4
ANT 464	Professional Preparation for Anthropologists/Geographers	1
or GEOG 464	Professional Preparation for Anthropologists/Geographers	
ANT 465	Internship <sup>2</sup>	3
or GEOG 465	Internship	
<b>Methodological Elective</b>		
Select from the following:		4
ANT 310	Archeological Field Methods	
ANT 311	Archaeological Laboratory Methods	
GEOG 328	Applications in Remote Sensing	
GEOG 440	Advanced-Applications in GIS	
<b>Regional Geography Elective</b>		
Select from the following:		4
GEOG 300	Geography of United States	
GEOG 340	Geography of California	
GEOG 370	Geography of Latin America	
<b>ANT Electives</b>		
Select from the 300-400 level		8
<b>GEOG Elective</b>		
Select from the 300-400 level		4
<b>Concentration or individualized course of study</b>		
(at least 16 units 300-400 level)		28
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
Select from the following:		4
ANT 461	Senior Project I	
& ANT 462	and Senior Project II	
GEOG 461	Senior Project I	
& GEOG 462	and Senior Project II	
<b>GENERAL EDUCATION (GE)</b>		
(See the GE program requirements below.)		60
<b>FREE ELECTIVES</b>		
Electives		20
Total units		180

<sup>1</sup> Satisfies General Education requirement

<sup>2</sup> Or approved study abroad course

## Concentrations

Students may select one of the following concentrations or the individualized course of study.

- Cross-Cultural Studies and International Development (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/socialsciences/bsanthropologyandgeography/crossculturalstudiesandinternationaldevelopmentconcentration>)
- Environmental Studies and Sustainability (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/>)

collegeofliberalarts/socialsciences/bsanthropologyandgeography/  
environmentalstudiesandsustainabilityconcentration)

- Human Ecology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/socialsciences/bsanthropologyandgeography/humanecologyconcentration>)
- Teaching (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/socialsciences/bsanthropologyandgeography/teachingconcentration>)

### Individualized Course of Study

When creating an individual program, it should consist of 28 units, with 16 of the 28 at the 300-400 level. Courses are selected by the student in consultation with an advising faculty member. The student must also provide a written justification for the courses and the way they constitute a cohesive, integrated course of study. The list of courses is a contract between the student and the Department.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (4 units in Major plus 4 units in GE) <sup>1</sup>	4
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions (4 units in Major) <sup>1</sup>	0
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (Not ANT or GEOG courses)	4
Area F	Technology	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Satisfies General Education requirement

## Cross Cultural Studies and International Development Concentration

GEOG 408	Geography of Development	4
SOC 309	The World System and Its Problems	4
ANT 401	Culture and Health	4
ANT 402	Nutritional Anthropology	4

### Problems and Issues Courses

Select from the following:		12
ANT 320	California's Native Past	
ANT 325	Pre-Columbian Mesoamerica	
ANT 330	Indigenous South Americans	
ANT 344	Sex, Death, and Human Nature	
ANT 425	Meaning, Gender, and Identity in Anthropological Theory	
BUS 302	International and Cross Cultural Management	
CRP 334	Cities in a Global World (D5)	
GEOG 301	Geography of Resource Utilization	
GEOG 370	Geography of Latin America	
GEOG 440	Advanced-Applications in GIS	
HIST 314	Middle East	
HIST 417	20th Century China	
or HIST 316	Modern East Asia	
HIST 430	Modern African History	
HUM 310	Humanities in World Cultures (C4)	
POLS 325	Global Political Issues (D5)	
or POLS 328	Politics of Developing Areas	
POLS 333	World Food Systems (Area F)	
WGS 320	Women in Global Perspective (D5)	
Foreign Language (201) or credit for a comparable level of proficiency (4 units max)		

Total units 28

## Environmental Studies and Sustainability Concentration

GEOG 301	Geography of Resource Utilization	4
GEOG 325	Climate and Humanity	4
GEOG 328	Applications in Remote Sensing	4
GEOG 414	Global and Regional Climatology	4

### Specialized electives

Select from the following:		8
BIO 114	Plant Diversity and Ecology (B2&B4)	
ERSC 202	Soil Erosion and Water Conservation	
ERSC 223	Rocks and Minerals	
ERSC 323	Geomorphology	
GEOG 415	Applied Meteorology and Climatology	
GEOL 201	Physical Geology	
GEOL 203	Fossils and the History of Life (B5)	
GEOL 204	Geologic History of California	

GEOL 205	Earthquakes (B3)
LA 221	California Plants and Plant Communities
PSC 201	Physical Oceanography (B5)
SS 121	Introductory Soil Science (B5)

**Approved Electives**

Select from the following:	4
AG 360	Holistic Management (F)
ANT 312	Introduction to Cultural Resources Management
BIO 112	Environmental Biology and Conservation (B5)
BIO 227	Wildlife Conservation Biology (B2)
BRAE 348	Energy for a Sustainable Society (F)
CRP 336	Introduction to Environmental Planning
EDES 406	Sustainable Environments
ENVE 330	Environmental Quality Control
ES/NR 308	Fire and Society (D5)
PSC 320	Energy, Society and the Environment (F)

Total units 28

## Human Ecology Concentration

ANT 345	Human Behavioral Ecology	4
ANT 401	Culture and Health	4
GEOG 325	Climate and Humanity	4

**Applications and Issues Courses**

Select from the following:	16
ANT 309	Elements of Archaeology
ANT 310	Archeological Field Methods
ANT 311	Archaeological Laboratory Methods
ANT 312	Introduction to Cultural Resources Management
ANT 320	California's Native Past
ANT 325	Pre-Columbian Mesoamerica
ANT 330	Indigenous South Americans
ANT 344	Sex, Death, and Human Nature
ANT 402	Nutritional Anthropology
ANT 415	Native American Cultures (USCP)
ANT 425	Meaning, Gender, and Identity in Anthropological Theory
GEOG 301	Geography of Resource Utilization
GEOG 340	Geography of California
GEOG 370	Geography of Latin America
GEOG 408	Geography of Development
GEOG 414	Global and Regional Climatology
GEOG 415	Applied Meteorology and Climatology
GEOG 440	Advanced-Applications in GIS

Total units 28

## Teaching Concentration

EDUC 300	Historical, Philosophical, and Social Foundations of Public Education	3
ANT 400	Special Problems for Advanced Undergraduates	1
or GEOG 400	Special Problems for Advanced Undergraduates	
Select from the following:		8

Last updated: 04/22/15

GEOG 300	Geography of United States
GEOG 340	Geography of California
GEOG 370	Geography of Latin America

Select from the following: 4

PSY 306	Adolescence
SOC 306	Sociology of the Family
SOC 316	American Ethnic Minorities (USCP)
SOC 406	Juvenile Delinquency

**Approved Electives**

Select from the following: 12

ANT 330	Indigenous South Americans
ANT 415	Native American Cultures (USCP)
ECON 304	Comparative Economic Systems
HIST 320	Colonial and Revolutionary America
HIST 321	Civil War America
HIST 322	Modern America
POLS 343	Civil Rights in America (USCP)

Total units 28

## BA Sociology

### Program Learning Objectives

1. Achieve an international/global perspective of societies
2. Develop an understanding of the problems of the U.S. as a pluralistic society
3. Learn to apply a holistic/integrated approach to social problems
4. Develop data collection skills and techniques used by modern sociology
5. Be prepared to enter careers which use the skills and knowledge of sociology
6. Demonstrate critical thinking concerning global issues
7. Demonstrate the writing skills necessary to communicate effectively

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

**MAJOR COURSES**

SOC 110	Comparative Societies (D3) <sup>1</sup>	4
SOC 111	Social Problems	4
SOC 218	International Political Economy (D2) <sup>1</sup>	4
SOC/WGS 311	Sociology of Gender	4
SOC 315	Global Race and Ethnic Relations	4

SOC 316	American Ethnic Minorities (USCP)	4
SOC 323	Social Stratification	4
SOC 354	Qualitative Research Methods	4
SOC 355	Quantitative Research Methods	4
SOC 421	Social Theory	4
SOC 461	Senior Project I	2
SOC 462	Senior Project II	2
Sociology electives (300-400 level)		12
STAT 217	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup>	4
GEOG 150	Introduction to Cultural Geography	4
ANT 201	Cultural Anthropology	4
Concentration or individualized course of study (see list below)		28
<b>GENERAL EDUCATION (GE)</b>		
(See the GE program requirements below.)		60
<b>FREE ELECTIVES</b>		
Free Electives		24
Total units		180

<sup>1</sup> Satisfies General Education requirement

## Concentration or Individualized Course of Study

Students are required to take one of the following concentrations or the individualized course of study.

- Criminal Justice (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/socialsciences/basociology/criminaljusticeconcentration>)
- Organizations (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/socialsciences/basociology/organizationsconcentration>)
- Social Services (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/socialsciences/basociology/socialservicesconcentration>)

### Individualized Course of Study

300-400 level courses selected in consultation with advising faculty. A written justification for the courses selected and the way they constitute a cohesive, integrated study is required. One-half of the units must be courses from the department.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (4 units in Major plus 4 units in GE) <sup>1</sup>	4
B2	Life Science	4

B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy (4 units in Major) <sup>1</sup>	0
D3	Comparative Social Institutions (4 units in Major) <sup>1</sup>	0
D4	Self Development (CSU Area E)	4
D5	Upper-division elective (no SOC course)	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Satisfies General Education requirement

## Criminal Justice Concentration

SOC 402	Crime and Violence	4
SOC 406	Juvenile Delinquency	4
SOC 412	Criminal Justice	4
SOC 440	Internship	8

### Applications and Issues Courses

Select from the following: 8

POLS 245	Judicial Process	
POLS 344	Civil Liberties	
POLS 351	Public Administration	
PSY 352	Conflict Resolution: Violent and Nonviolent	
PSY 375	Forensic Psychology	
PSY 460	Child Abuse and Neglect	
SOC 301	Social Work and Social Welfare Institutions	
SOC 395	Sociology of Complex Organizations	
SOC 413	Methods of Social Work	
SOC 440	Internship	
(internship units not to exceed 12 in concentration)		
Total units		28

## Organizations Concentration

Select from the following: 20

SOC 310	Self, Organizations and Society	
SOC 350	Social Organization of Modern Japan	
SOC 395	Sociology of Complex Organizations	
SOC 440	Internship (maximum 8 units)	
BUS 382	Organizations, People, and Technology	
BUS 384	Human Resources Management	
BUS 387	Organizational Behavior	



or PSY 302 Behavior in Organizations

### Approved Electives <sup>1</sup>

Select from the following: 8

BUS 207	Legal Responsibilities of Business
BUS 404	Governmental and Social Influences on Business
BUS 407	Managing People in Global Markets
BUS 472	Labor Relations
BUS 473	Employment Law
BUS 478	Organization Design
POLS 351	Public Administration
SOC 412	Criminal Justice
SOC 440	Internship <sup>2</sup>

Total units 28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>2</sup> Internship units not to exceed 8 in concentration.

## Social Services Concentration

SOC 301	Social Work and Social Welfare Institutions	4
SOC 413	Methods of Social Work	4
SOC 440	Internship	8

### Approved Electives <sup>1</sup>

Select from the following: 12

ES 340	Cultural Production and Ethnicity
ES/WGS 350	Gender, Race, Science and Technology
POLS 310	Politics of Ethnicity and Gender
POLS 343	Civil Rights in America
POLS 419	Social Movements and Political Protest
POLS 459	The Politics of Poverty
POLS 471	Urban Politics
POLS/UNIV 333	World Food Systems
PSY 310	Psychology of Death
PSY 318	Psychology of Aging
PSY 330	Behavioral Effects of Psychoactive Drugs
PSY/CD 306	Adolescence
SOC 306	Sociology of the Family
SOC 309	The World System and Its Problems
SOC 310	Self, Organizations and Society
SOC 402	Crime and Violence
SOC 406	Juvenile Delinquency
SOC 412	Criminal Justice
WGS 301	Contemporary Issues in Women's and Gender Studies
WGS 401	Seminar in Women's and Gender Studies
WGS/RELS 370	Religion, Gender, and Society

Total units 28

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Anthropology and Geography Minor

### Required Courses

ANT 250	Biological Anthropology (B2)	4
GEOG 250	Physical Geography	4

Select from the following: 4

ANT 201	Cultural Anthropology (D3)
ANT 202	World Prehistory (D3)
GEOG 150	Introduction to Cultural Geography (D3)

### Ecological Courses

Select from the following: 4

ANT 360	Human Cultural Adaptations (D5)
GEOG 301	Geography of Resource Utilization (D5)
GEOG 325	Climate and Humanity
GEOG 333	Human Impact on the Earth

### Global and Regional Courses

Select from the following: 4

ANT 320	California's Native Past
ANT 325	Pre-Columbian Mesoamerica (D5)
ANT 330	Indigenous South Americans (D5)
ANT 415	Native American Cultures (USCP)
GEOG 300	Geography of United States (D5)
GEOG 308	Global Geography (D5)
GEOG 340	Geography of California
GEOG 370	Geography of Latin America (D5)

### Special Topics

Select from the following: 4

ANT 309	Elements of Archaeology
ANT 310	Archeological Field Methods
ANT 311	Archaeological Laboratory Methods
ANT 344	Sex, Death, and Human Nature (D5)
ANT 345	Human Behavioral Ecology (D5)
ANT 401	Culture and Health
GEOG 414	Global and Regional Climatology
GEOG 415	Applied Meteorology and Climatology

### Technical Skills

Select from the following: 4

GEOG 318	Applications in GIS
GEOG 328	Applications in Remote Sensing
GEOG 440	Advanced-Applications in GIS

Total units 28

## Latin American Studies Minor

### Required Courses

GEOG 370	Geography of Latin America (D5)	4
SPAN 201	Intermediate Spanish I	4

Select from the following: 4

ES 243	Survey of Latino/a Studies (D3)	
ES 323	Mexican American Cultural Images (D5) (USCP)	
SPAN 233	Introduction to Hispanic Readings (C1)	
Select from the following:		4
ANT 325	Pre-Columbian Mesoamerica (D5)	
ANT 330	Indigenous South Americans (D5)	
HIST 340	Modern Latin America	
HUM 310	Humanities in World Cultures (subtitles: Culture of Latin America or Mexico) (C4)	
HUM 315	Critical Issues in Latin American Studies (D5)	
POLS 328	Politics of Developing Areas (Latin America topic only)	
<b>Approved Electives</b>		
Electives <sup>1</sup>		8
Total units		24

<sup>1</sup> A minimum of 4 units must be 300-400 level.

## Sociology Minor

<b>Required Courses</b>		
SOC 110	Comparative Societies (D3)	4
SOC 111	Social Problems	4
SOC 309	The World System and Its Problems	4
Select from the following:		4
SOC 315	Global Race and Ethnic Relations (D5)	
SOC 316	American Ethnic Minorities (USCP)	
SOC 323	Social Stratification	4
<b>Approved Electives</b>		
Electives		8
(At least 4 units at 300-400 level)		
Total units		28

## Theatre & Dance

Davidson Music Center (45), Room 104

Phone: 805.756.1465

<http://cla.calpoly.edu/thtrdanc.html>

Department Chair: Josh Machamer

### Academic Programs

Program name	Program type
Theatre Arts	BA, Minor
Dance	Minor

The courses offered by the Theatre and Dance Department provide students with well-balanced programs of study, integrating practical production work with classes that examine the principles, theoretical aspects, and historical development of theatre and dance.

A full range of studio dance courses are offered. They include ballet, modern, jazz, ballroom, and folk. Composition and dance production are available, as well as courses designed for future elementary and secondary teachers of dance. The department also provides general education and breadth courses in the areas of dance history and dance appreciation.

The department also acts as a cultural focus for the campus and community. An annual dance concert is presented under the auspices of the Orchestis Dance Company. Every spring a student-directed dance concert is also produced. Each quarter the department presents three main-stage theatre productions. Recent performances include: *A Streetcar Named Desire*, *Smash*, *Falsettos*, *Antigone* and *Letters to Soldiers Lost*, *The Bald Soprano*, *Julius Caesar*, *The Phantom Tollbooth*, *Blood Wedding (Bodas de sangre)*, *The Arabian Nights*, *Animal Farm*, and *The Beauty Queen of Leenane*. The department also produces original works; sponsors guest lecturers and specialized workshops; and manages a program of student-directed works, field trips, and internships.

## Undergraduate Programs

### BA Theatre Arts

Students who major in theatre study dramatic literature, technical theatre, design, playwriting, acting, and directing. Participation in main-stage productions, as actors and members of the production staff, is a major aspect of each student's training. In addition, the department offers general education courses in introductory theatre, theatre history and literature, and specialized study of theatre such as Women's Theatre, Theatre in the United States, Global Theatre and Performance and Topics in Diversity on the American Stage.

### Dance Minor

The Dance Minor consists of 30 units designed to provide the student with a well-balanced program in the art and education of dance.

Admission to the minor is contingent upon a departmental interview and review. Students must have more than a 2.0 GPA.

### Theatre Minor

The Theatre Minor is designed to provide the student with a sound foundation in the major aspects of theatre. This program assures each student of a balanced program in the major areas of theatre, and it

allows for a degree of specialization in an area of the student's choice. Students should discuss their interests with department faculty.

Admission to the minor is contingent upon a departmental interview and review. Students must have more than a 2.0 GPA.

## BA Theatre Arts

### Program Learning Objectives

1. Students will develop a fundamental knowledge of theatrical history as well as dramatic literature;
2. Students will acquire skills necessary to do script analysis;
3. Students will develop a theoretical foundation to both production and performance;
4. Students will be exposed to a variety of theatrical skills, then provided with opportunities to apply this knowledge in practical terms;
5. Students will practice values and ethics that foster a creative environment where theatrical activity can flourish;
6. Students will develop written proficiency in a wide variety of assignments.

### Program Learning Outcomes

1. Understand the conventions, innovations, principles and prominent practitioners of the primary periods of theatrical history, including western and non-western forms;
2. Recognize and demonstrate knowledge of a significant number of plays that are representative of key theatrical periods;
3. Articulate the basic principles of the major genres of dramatic literature;
4. Understand the political and social context in which theatre has occurred;
5. Analyze a play from a design perspective, creating an environment that captures the theme and spirit of a play;
6. Analyze a play from a directorial point of view, being able to articulate the structure, construct a character analysis for each role, formulate movement, and craft interaction that illuminates the theme and spirit of a play;
7. Analyze a play from a dramaturgical perspective, understanding the historical context and social conventions in which the play was written or is set;
8. Apply scholarly research to the process of design, playwriting, directing, and creating a character;
9. Be able to create and communicate concepts using appropriate visual means and with vocal clarity;
10. Understand and apply the principles and process involved in creating a design;
11. Understand and apply the principles and process in directing a play;
12. Understand and apply the principles and process in writing a play;
13. Understand and apply the principles and process in the creation and portrayal of a character;
14. Develop vocal, physical, and imaginative skills in order to express their ideas and vision;
15. Understand and apply construction techniques used in building and painting scenery or construction costumes;

- 16.Utilize scene or costume shop machinery in a safe and appropriate manner;
- 17.Understand the role of the stage manager, publicist, producer, house manager and box office manager;
- 18.Develop an understanding of diverse and non-traditional theatrical conventions and viewpoints;
- 19.Practice discipline, develop strong time management skills, and display commitment to process;
- 20.Work in a respectful, collaborative environment;
- 21.Understand the research process and write research reports;
- 22.Critically analyze theatre performance through written reviews;
- 23.Write a one-act play;
- 24.Write coherent, persuasive critical analysis essays in a variety of topics drawn from history, literature, and theory.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism

Note: No major or support courses may be taken as credit/no credit.

### MAJOR COURSES

TH 210	Introduction to Theatre (C3) <sup>1</sup>	4
TH 220	Acting Methods	4
TH 227	Theatre History I	4
TH 228	Theatre History II	4
TH 230	Stagecraft I	4
TH 250	Costume Construction	4
TH 260	Voice and Diction for the Stage	4
or TH 280	Body Awareness and Expression	
TH 290	Script Analysis	4
TH 295	Foundations in Theatrical Design	4
TH 300	Topics in Diversity on the American Stage (USCP)	4
or TH 310	Women's Theatre	
or TH 320	Black Theatre	
TH 330	Stagecraft II	4
TH 350	Seminar in Playwriting	4
TH 430	Scenic Design	4
or TH 432	Costume Design	
TH 450	Directing	4
TH 461	Senior Project Seminar	4
Select from the following:		8
TH 240	Improvisational Theatre	
TH 250	Costume Construction	
TH 260	Voice and Diction for the Stage	
TH 270	Stage Make-Up	

TH 280	Body Awareness and Expression	
Select from the following:		4
TH 300	Topics in Diversity on the American Stage	
TH 310	Women's Theatre	
TH 320	Black Theatre	
TH 341	Advanced Acting Studio	
TH 360	Theatre in the United States	
TH 370	Costume History	
TH 380	Children's Drama	
TH 390	Global Theatre and Performance	
TH 470	Selected Advanced Topics	
TH 471	Selected Advanced Laboratory	
Select from the following:		4
TH 330	Stagecraft II	
TH 345	Rehearsal and Performance	
TH 400	Special Problems for Advanced Undergraduates	
TH 430	Scenic Design	
TH 432	Costume Design	
TH 434	Lighting Design	
TH 480	Internship	

### SUPPORT COURSES

ENGL 339	Introduction to Shakespeare (C4) <sup>1</sup>	4
Select from the following:		4
ARCH 217	History of World Architecture: Prehistory - Middle Ages	
ARCH 218	History of World Architecture: Middle Ages - 18th Century	
ARCH 219	History of World Architecture: 18th Century - Present	
ART 101	The Fundamentals of Drawing	
ART 111	Introduction to Art	
ART 112	Survey of Western Art	
MU 154	Beginning Voice	
MU 181	Polyphonics	
MU 185	University Singers	
MU 187	Vocal Jazz Ensemble	
MU 188	Arab Music Ensemble	
Select from the following:		4
ENGL 352	Modern Drama	
ENGL 370	World Cinema	
ENGL 389	Creative Writing: Drama	
ENGL 431	Shakespeare	
LS 310	Storytelling: Modern Applications of Traditional Narrative	
MU 324	Music and Society	
MU 325	America's Music	
MU 381	Polyphonics	
MU 385	University Singers	
MU 387	Vocal Jazz Ensemble	
MU 388	Arab Music Ensemble	

### GENERAL EDUCATION (GE)

(See the list GE requirements below.)

64

### FREE ELECTIVES

Electives (At least 12 units must be upper division)	28
Total units	180

<sup>1</sup> Required in Major; also satisfies GE

## General Education (GE) Requirements

- 72 units required, 8 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics	8
B2	Life Science	4
B3	Physical Science	4
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5)	4
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts (4 units in Major) <sup>1</sup>	0
C4	Upper-division elective (4 units in Support) <sup>1</sup>	0
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		64

<sup>1</sup> Required in Major; also satisfies GE

## Dance Minor

### Required Courses

DANC 134	Beginning Ballroom Dance <sup>1</sup>	2
or DANC 130	Pilates/Physicalmind Conditioning Methods	
or DANC 234	Intermediate Ballroom Dance	
DANC 221	Dance Appreciation (C3)	4
DANC 231	Intermediate Ballet	2
DANC 232	Intermediate Modern Dance	2
DANC 321	Cultural Influence on Dance in America (C4) (USCP)	4
DANC 340	Dance Composition	4
DANC 381	Dance for KINE/Dance Minors	4

### Electives

Select from the following:		8
(at least 3 elective units must be upper division)		
DANC 130	Pilates/Physicalmind Conditioning Methods	
DANC 135	International Folk Dance	
DANC 139	Beginning Tap	
DANC 233	Intermediate Jazz Dance	
DANC 234	Intermediate Ballroom Dance	
DANC/TH 280	Body Awareness and Expression	
DANC 311	Dance in American Musical Theatre (C4)	
DANC 331	Advanced Ballet and Repertory	
DANC 332	Modern Dance Repertory	
DANC 345	Choreography/Workshop in Dance Concert Preparation	
DANC 346	Dance Production	
DANC 400	Special Problems	
DANC 470	Selected Advanced Topics	
DANC 471	Selected Advanced Laboratory	
Total units		30

<sup>1</sup> If credit in any of these courses is used to meet a core requirement in the minor, the credit cannot be double-counted as an elective.

## Theatre Minor

### Required Courses

TH 210	Introduction to Theatre (C3)	4
TH 230	Stagecraft I	4
TH 300	Topics in Diversity on the American Stage	4
or TH 310	Women's Theatre	
or TH 320	Black Theatre	

### Theatre Electives (lower division):

Select lower division electives	4
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### Theatre Electives (upper division):

Select upper division electives	12
Total units	28



## Women's and Gender Studies

Faculty Office Building (Bldg. 47), Room 25H  
Phone: 805.756.1525

Department Chair: Jane Lehr

### Academic Program

Program name	Program type
Women's and Gender Studies	Minor

The program embraces the intellectual perspectives of faculty and students across the spectrum of Cal Poly's majors and colleges.

The Minor is housed within the College of Liberal Arts, and its courses are offered by the departments of Art and Design, Communication Studies, English, Ethnic Studies, History, Kinesiology, Music, Philosophy, Political Science, Psychology and Child Development, Social Sciences, Theatre and Dance, and Women's and Gender Studies.

### Undergraduate Program

#### Women's and Gender Studies Minor

The Women's and Gender Studies Minor provides a thorough, interdisciplinary background in feminist thought and theory. Required and elective courses interrogate the history and evolution of ideas about gender and sexual identity, and engage with these issues on multiple levels of inquiry. The minor encourages active student learning and emphasizes sophisticated analysis of how gender and sexuality, as well as race, ethnicity and class (and other markers of identity) shape women's and men's lives.

## Women's and Gender Studies Minor

#### Required Courses

WGS 201	Introduction to Women's and Gender Studies in the United States (D1) (USCP)	4
WGS 450	Feminist Theory (USCP)	4
Select from the following:		12
WGS 301	Contemporary Issues in Women's and Gender Studies (D5) (USCP)	
WGS/SOC 311	Sociology of Gender	
WGS 320	Women in Global Perspective (D5)	
WGS/PSY 324	Psychology of Gender	
WGS 340	Sexuality Studies (D5)	
WGS/ES 350	Gender, Race, Science and Technology (Area F) (USCP)	
WGS/RELS 370	Religion, Gender, and Society (C4) (USCP)	
WGS 401	Seminar in Women's and Gender Studies	
WGS/HIST 435	American Women's History from 1870 (USCP)	

#### Approved Electives

Select from the following: 4

ANT 425	Meaning, Gender, and Identity in Anthropological Theory
COMS 421	Gender and Communication
ENGL 345	Women Writers of the Twentieth Century (C4) (USCP)
ENGL 349	Gender in Twentieth Century Literature (C4) (USCP)
ENGL 382	LGBT Literature and Media
ENGL 469	Women's Rhetoric(s): Definitions, Contexts, Issues
ENGL topics courses <sup>2</sup>	
ES 300	Chicano/a Non-Fiction Literature (C4)(USCP)
ES 325	Sex and Gender in African American Communities (USCP)
HIST 421	The History of Prostitution
HIST 458	Gender and Sexuality in Modern Europe
KINE 323	Sport and Gender (D5) (USCP)
MU 328	Women in Music (C4)
PHIL 336	Feminist Ethics, Gender and Society (C4) (USCP)
POLS 310	Politics of Ethnicity and Gender (USCP)
PSY 303	Intergroup Dialogues
TH 300	Topics in Diversity on the American Stage (USCP)
TH 310	Women's Theatre (C4)
WGS 301	Contemporary Issues in Women's and Gender Studies (D5) (USCP)
WGS/SOC 311	Sociology of Gender
WGS/ART 316	Women as Subject and Object in Art History
WGS 320	Women in Global Perspective (D5)
WGS 324	Psychology of Gender
WGS 340	Sexuality Studies (D5)
WGS/ES 350	Gender, Race, Science and Technology (Area F) (USCP)
WGS/ES 351	Global Engineering: Gender, Race, Class, Nation
WGS/RELS 370	Religion, Gender, and Society (C4) (USCP)
WGS 400	Special Problems for Advanced Undergraduates
WGS 401	Seminar in Women's and Gender Studies
WGS/HIST 434	American Women's History to 1870
WGS/HIST 435	American Women's History from 1870 (USCP)
WGS 467	Women's and Gender Studies Internship
WGS 470	Selected Advanced Topics

Total units 24

<sup>1</sup> Select from the approved list of elective courses in consultation with their Women's and Gender Studies faculty advisor.

<sup>2</sup> See a Women's and Gender Studies advisor for approval of specific topics. Topics courses include: ENGL 439, ENGL 449, ENGL 459, ENGL 495.

## College of Science & Mathematics

Faculty Offices East (25), Room 229  
Phone: 805.756.2226

Dean: Philip S. Bailey  
Associate Dean: Dean E. Wendt

### Academic Programs

Program name	Program type
Actuarial Preparation	Minor
Astronomy	Minor
Biochemistry	BS
Biological Sciences	BS, MA, MS
Biology	Minor
Biotechnology	Minor
Chemistry	BS
Environmental Studies	Minor
Geology	Minor
Kinesiology	BS, MS
Liberal Studies	BS
Mathematics	BS, MS, Minor
Microbiology	BS, Minor
Physics	BA, BS, Minor
Polymers and Coatings Science	MS
Statistics	BS, Minor

### School of Education Programs

Program name	Program type
Administrative Services	Credential
Agriculture Specialist	Teaching Credential
Education	MA
Special Education (Education Specialist - Mild/Moderate Disabilities)	Credential
Multiple Subject	Teaching Credential
Single Subject	Teaching Credential

See the School of Education (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation>) section for further information.

### Mission

The mission of the College of Science and Mathematics is to facilitate learning, understanding, and appreciation of science and mathematics as a basis for creative endeavors, intellectual pursuits, careers, and critical consideration of issues confronting society. The College has two equally important roles: (1) to provide specialized coursework for students enrolled in the College's undergraduate, graduate and minor programs, and (2) to provide support and breadth courses in science and mathematics for all students of the university. Cal Poly is a national leader in preparing college students for careers in science, technology, engineering, and mathematics (STEM) professions, including science and mathematics teaching careers.

The College of Science and Mathematics has a tradition and reputation for excellence in teaching and is dedicated to both undergraduate and graduate instruction. The College provides a student-centered learning environment consistent with the University's "learn by doing" philosophy. In laboratories, students have access to modern instrumentation and computer technology. Classroom instruction is done in relatively small classes so that a personal approach by instructors is possible. Because of the College's large role in offering support courses to the rest of the university community, the number of faculty in each department is relatively large and favors student-faculty interaction, both inside and outside of the classroom.

### School of Education

The School of Education prepares students to be effective, ethical and informed teachers, counselors and administrators, who have a particular expertise relative to current state and national needs in their respective fields through an inquiry-focused clinical approach. The School of Education offers a range of programs: multiple subject and single subject teaching credentials; agriculture specialist credential; integrated credential and M.A. in Education with specializations in special education and educational leadership and administration; and M.A. in Education with specialization in counseling and guidance. Single subject credential programs are offered in Agriculture, English, Biology, Chemistry, Mathematics, Physics and Social Science.

To prepare students in these fields, faculty from agriculture, science, mathematics, and the liberal arts work collaboratively with faculty in the School of Education to provide outstanding programs that maintain a balance of coursework in subject matter, foundations of education, and pedagogy, integrated with field experiences for applied practice. In the Liberal Studies Program, students can pursue a pre-professional program that leads to a B.S. degree and includes preparation toward a multiple subject credential to teach in elementary school. Cal Poly takes pride in producing school teachers and leaders through a balanced curriculum. More information on the programs offered can be found in the School of Education (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation>) section of this catalog.

### CESaME

The University Center for Excellence in Science and Mathematics Education (CESaME) was created to focus Cal Poly on preschool through college (P-16) STEM education in order to improve the STEM education and workforce pipeline and to enhance the scientific and technological literacy of our citizens. As an interdisciplinary, university-wide endeavor, CESaME fosters collaborations among students, staff and faculty from across campus and nurtures partnerships with preschool through high school (P-12) teachers and community college faculty as well as business, industry, government and foundations in support of improving STEM learning and teacher education.

CESaME leads the state in the development and implementation of model programs in teacher education and professional development, such as the Science Teacher and Researcher (STAR) program that provides summer research internships for aspiring and early career science and mathematics teachers from any CSU campus. CESaME is responsible for Cal Poly's Math and Science Teacher Initiative and fosters other programs such as Cal Poly's Noyce Scholarship program, the Learn By Doing Laboratory (a local P-16 STEM initiative) and various professional development programs for local science and mathematics teachers.

## Student Services

The College Office acts on various student-initiated petitions (change of major, curriculum substitutions, withdrawal from the university). In addition, the office has the dual function of counseling those on academic probation and notifying those undergraduate students who are eligible each quarter for the Dean's Honor List.

## Faculty Advising

Faculty members take an active role in academic and career advising. Students are encouraged to obtain academic advising prior to registration each quarter. The advisor-student relationship becomes important especially when the student needs a letter of reference for a potential employer or graduate school or needs career advice.

## College of Science and Mathematics Advising Center

Science North (Bldg. 53), Room 211  
Phone: 805.756.2615  
<http://www.csmadvising.calpoly.edu>

Director/Advisor: Kristi Weddige  
Advisor: Meghan Farrier-Nolan  
Administrative Coordinator: Rebecca Westmoreland

The College of Science and Mathematics Advising Center provides academic advising services to students within the college. Professional advisors take a holistic approach to advising by helping students to define academic, career and personal goals, and empowering them to create an educational plan that is consistent with these goals. Services include assistance with developing long-range academic plans, interpreting university and college policy and procedures, articulation agreements, scheduling classes, and informing students of their graduation requirements. In addition, the Advising Center provides academic coaching for students experiencing academic difficulty. Students are encouraged to seek advice early and often throughout their time at Cal Poly.

## Applying to Graduate School

College of Science and Mathematics faculty have earned advanced degrees from a wide variety of universities and are excellent sources for information and advice about graduate programs, prerequisites and application procedures. Applications to graduate programs should be made in the fall for admission to the following fall term. The Graduate Record Exam (GRE) should be taken early in the application cycle. Generally, two or more letters of reference from faculty are required. Most Ph.D. granting institutions offer financial support in the form of teaching assistantships and research fellowships.

## Actuarial Preparation Minor

Actuaries are professional risk managers that assess the likelihood and impact of future, uncertain events. They use their quantitative skills to prepare businesses for the financial impact of the risk to which they are exposed. Actuaries must meet rigorous standards for admission to professional societies. To be called an actuary in the United States, one must become an Associate or Fellow of the Society of Actuaries (SOA) or the Casualty Actuarial Society (CAS).

The Actuarial Preparation Minor provides education in probability, financial mathematics, and mathematical statistics. The coursework will satisfy the Validation by Educational Experience (VEE)

requirements of the SOA and CAS, and will help students prepare for the actuarial exams, which are also prerequisite to SOA or CAS membership.

The minor is open to any major, but it is especially suited to students in statistics, mathematics, and business/finance. Students interested in the minor should consult the website <http://statistics.calpoly.edu/content/actuary>.

Additional information about the actuarial profession, societies, and exams, as well as additional suggested coursework, is available at the website above.

## Biotechnology Minor

Biotechnology is one of the most important areas of growth in the biomedical sciences and has transformed medicine, chemical manufacturing, and agriculture over the last 20 years. Cal Poly's Biotechnology minor is designed to give undergraduate students a grounding in the sciences that underlie biotechnology; in addition, students are given practical experience in biotechnology lab work.

Students completing the Biotechnology minor take a core of required courses and approved elective courses focusing on biotechnology. The Biotechnology Minor Form is available from the Dean's Office or the Advising Center in the College of Science and Mathematics. Final approval of the minor is by one of the Minor Coordinators in the College of Science and Mathematics.

The minor is open to any major except Biochemistry, Microbiology, and Biological Sciences with the Molecular and Cellular Biology concentration.

Biological Sciences students preparing for the minor should take CHEM 216, CHEM 217, and CHEM 371 to fulfill the organic chemistry and biochemistry requirements in their major.

Students interested in more information should contact the Biotechnology Minor Coordinators in the Chemistry and Biochemistry Department or the Biological Sciences Department.

## Environmental Studies Minor

Students who complete a minor in Environmental Studies will be able to:

- Analyze, explain, and evaluate environmental issues from both scientific/technical and social/political/economic/ethical perspectives.
- Integrate and synthesize knowledge from multiple disciplines.
- Explain and apply the methodologies and approaches that different disciplines bring to bear on complex problems.
- Work productively and effectively with students from other disciplines and with other points of view.
- Confront and grapple with real issues of contemporary significance.
- Gain employment or pursue further study that emphasizes interdisciplinary knowledge and skills.

More information about the Environmental Studies Minor, including Subject Area Electives appropriate for students in each of the colleges, can be obtained from the College of Science and Mathematics Dean's Office in Building 25, Room 229C.

## Actuarial Preparation Minor

### Required Courses (Validation by Educational Experience)

ECON 221	Microeconomics	4
ECON 222	Macroeconomics (D2)	4
BUS 342	Fundamentals of Corporate Finance	4
STAT 324	Applied Regression Analysis	4
STAT 416	Statistical Analysis of Time Series	4
or ECON 406	Applied Forecasting	

### Approved Electives

BUS 431	Security Analysis and Portfolio Management	4
or BUS 439	Fixed Income Securities Market	
STAT 325	Introduction to Probability Models	4
or STAT 425	Probability Theory	

Total units 28

## Biotechnology Minor

### Required Courses

Select from the following: 4-5

BIO 161	Introduction to Cell and Molecular Biology (B2/B4)	
BOT 121	General Botany (B2/B4)	
MCRO 221	Microbiology (B2/B4)	
MCRO 224	General Microbiology I (B2/B4)	

Select from the following: 3/5

BIO 303	Survey of Genetics	
BIO 351	Principles of Genetics	
CHEM 373	Molecular Biology	
CHEM 313	Survey of Biochemistry and Biotechnology	5
or CHEM 371	Biochemical Principles	

### Laboratory Elective

Select from the following: 2-5

ASCI 403	Applied Biotechnology in Animal Science	
BIO/CHEM 475	Molecular Biology Laboratory	
CHEM 474	Protein Techniques Laboratory	
SCM 201	Orientation to Biotechnology	1-2

### Approved Electives

Select from the following: 6-13

#### Animal Biotechnology

ASCI 403	Applied Biotechnology in Animal Science	
ASCI 406	Applied Animal Embryology and Assisted Reproduction	
ASCI 440	Immunology and Diseases of Animals	
ASCI 503	Advanced Molecular Techniques in Animal Science	
DSCI 330	Artificial Insemination and Embryo Biotechnology	

#### Bioinformatics

BIO/CHEM 441	Bioinformatics Applications	
CSC/CPE 448	Bioinformatics Algorithms	

### Cell and Molecular Biology/Microbial Biotechnology

BIO 426	Immunology	
BIO 452	Cell Biology	
BIO/CHEM 475	Molecular Biology Laboratory	
BIO 476	Gene Expression Laboratory	
CHEM 474	Protein Techniques Laboratory	
CHEM 528	Nutritional Biochemistry	
MCRO 225	General Microbiology II	
MCRO 320	Emerging Infectious Diseases	
MCRO 402	General Virology	
MCRO 433	Microbial Biotechnology	

### Engineering-related Biotechnology

BRAE 448	Bioconversion	
ENVE 443	Bioremediation Engineering I	
ENGR 581	Biochemical Engineering I	
ENGR 582	Biochemical Engineering II	
ENGR 583	Biochemical Engineering III	

### Ethics

PHIL 339	Biomedical Ethics	
SCM 451	Ethics in the Sciences	

### Pharmaceutical Biotechnology

CHEM 377	Chemistry of Drugs and Poisons	
CHEM 477	Biochemical Pharmacology	

### Plant Biotechnology

BOT 323	Plant Pathology	
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Total units 28

## Environmental Studies Minor

Select one course from each subject area. Electives must be approved in advance by an advisor for the minor.

### Biology and ecology

Select from the following: 4

BIO 112	Environmental Biology and Conservation (B5)	
BIO 227	Wildlife Conservation Biology (B2)	
BIO 325	General Ecology	
BIO 327	Wildlife Ecology	
BIO 401	Conservation Biology	
NR 306	Natural Resource Ecology and Habitat Management	
NR 319	Natural Resource Ecology, Theories and Applications (B5)	

### Earth science

Select from the following: 3-4

ERSC 144	Introduction to Earth Science	
ERSC 202	Soil Erosion and Water Conservation	
GEOG 250	Physical Geography	
GEOL 102	Introduction to Geology (B3)	
PHYS 107	Introduction to Meteorology (B3)	
PHYS 313	Introduction to Atmospheric Physics	
PSC 201	Physical Oceanography (B5)	

### Energy and pollution

Select from the following: 3-4

BRAE 348	Energy for a Sustainable Society (F)
CHEM 341	Environmental Chemistry: Water Pollution
ENVE 324	Introduction to Air Pollution (F)
ENVE 330	Environmental Quality Control
ENVE 331	Introduction to Environmental Engineering
PHYS 310	Physics of Energy
PSC 320	Energy, Society and the Environment (F)

**Social, political, economic, and ethical issues**

Select from the following: 3-4

CRP 404	Environmental Law
ECON 431	Environmental Economics
GEOG 325	Climate and Humanity
HUM 303	Values and Technology (C4)
PHIL 340	Environmental Ethics (C4)
POLS/UNIV 333	World Food Systems (F)
RPTA 302	Environmental and Wilderness Education

**Environmental planning, management, and sustainability**

Select from the following: 3-4

AG 315	Organic Agriculture (F)
AG/HUM/UNIV 330	Cal Poly Land: Nature, Technology, and Society (F)
AG 360	Holistic Management (F)
ASCI 329	Principles of Range Management
CRP 336	Introduction to Environmental Planning
EDES 406	Sustainable Environments
ERSC/GEOG 333	Human Impact on the Earth
GEOG 301	Geography of Resource Utilization (D5)
NR 142	Environmental Management
RPTA 313	Sustainability in Recreation, Parks, and Tourism

**Approved Elective**

Choose one additional 300-400 level course from the above lists. 4

**Capstone Course**

AG/EDES/ENGR/HUM/SCM/UNIV 350	The Global Environment (F)	4
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Total units 24-28



## Biological Sciences

Fisher Science Hall (33), Room 273

Phone: 805.756.2788

Email: biosci@calpoly.edu

bio.calpoly.edu/

Department Chair: Christopher L. Kitts

### Academic Programs

Program name	Program type
Biological Sciences	BS, MA, MS
Microbiology	BS, Minor
Biology	Minor

The department offers several undergraduate programs leading to Bachelor of Science degrees in Biological Sciences and Microbiology, and minors in Biology and Microbiology. For qualified students, a graduate program is available leading to a Master of Science or a Master of Arts degree. In addition, courses are offered to satisfy biology requirements in academic majors across campus.

The Biological Sciences department teaches courses with the following prefixes: BIO (Biology), BOT (Botany), MCRO (Microbiology), and ZOO (Zoology).

The department is housed in modern facilities equipped with up-to-date instrumentation. Cal Poly's geographical setting offers unusual opportunities for studying representative plants and animals of both Northern and Southern California. Graduates of the various programs enter fields in teaching; laboratory technology; public health; biotechnology research and manufacturing; wildlife management; consulting; agriculture; industry; and private, state, and national park and forest services. A significant number of graduates enter graduate or professional schools for advanced study of botany, entomology, microbiology, plant pathology, zoology, marine sciences, veterinary science, cell and molecular biology, medicine, and dentistry. The department offers courses required for preprofessional training in medicine and paramedical fields.

The department supports the concept of international education and encourages students to investigate opportunities for overseas study. For further information, see Cal Poly International Center (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicsupportandcampuslife/academicservicesandprograms/calpolyinternationalcenter>).

Students majoring in Biological Sciences or Microbiology may take advantage of opportunities to participate in research projects. Special opportunities are available through the Center for Applications in Biotechnology (CAB) that is developing biological tools to address environmental concerns through collaborative interdisciplinary research and education; the Center for Coastal Marine Science (CCMS) that promotes and facilitates basic and applied studies of coastal marine systems for the purposes of addressing environmental concerns and fostering hands-on learning through discovery and outreach; and the Undergraduate Biotechnology Laboratory (UBL), which is co-funded by Cal Poly and the National Science Foundation to provide undergraduates with hands-on experience with biotechnology. In addition, there are a large number of opportunities to work in the laboratory of individual faculty members in areas such as conservation, genetics and genomics, botany, ecology, endangered species,

infectious disease mechanisms, developmental biology, anatomy, and physiology.

### Undergraduate Programs

#### BS Biological Sciences

The degree offers students a broad education in biology from molecules to ecosystems. It offers preprofessional preparation in the biomedical fields, coursework towards a teaching credential, technical competency in the area of concentrations, and progress towards certification as an Associate Ecologist, Fisheries Biologist, or Associate Wildlife Biologist, or as a base for work toward post-baccalaureate studies. Students are encouraged to consult with a faculty advisor and the College of Science and Mathematics Advising Center to help them learn about their chosen degree program, concentration choices, career options, study skills, and departmental opportunities. In order to gain a deeper, more focused understanding of a specific subfield within biology, students are encouraged to choose a concentration. For a broader survey of biology topics, students may follow the General Curriculum in Biology instead. Students interested in teaching may choose any concentration and should contact the Single Subject Credential Advisor for information about teaching opportunities and recommended coursework.

#### Concentrations

##### Anatomy and Physiology

Designed for students who are interested in the biological sciences with an emphasis in the structure and function of humans and other animals. This concentration is ideal for those students preparing for careers in the health professions.

##### Ecology

The study of ecology spans a wide breadth of habitats, from terrestrial to marine, and multiple scales of organization, from microbial interactions to global processes. As such, the ecology concentration allows flexibility for students to design a program to fit their interests and career goals within this broad discipline. The concentration emphasizes collection and analysis of data to better understand the factors that affect the distribution and abundance of organisms. In many contexts, these results are used to identify and solve environmental problems. Graduates may pursue careers in education, ecological consulting, planning or coordination, habitat restoration, or environmental law. A graduate may be academically qualified for professional certification as an Associate Ecologist by the Ecological Society of America.

##### Field and Wildlife Biology

Field and Wildlife biologists are able to identify terrestrial plants and animals, understand the factors that affect their distribution and abundance, and have a conceptual understanding of conservation, ecology and community structure. Many of the courses focus on the study of plants and animals in their natural environments. The concentration prepares students for graduate training or for professional employment in public or private agencies dealing with field inventories of biological diversity, abundance and distribution. Graduates may pursue careers as field biologists, outdoor educators, park naturalists, biological resource scientists, biology teachers, environmental consultants, or wildlife conservation biologists.

## Marine Biology and Conservation

Prepares students for advanced training or professional employment in public or private agencies concerned with marine sciences, freshwater ecology, fisheries biology, fisheries management, or related fields. By judicious selection of electives, the student is academically prepared to apply for professional certification as a Fisheries Biologist by the American Fisheries Society.

## Molecular and Cellular Biology

Designed for students who are interested in how genes and their products work to create subcellular and cellular structures. This concentration augments the diverse biological sciences curriculum with laboratory courses in nucleic acid and protein techniques, along with additional courses in bioinformatics, industrial microbiology, immunology, and virology. This concentration is ideal for students interested in biotechnology or biomedical research, and also works well for students planning future studies in the health professions. Students electing this concentration are not eligible for the Biotechnology Minor.

## General Curriculum in Biology

A General Curriculum in Biology is also an option. It is not a formal concentration. Students are encouraged to select from one of the concentrations listed above, but those who do not declare a concentration will default to the General Curriculum.

## BS Microbiology

Microbiology is the study of bacteria, viruses, fungi, and protists. Microorganisms are ubiquitous in the environment as important contributors to nutrient cycling, and many have symbiotic relationships with other organisms. Species of medical importance impact human and animal health as pathogens associated with infectious diseases. Additionally, microorganisms are critical research tools in fields such as molecular biology and genetics, and are used for large-scale production of many foods, pharmaceuticals, and industrial chemicals. Cal Poly is one of the few public universities in California offering a laboratory-intensive Bachelor of Science degree in Microbiology. In the freshman year, the Microbiology major consists of a core of courses that provide students with a basic foundation in key biological principles. In the sophomore year, majors are provided with a solid training in the manipulation of microorganisms and how these techniques may be used to understand microbial cell structure and function, metabolism, genetics, and ecology.

In the junior and senior years, majors take specialized courses in medical microbiology, immunology, microbial physiology, genetics, virology, and cell biology. During this time students also choose elective courses related to student interests and career goals in close consultation with their faculty advisor. Such goals may include graduate school or professional studies with further training through Clinical Laboratory Scientist (CLS) or Public Health Microbiologist certification programs. Graduates may also pursue post-baccalaureate employment in applied areas such as industrial microbiology, food and dairy microbiology, biotechnology, public health, epidemiology, or medical laboratory technology.

## Biotechnology Minor

For information regarding the Biotechnology Minor, please see College of Science and Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics>) section.

## Biology Minor

The purpose of the minor is to help students from other disciplines acquire increased factual and conceptual knowledge in biology, an increased understanding of scientific methods and techniques used to study biology, and an increased ability to analyze biological topics in the news or in various jobs. Biological issues are important throughout modern life and particularly relevant in many careers, including those in health-related businesses, agriculture, several engineering disciplines, city planning, teaching K-12 students, journalism, political science, psychology, and statistics. Students in more closely related majors such as biochemistry or kinesiology may also be interested in strengthening their biology background. In addition, an enhanced biology background helps students become better educated citizens regarding a variety of controversial issues in modern society (e.g. genetically-modified organisms in agriculture, human cloning, genetic discrimination, the pressures of population growth).

## Microbiology Minor

This minor is designed to give students from majors in which microbiology may be an important component increased exposure to factual information, concepts, and skills in order to provide those students a more complete understanding of the roles of microorganisms as they pertain to studies in their chosen major. Students in the allied health and related fields may expand their breadth of knowledge in microbial diseases, transmission and prevention, and immunologic responses. Students in applied fields of study such as Food and Dairy Sciences and various aspects of agriculture can gain additional information in pertinent topics such as the presence and role of microorganisms in water and wastewater treatment, in recycling of nutrients and soil fertility, in food processing, spoilage, and production, and in disease transmission.

## Graduate Programs

### Master of Arts Degree in Biological Sciences

#### General Characteristics

This degree offers a broad background in the biological sciences. The program is designed to offer sufficient breadth and depth to strengthen the student's academic understanding and improve competence for:

1. many types of biological work that require advanced training beyond the bachelor's degree;
2. careers in industry and/or civil service;
3. teaching biological sciences at the elementary, secondary, and community college levels.

This degree differs from the MS in Biological Sciences in that a research thesis is not required.

#### Prerequisites

Admission as a conditionally classified or classified student in this program requires a minimum grade point average of 3.0 in the last 90 quarter units attempted, submission of satisfactory scores on the Graduate Record Examination (GRE), and two letters of recommendation from persons knowing your academic potential.

Advancement to candidacy requires a satisfactory background in biology, and completion of 12 units of courses specified in an informal study plan with a minimum grade point average of 3.0. Information

pertaining to specific departmental requirements for admission to graduate standing—classified or graduate standing—conditionally classified may be obtained from the Director of the Graduate and Research Committee (Graduate Coordinator) of the Biological Sciences Department.

## Program of Study

The formal program of study for the degree must include 45 units of committee-approved graduate work, at least 30 units of which must be at the 500 level. A grade point average of 3.0 or better is required from the combination of all courses included in the Formal Study Plan. Coursework must include 32 units within the Biological Sciences Department at Cal Poly. Only 4 units of BIO 575 College Teaching Practicum can be used; a maximum of 3 units of BIO 590 Seminar in Biology can be used in the Formal Study Plan. To complete the degree the GRE Advanced Biology exam must be passed with a score of 650 or higher. The culminating experience is a comprehensive written exam covering three areas of biology.

## Master of Science Degree in Biological Sciences

### General Characteristics

This degree offers a broad background in the biological sciences. The program is designed to offer sufficient breadth and depth to strengthen the student's academic understanding and improve competence for:

1. many types of biological work that require advanced training beyond the bachelor's degree;
2. careers in industry and/or civil service;
3. teaching biological sciences at the elementary, secondary, and community college levels;
4. independent research in the field of specialization;
5. continued graduate work at other institutions.

### Prerequisites

Admission as a conditionally classified or classified student in this program requires a minimum grade point average of 3.0 in the last 90 quarter units attempted, submission of satisfactory Graduate Record Examination (GRE) scores, and two letters of recommendation from persons knowing your academic potential.

Information pertaining to specific departmental requirements for admission to graduate standing—classified or graduate standing—conditionally classified may be obtained from the Director of the Graduate and Research Committee (Graduate Coordinator) of the Biological Sciences Department.

## Program of Study

The formal program of study for the degree must include 45 units of committee-approved graduate work, at least 30 units of which must be at the 500 level. Coursework must include 32 units taken within the Biological Sciences Department at Cal Poly. A grade point average of 3.0 or better is required from the combination of all courses included in the Formal Study Plan. A maximum of 3 units of BIO 590 Seminar in Biology can be used. To complete the degree the GRE Advanced Biology exam must be passed with a score of 650 or better.

## MS Biological Sciences, Specialization in Stem Cell Research

**Characteristics.** Prepares students for research careers working with stem cells. Graduates of the program are well-prepared to matriculate into stem-cell focused doctoral programs. Following completion of a PhD in a stem-cell focused program (and likely post-doctoral training), students would have job opportunities as principal investigators at universities/non-profit research institutes or as lead scientists at for profit institutions. Graduates are also well prepared for immediate employment as research specialists/laboratory managers at universities, research institutes, or private companies in the field of stem cells/regenerative medicine.

**Culminating Experience.** Students who obtain a degree in the Master of Science in Biological Sciences with a specialization in Stem Cell Research are not required to complete the GRE Advanced Biology exam or BIO 599. In place of the thesis as a culminating experience, students are required to complete a non-traditional Comprehensive Exam. This non-traditional Comprehensive Exam includes a 9-month internship in a stem cell research laboratory<sup>1</sup> (BMED 593/ASCI 593/BIO 593), a quarter-long project course at Cal Poly (BMED 594/ASCI 594/BIO 594), a written report of their internship research, a written report of their quarter-long project course, and an oral presentation of their internship research. Through the completion of these components, students demonstrate their ability to integrate the knowledge of the area, show critical and independent thinking, and demonstrate mastery of the subject matter.

- 1 Students will complete their internship in stem cell research laboratories at UCSD, The Salk Institute, The Scripps Research Institute, Stanford University, or Novocell Inc.

## BS Biological Sciences

### Program Learning Objectives

1. Students will demonstrate a writing style appropriate for communicating scientific results to a diverse audience.
2. Students will integrate math, physical sciences and technology to answer biological questions using the scientific method.
3. Students will demonstrate proficiency of lab and field techniques in their area of specialization.
4. Students will master and retain fundamental concepts in biology (atom to ecosystem).
5. Students will demonstrate the skill to assess and analyze data with objectivity.
6. Students will demonstrate proficiency in searching, reading and evaluating the scientific literature.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

**MAJOR COURSES**

BIO 160	Diversity and History of Life	4
BIO 161	Introduction to Cell and Molecular Biology (B2&B4) <sup>1</sup>	4
BIO 162	Introduction to Organismal Form and Function	4
BIO 263	Introductory Ecology and Evolution	4
BIO 351	Principles of Genetics	5
BIO 414	Evolution	4
BIO 461	Senior Project - Research Proposal	2
or BIO 462	Senior Project - Research	

**Biological Diversity** <sup>2</sup>

Select from the following:		4
BIO 415	Biogeography	
BOT 313	Taxonomy of Vascular Plants	
BOT 323	Plant Pathology	
BOT 433	Field Botany	
BOT 437	Marine Plants	
MCRO 224	General Microbiology I	
MCRO 402	General Virology	
ZOO 321	Mammalogy	
ZOO 322	Ichthyology	
ZOO 323	Ornithology	
ZOO 329	Vertebrate Field Zoology	
ZOO 335	General Entomology	
ZOO 336	Invertebrate Zoology	
ZOO 341	Herpetology	
ZOO 425	Parasitology	

**Ecology** <sup>3</sup>

Select from the following:		4
BIO 325	General Ecology	
BIO 327	Wildlife Ecology	
BIO 328	Marine Ecology	
BIO 401	Conservation Biology	
BIO 445	Community Ecology	
BIO 446	Ecosystem Ecology	
BOT 326	Plant Ecology	
MCRO 436	Environmental Microbiology	

**Physiology** <sup>4</sup>

Select from the following:		4
BIO 361	Principles of Physiology	
BIO 434	Environmental Physiology	
BIO 435	Plant Physiology	

**Concentration or General Curriculum in Biology** <sup>5,6</sup>

(See list of Concentrations and General Curriculum in Biology below)

**SUPPORT COURSES**

CHEM 127	General Chemistry for Agriculture and Life Science I (B3&B4) <sup>1</sup>	4
CHEM 128	General Chemistry II	4
CHEM 129	General Chemistry III	4
CHEM 216	Organic Chemistry for Life Sciences I <sup>7</sup>	5

or CHEM 312	Survey of Organic Chemistry	
MATH 161	Calculus for the Life Sciences I (B1) <sup>1</sup>	4
MATH 162	Calculus for the Life Sciences II (B1) <sup>1</sup>	4
PHYS 121	College Physics I	4
PHYS 122	College Physics II	4
PHYS 123	College Physics III	4
STAT 218	Applied Statistics for the Life Sciences	4

**GENERAL EDUCATION (GE)**

(See GE program requirements below.)

**FREE ELECTIVES**

Free Electives	5
<b>Total units</b>	<b>180</b>

- <sup>1</sup> Required in Major/Support; also satisfies GE.
- <sup>2</sup> Students in the Molecular and Cellular Biology concentration should take MCRO 224 to fulfill this requirement.
- <sup>3</sup> Students in the Marine Biology and Conservation concentration should take BIO 328 to fulfill this requirement.
- <sup>4</sup> Students in the Anatomy and Physiology concentration should take BIO 361 to fulfill this requirement.
- <sup>5</sup> Note that courses in concentrations or the general curriculum may not double-count in the major core.
- <sup>6</sup> Maximum of 6 units may be applied toward the major from the following courses: BIO 400, BIO 450, BIO 462, BIO 463.
- <sup>7</sup> Students in the Molecular and Cellular Biology concentration should take CHEM 216 to fulfill this requirement.

**General Curriculum in Biology or Concentrations (Select one)**

- General Curriculum in Biology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/bsbiologicalsciencerequirements/generalcurriculuminbiologyconcentration>)
- Anatomy and Physiology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/bsbiologicalsciencerequirements/anatomyandphysiologyconcentration>)
- Ecology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/bsbiologicalsciencerequirements/ecologyconcentration>)
- Field and Wildlife Biology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/bsbiologicalsciencerequirements/fieldandwildlifebiologyconcentration>)
- Marine Biology and Conservation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/bsbiologicalsciencerequirements/marinebiologyandconservation>)
- Molecular and Cellular Biology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/>)



biologicalsciences/bsbiologicalsciencerequirements/  
molecularandcellularbiologyconcentration)

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course (in Major) <sup>1</sup>	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		56

<sup>1</sup> Required in Major/Support; also satisfies GE.

## General Curriculum in Biology

**The General Curriculum in Biology is to be followed by default, if no concentration is declared.**

CHEM 313	Survey of Biochemistry and Biotechnology	5
or CHEM 371	Biochemical Principles	

### Anatomy/Physiology

Select from the following: 4-5

BIO 361	Principles of Physiology	
BIO 432	Vertebrate/Human Anatomy and Physiology I	
BIO 433	Vertebrate/Human Anatomy and Physiology II	
BIO 434	Environmental Physiology	
BIO 435	Plant Physiology	

MCRO 424 Microbial Physiology

ZOO 422 Functional Histology

### Botany

Select from the following: 4

BOT 311 Plants, People and Civilization

BOT 313 Taxonomy of Vascular Plants

BOT 323 Plant Pathology

BOT 431 Advanced Plant Pathology

BOT 433 Field Botany

BOT 437 Marine Plants

### Ecology/Evolution/Conservation

Select from the following: 3-4

BIO 325 General Ecology

BIO 327 Wildlife Ecology

BIO 328 Marine Ecology

BIO 401 Conservation Biology

BIO 415 Biogeography

BIO 419 Ecological Methodology

BIO 427 Wildlife Management

BIO 428 Marine Conservation and Policy

BIO 438 Aquaculture

BIO 439 Fisheries Science and Resource Management

BIO 440 Communicating Ocean Sciences to Informal Audiences

BIO 442 Behavioral Ecology

BIO 443 Molecular Ecology and Systematics

BIO 444 Population Ecology

BIO 445 Community Ecology

BIO 446 Ecosystem Ecology

BOT 326 Plant Ecology

MCRO 436 Environmental Microbiology

### Microbiology

Select from the following: 3-5

MCRO 224 General Microbiology I

MCRO 225 General Microbiology II

MCRO 301 Wine Microbiology

MCRO 320 Emerging Infectious Diseases

MCRO 342 Sanitary Microbiology

MCRO 421 Food Microbiology

MCRO 423 Medical Microbiology

MCRO 433 Microbial Biotechnology

ZOO 425 Parasitology

### Molecular/Cellular Biology

Select from the following: 3-4

BIO 405 Developmental Biology

BIO 426 Immunology

BIO 452 Cell Biology

BIO/CHEM 441 Bioinformatics Applications

BIO/CHEM 475 Molecular Biology Laboratory

BIO/CHEM 476 Gene Expression Laboratory



MCRO 402	General Virology	
ZOO 428	Hematology	
<b>Zoology</b>		
Select from the following:		4
ZOO 321	Mammalogy	
ZOO 322	Ichthyology	
ZOO 323	Ornithology	
ZOO 324	Marine Mammals, Birds and Reptiles	
ZOO 329	Vertebrate Field Zoology	
ZOO 335	General Entomology	
ZOO 336	Invertebrate Zoology	
ZOO 341	Herpetology	
<b>Research, Projects and Seminars</b>		
Select from the following:		0-6
BIO 200	Special Problems For Undergrads	
BIO 330	Extended Field Biology Activity	
BIO 400	Special Problems for Advanced Undergraduates	
BIO 440	Communicating Ocean Sciences to Informal Audiences	
BIO 450	Undergraduate Laboratory Assistantship	
BIO 462	Senior Project - Research	
BIO 463	Honors Research	
BIO 470	Selected Advanced Topics	
BIO 471	Selected Advanced Laboratory	
BIO 472	Current Topics in Biological Research	
SCM 302	The Learn By Doing Lab Teaching Practicum	
<b>Approved Electives</b> <sup>1</sup>		
Select additional courses in any of the areas listed or request faculty advisor approval for other courses with a maximum allowed of 8 units of coursework outside of the department		2-13
Total units		39

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Anatomy and Physiology Concentration

BIO 432	Vertebrate/Human Anatomy and Physiology I	5
BIO 433	Vertebrate/Human Anatomy and Physiology II	5
BIO 452	Cell Biology	4
CHEM 371	Biochemical Principles	5
or CHEM 313	Survey of Biochemistry and Biotechnology	
<b>Approved Electives</b>		
Select from the following:		20
8 units minimum from:		
BIO 405	Developmental Biology	
BIO 426	Immunology	
BIO 434	Environmental Physiology	
BIO 435	Plant Physiology	
BIO/CHEM 475	Molecular Biology Laboratory	

MCRO 225	General Microbiology II	
MCRO 320	Emerging Infectious Diseases	
MCRO 342	Sanitary Microbiology	
MCRO 402	General Virology	
MCRO 423	Medical Microbiology	
MCRO 424	Microbial Physiology	
ZOO 422	Functional Histology	
ZOO 425	Parasitology	
ZOO 428	Hematology	
11 units maximum from:		
CHEM 217	Organic Chemistry for Life Sciences II	
CHEM 218	Organic Chemistry for Life Sciences III	
CHEM 219	Organic Chemistry Laboratory III for Life Sciences	
CHEM 372	Metabolism	
8 units maximum from:		
ASCI 351	Reproductive Physiology	
ASCI 406	Applied Animal Embryology and Assisted Reproduction	
BIO 400	Special Problems for Advanced Undergraduates	
BIO 462	Senior Project - Research	
BIO 463	Honors Research	
FSN 310	Maternal and Child Nutrition	
FSN 429	Clinical Nutrition I	
KINE 406	Neuroanatomy	
KINE 445	Electrocardiography	
KINE 446	Echocardiography	
PHIL 339	Biomedical Ethics	
PSY 340	Biopsychology	
SCM 302	The Learn By Doing Lab Teaching Practicum	
SCM 451	Ethics in the Sciences	
Total units		39

<sup>1</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Ecology Concentration

<b>Levels</b>		
Select from the following:		11-12
BIO 442	Behavioral Ecology	
BIO 444	Population Ecology	
BIO 445	Community Ecology	
BIO 446	Ecosystem Ecology	
<b>Systems and Applications</b>		
Select from the following:		12
BIO 327	Wildlife Ecology	
BIO 328	Marine Ecology	
BIO 401	Conservation Biology	
BIO 415	Biogeography	
BOT 326	Plant Ecology	
<b>Approved Electives</b> <sup>1,2</sup>		

Select from the following:

15-16

BIO 325	General Ecology
BIO 330	Extended Field Biology Activity
BIO 361	Principles of Physiology
BIO 400	Special Problems for Advanced Undergraduates
BIO 419	Ecological Methodology
BIO 427	Wildlife Management
BIO 434	Environmental Physiology
BIO 435	Plant Physiology
BIO 439	Fisheries Science and Resource Management
BIO 440	Communicating Ocean Sciences to Informal Audiences
BIO 441	Bioinformatics Applications
BIO 462	Senior Project - Research
BIO 463	Honors Research
BIO 472	Current Topics in Biological Research
BIO/CHEM 475	Molecular Biology Laboratory
BOT 311	Plants, People and Civilization
BOT 313	Taxonomy of Vascular Plants
BOT 323	Plant Pathology
BOT 433	Field Botany
BOT 437	Marine Plants
GEOG 250	Physical Geography
MCRO 224	General Microbiology I
MCRO 402	General Virology
MCRO 424	Microbial Physiology
MCRO 436	Environmental Microbiology
NR/LA 218	Applications in GIS
NR 307	Fire Ecology
NR 311	Environmental Measurements and Interpretation
NR 418	Applied GIS
NR 421	Wetlands
SCM 302	The Learn By Doing Lab Teaching Practicum
SS 121	Introductory Soil Science
SS 321	Soil Morphology
SS 322	Soil Plant Relationships
SS 421	Wetlands
SS 422	Soil Microbiology and Biochemistry
STAT 313	Applied Experimental Design and Regression Models
STAT 419	Applied Multivariate Statistics
UNIV 350	The Global Environment
ZOO 321	Mammalogy
ZOO 322	Ichthyology
ZOO 323	Ornithology
ZOO 329	Vertebrate Field Zoology
ZOO 335	General Entomology
ZOO 336	Invertebrate Zoology
ZOO 341	Herpetology
ZOO 425	Parasitology

Total units

39

<sup>1</sup> Select courses from the above lists in this concentration, or from the Biological Diversity list of courses in the major core, or from the list of Approved electives with a maximum of 8 units of coursework allowed outside of the department.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Field and Wildlife Biology Concentration

BOT 313	Taxonomy of Vascular Plants	4
BOT 433	Field Botany	4
ZOO 321	Mammalogy	4
ZOO 323	Ornithology	4
ZOO 341	Herpetology	4

### Emphasis Area

Select Field Biology or Wildlife Biology:

11-12

### Field Biology Emphasis

BIO 439	Fisheries Science and Resource Management
or ZOO 322	Ichthyology
BIO 442	Behavioral Ecology
ZOO 335	General Entomology

### Wildlife Biology Emphasis <sup>1</sup>

BIO 327	Wildlife Ecology
BIO 401	Conservation Biology or BIO 444
BIO 427	Wildlife Management

### Approved Electives <sup>2</sup>

Select from the following:

7-8

BIO 325	General Ecology
BIO 327	Wildlife Ecology
BIO 328	Marine Ecology
BIO 330	Extended Field Biology Activity
BIO 400	Special Problems for Advanced Undergraduates
BIO 401	Conservation Biology
BIO 415	Biogeography
BIO 419	Ecological Methodology
BIO 427	Wildlife Management
BIO 439	Fisheries Science and Resource Management
BIO 434	Environmental Physiology
BIO 443	Molecular Ecology and Systematics
BIO 444	Population Ecology
BIO 445	Community Ecology
BIO 446	Ecosystem Ecology
BIO 462	Senior Project - Research
BIO 463	Honors Research
BOT 326	Plant Ecology
BOT 437	Marine Plants
NR 141	Introduction to Forest Ecosystem Management
NR 142	Environmental Management
NR 203	Resource Law Enforcement
NR/LA 218	Applications in GIS

NR 307	Fire Ecology
NR 404	Environmental Law
NR 416	Environmental Impact Analysis and Management
MCRO 402	General Virology
SCM 302	The Learn By Doing Lab Teaching Practicum
SS 121	Introductory Soil Science
SS 321	Soil Morphology
SS 322	Soil Plant Relationships
STAT 313	Applied Experimental Design and Regression Models
STAT 324	Applied Regression Analysis
STAT 330	Statistical Computing with SAS
STAT 416	Statistical Analysis of Time Series
STAT 419	Applied Multivariate Statistics
STAT 421	Survey Sampling and Methodology
ZOO 322	Ichthyology
ZOO 329	Vertebrate Field Zoology
ZOO 335	General Entomology
ZOO 336	Invertebrate Zoology
ZOO 425	Parasitology

Total units 39

- Students seeking Wildlife Biologist Certification should see faculty advisor for assistance.
- Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Marine Biology and Conservation Concentration

PSC 201	Physical Oceanography	4
STAT 313	Applied Experimental Design and Regression Models	4

### Marine Biodiversity

Select from the following: 8

BOT 437	Marine Plants
ZOO 322	Ichthyology
ZOO 324	Marine Mammals, Birds and Reptiles
ZOO 336	Invertebrate Zoology

### Marine Resources and Conservation

Select from the following: 8

BIO 401	Conservation Biology
BIO 428	Marine Conservation and Policy
BIO 438	Aquaculture
BIO 439	Fisheries Science and Resource Management

### Approved Electives

Select from the following: 15

At least 8 units from:

BIO 325	General Ecology
BIO 327	Wildlife Ecology
BIO 400	Special Problems for Advanced Undergraduates
BIO 401	Conservation Biology

BIO 405	Developmental Biology
BIO 419	Ecological Methodology
BIO 434	Environmental Physiology
BIO 435	Plant Physiology
BIO 438	Aquaculture
BIO 439	Fisheries Science and Resource Management
BIO 440	Communicating Ocean Sciences to Informal Audiences
BIO 442	Behavioral Ecology
BIO 443	Molecular Ecology and Systematics
BIO 444	Population Ecology
BIO 445	Community Ecology
BIO 446	Ecosystem Ecology
BIO 452	Cell Biology
BIO 462	Senior Project - Research
BIO 463	Honors Research
BIO/CHEM 475	Molecular Biology Laboratory
MCRO 436	Environmental Microbiology
ZOO 321	Mammalogy
ZOO 323	Ornithology
ZOO 324	Marine Mammals, Birds and Reptiles
ZOO 425	Parasitology

No more than 8 units from:

CHEM 217	Organic Chemistry for Life Sciences II
CHEM 313	Survey of Biochemistry and Biotechnology
or CHEM 371	Biochemical Principles
CHEM 341	Environmental Chemistry: Water Pollution
CHEM 474	Protein Techniques Laboratory
SCM 302	The Learn By Doing Lab Teaching Practicum

Total units 39

- Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

## Molecular and Cellular Biology Concentration

BIO 452	Cell Biology	4
BIO/CHEM 475	Molecular Biology Laboratory	3
CHEM 217	Organic Chemistry for Life Sciences II	4
CHEM 371	Biochemical Principles	5
CHEM 372	Metabolism	4
CHEM 474	Protein Techniques Laboratory <sup>1</sup>	2
or BIO/CHEM 476	Gene Expression Laboratory	

Select from the following: 5-8

BIO 405	Developmental Biology
BIO 426	Immunology
BIO/CHEM 441	Bioinformatics Applications
BIO/CHEM 476	Gene Expression Laboratory

or CHEM 474 Protein Techniques Laboratory

MCRO 402 General Virology

MCRO 433 Microbial Biotechnology

### Approved Electives<sup>2</sup>

Select from the following: 9-12

#### List A

BIO 400 Special Problems for Advanced Undergraduates<sup>3</sup>

BIO 405 Developmental Biology

BIO 426 Immunology

BIO 432 Vertebrate/Human Anatomy and Physiology I

BIO 433 Vertebrate/Human Anatomy and Physiology II

BIO 435 Plant Physiology

BIO 462 Senior Project - Research

BIO 463 Honors Research

BIO/CHEM 441 Bioinformatics Applications

BIO/CHEM 476 Gene Expression Laboratory

or CHEM 474 Protein Techniques Laboratory

BOT 323 Plant Pathology

MCRO 320 Emerging Infectious Diseases

MCRO 402 General Virology

MCRO 423 Medical Microbiology

MCRO 424 Microbial Physiology

MCRO 433 Microbial Biotechnology

ZOO 422 Functional Histology

ZOO 425 Parasitology

ZOO 428 Hematology

#### List B (Maximum of one course from List B)

ASCI 403 Applied Biotechnology in Animal Science

ASCI 406 Applied Animal Embryology and Assisted Reproduction

ASCI 503 Advanced Molecular Techniques in Animal Science

CHEM 218 Organic Chemistry for Life Sciences III

CHEM 331 Quantitative Analysis

CHEM 377 Chemistry of Drugs and Poisons

CHEM 477 Biochemical Pharmacology

CHEM 478 Pharmaceutical Development

CHEM 528 Nutritional Biochemistry

SCM 201 Orientation to Biotechnology

SCM 302 The Learn By Doing Lab Teaching Practicum

SCM 451 Ethics in the Sciences

Total units 39

<sup>1</sup> The courses selected to satisfy this requirement may not be used to satisfy electives in the concentration.

<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.

<sup>3</sup> Total credit limited to 4 units.

## BS Microbiology

### Program Learning Objectives

1. Students will demonstrate a writing style appropriate for communicating scientific results to a diverse audience.
2. Students will integrate math, physical sciences and technology to answer biological questions using the scientific method.
3. Students will demonstrate proficiency of lab and field techniques in their area of specialization.
4. Students will master and retain fundamental concepts in biology (atom to ecosystem).
5. Students will demonstrate the skill to assess and analyze data with objectivity.
6. Students will demonstrate proficiency in searching, reading and evaluating the scientific literature.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support, or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

BIO 160	Diversity and History of Life	4
BIO 161	Introduction to Cell and Molecular Biology (B2&B4) <sup>1</sup>	4
BIO 263	Introductory Ecology and Evolution	4
BIO 351	Principles of Genetics	5
BIO 426	Immunology	4
BIO 452	Cell Biology	4
MCRO 224	General Microbiology I	5
MCRO 225	General Microbiology II	5
MCRO 402	General Virology	4
MCRO 423	Medical Microbiology	5
MCRO 424	Microbial Physiology	5
BIO 461	Senior Project - Research Proposal	2
or BIO 462	Senior Project - Research	

#### Approved Electives<sup>2,3</sup>

Select from the following: 19

#### Biotechnology

MCRO 433 Microbial Biotechnology

ASCI 403 Applied Biotechnology in Animal Science

BIO/CHEM 441 Bioinformatics Applications

BIO/CHEM 475 Molecular Biology Laboratory

BIO/CHEM 476	Gene Expression Laboratory
BRAE 448	Bioconversion
CHEM 331	Quantitative Analysis
CHEM 372	Metabolism
CHEM 373	Molecular Biology
CHEM 474	Protein Techniques Laboratory
CHEM 478	Pharmaceutical Development
SCM 201	Orientation to Biotechnology

**Food Microbiology**

MCRO/WVIT 301	Wine Microbiology
MCRO 421	Food Microbiology
DSCI 402	Quality Assurance and Control of Dairy Products
DSCI 434	Cheese and Fermented Dairy Foods
DSCI 444	Dairy Microbiology
FSN 230	Elements of Food Processing
FSN 275	Elements of Food Safety
FSN 335	Food Quality Assurance
FSN 341	Wines and Fermented Foods
FSN 364	Food Chemistry
FSN 368	Food Analysis
FSN 374	Food Laws and Regulations
FSN 474	Advanced Food Processing

**Medical and Public Health Microbiology**

MCRO 320	Emerging Infectious Diseases
MCRO 342	Sanitary Microbiology
ASCI 203	Animal Parasitology
ASCI 312	Production Medicine
ASCI 321	Zoonoses and Veterinary Public Health Concerns
ASCI 438	Systemic Animal Physiology
ASCI 440	Immunology and Diseases of Animals
BIO 162	Introduction to Organismal Form and Function
BIO 432	Vertebrate/Human Anatomy and Physiology I
BIO 433	Vertebrate/Human Anatomy and Physiology II
CHEM 331	Quantitative Analysis
CHEM 349	Chemical and Biological Warfare
CHEM 377	Chemistry of Drugs and Poisons
CHEM 477	Biochemical Pharmacology
KINE 301	Functional Muscle Anatomy
ZOO 425	Parasitology
ZOO 428	Hematology

**Microbial Ecology and Evolution**

MCRO 436	Environmental Microbiology
BIO 325	General Ecology
BIO 414	Evolution
BIO 443	Molecular Ecology and Systematics
CHEM 341	Environmental Chemistry: Water Pollution
ENVE 434	Water Chemistry and Water Quality Measurements
SS 422	Soil Microbiology and Biochemistry

**Other electives for Microbiology Majors**

BIO 361	Principles of Physiology
BIO 400	Special Problems for Advanced Undergraduates
BIO 434	Environmental Physiology
BIO 450	Undergraduate Laboratory Assistantship <sup>2</sup>
BIO 462	Senior Project - Research
BIO 463	Honors Research
BOT 323	Plant Pathology
CHEM 218	Organic Chemistry for Life Sciences III
CHEM 219	Organic Chemistry Laboratory III for Life Sciences
CHEM 419	Bioorganic Chemistry
MATH 162	Calculus for the Life Sciences II
PPSC 311	Agricultural Entomology
PPSC 441	Biological Control for Pest Management
SCM 451	Ethics in the Sciences
STAT 313	Applied Experimental Design and Regression Models
STAT 419	Applied Multivariate Statistics
STAT 421	Survey Sampling and Methodology
ZOO 335	General Entomology
ZOO 336	Invertebrate Zoology

**SUPPORT COURSES <sup>4</sup>**

CHEM 127	General Chemistry for Agriculture and Life Science I (B3&B4) <sup>1</sup>	4
CHEM 128	General Chemistry II	4
CHEM 129	General Chemistry III	4
CHEM 216	Organic Chemistry for Life Sciences I	5
CHEM 217	Organic Chemistry for Life Sciences II	4
CHEM 313	Survey of Biochemistry and Biotechnology <sup>5</sup>	5
or CHEM 371	Biochemical Principles	
MATH 161	Calculus for the Life Sciences I (B1) <sup>1</sup>	4
PHYS 121	College Physics I	4
PHYS 122	College Physics II	4
PHYS 123	College Physics III	4
STAT 218	Applied Statistics for the Life Sciences (B1) <sup>1</sup>	4

**GENERAL EDUCATION (GE)**

(See list of GE program requirements below.) 56

**FREE ELECTIVES**

Free Electives <sup>5</sup>	8
Total units	180

<sup>1</sup> Required in Major/Support; also satisfies GE.<sup>2</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.<sup>3</sup> Limited to a total of 4 units from BIO 400, BIO 450, BIO 462, and BIO 463. At least 14 units must be upper division (300-400 level).<sup>4</sup> Students planning to attend graduate or professional schools are strongly advised to meet with their advisors to ensure that they meet necessary prerequisites for entry into these programs. Additional courses in math and chemistry may be necessary.



- <sup>5</sup> CHEM 371 suggested for students who plan to pursue graduate school or a health professions career.

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		56

<sup>1</sup> Required in Major/Support; also satisfies GE.

## Biology Minor

Select 3 courses from one of the following tracks: 12-13

### Track 1 <sup>1</sup>

BIO 160	Diversity and History of Life
BIO 161	Introduction to Cell and Molecular Biology (B2 & B4)
BIO 162	Introduction to Organismal Form and Function
BIO 263	Introductory Ecology and Evolution
MCRO 221	Microbiology (B2 & B4)
or MCRO 224	General Microbiology I

### Track 2

BIO 111	General Biology (B2 & B4)
BIO 112	Environmental Biology and Conservation
or BIO 123	Biology of Sex

or BIO 227	Wildlife Conservation Biology
BIO 114	Plant Diversity and Ecology (B2 & B4)
or BOT 121	General Botany
BIO 211	Biology of Plants and Animals
MCRO 221	Microbiology (B2 & B4)
or MCRO 224	General Microbiology I

Approved Electives <sup>2</sup> 16

Total units 28-29

- <sup>1</sup> Includes prerequisites for a large number of classes at the upper division. The choice of which introductory courses to take should be made in consultation with one of the Biology Minor Coordinators to ensure that students have appropriate prerequisites for upper division electives.
- <sup>2</sup> Select at least four courses at the 300-400 level in BIO, BOT, MCRO or ZOO, with the exception of BIO 450, BIO 485, and BIO 495. A maximum of 1 unit of BIO 400 may be used in the minor. Suggested combinations of courses in particular areas of biology are available in the department. Specific combinations of courses may not be allowed if the courses overlap too much in content. Students must obtain **prior approval** from one of the Biology Minor Coordinators.

## Microbiology Minor

### Required Courses

MCRO 221	Microbiology (B2 & B4)	4-5
or MCRO 224	General Microbiology I	
MCRO 225	General Microbiology II	5

Select from the following: 4-5

MCRO 402	General Virology
MCRO 423	Medical Microbiology
MCRO 424	Microbial Physiology

### Approved Electives <sup>1</sup>

Select from the following: 11-13

BIO 426	Immunology
DSCI 444	Dairy Microbiology
MCRO 301	Wine Microbiology
MCRO 320	Emerging Infectious Diseases
MCRO 342	Sanitary Microbiology
MCRO 402	General Virology
MCRO 421	Food Microbiology
MCRO 423	Medical Microbiology
MCRO 424	Microbial Physiology
MCRO 433	Microbial Biotechnology
MCRO 436	Environmental Microbiology
SS 422	Soil Microbiology and Biochemistry
ZOO 425	Parasitology
ZOO 428	Hematology

Total units 26

## MA Biological Sciences

### Required Courses

BIO 501	Molecular & Cellular Biology	4
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BIO 502	Biology of Organisms	4
BIO 503	Population Biology	4
BIO 590	Seminar in Biology	3
BIO 500	Individual Study	4

**Electives**

Advisor approved electives 500-level	11
Advisor approved electives 400- or 500- level	15

**Satisfactory completion of the comprehensive examinations.**

<b>Total units</b> <sup>1</sup>	45
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- <sup>1</sup> All 45 units must be acceptable for graduate credit and in accordance with Graduate Guidelines of the Biological Sciences Department. For further information, students should communicate with the Chair of the Biological Sciences Department or with the Director of the Graduate and Research Committee.

## MS Biological Sciences

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**Required Courses**

BIO 501	Molecular & Cellular Biology	4
BIO 502	Biology of Organisms	4
BIO 503	Population Biology	4
BIO 561	Proposal Writing for Biological Research	3
BIO 590	Seminar in Biology	3
BIO 599	Thesis	9

**Electives**

Additional units at the 400 or 500 level. At least 3 units must be 500 level to meet the 30 unit requirement.	18
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<b>Total units</b>	45
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All 45 units must be acceptable for graduate credit and in accordance with Graduate Guidelines of the Biological Sciences Department. Coursework must include 32 units taken within the Biological Sciences Department at Cal Poly. To complete the degree the GRE Advanced Biology exam must be passed with a score of 650 or better. For further information, students should communicate with the Chair of the Biological Sciences Department or with the Director of the Graduate and Research Committee.

## MS Biological Sciences, Specialization in Stem Cell Research

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**Required Courses**

BIO 501	Molecular & Cellular Biology	4
BIO 502	Biology of Organisms	4
BIO 534	Principles of Stem Cell Biology	2
BIO 590	Seminar in Biology	1
BIO/BMED/ASCI 593	Stem Cell Research Internship <sup>1</sup>	10
BIO/BMED/ASCI 594	Applications in Stem Cell Research	2
BMED 510	Principles of Tissue Engineering	4
BMED 515	Introduction to Biomedical Imaging	4
BMED 545	Cell Transplantation and Biotherapeutics	4

BMED 563 & ASCI 581	Biomedical Engineering Graduate Seminar and Graduate Seminar in Animal Science	3
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**Electives**

Approved engineering, science and mathematics electives	7
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<b>Total units</b>	45
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- <sup>1</sup> Students will complete their internship in stem cell research laboratories at UCSD, the Salk Institute, the Scripps Research Institute, Stanford University, or Novocell Inc.

# Chemistry & Biochemistry

Baker Center for Sciences and Mathematics Bldg. (180), Room 206  
Phone: 805.756.2693

<http://www.chemistry.calpoly.edu>

Department Chair: Nanine Van Draanen

## Academic Programs

Program name	Program type
Biochemistry	BS
Chemistry	BS
Polymers and Coatings Science	MS

The Chemistry and Biochemistry Department has two roles in the university: to provide professional education for students who are majors in chemistry and biochemistry and who plan careers in the natural sciences and related fields, and to provide instruction in the fundamentals of chemistry to students with majors in fields related to chemistry, especially in the life sciences, agriculture, and engineering.

The department offers a flexible chemical education degree option for students interested in a career in pre-college science education. Interested students should contact the single subject teaching credential advisor early in their academic career for more information.

Career opportunities for chemists are increasing. There are openings in traditional areas such as environmental analysis, the health professions, industrial research and production, pharmacology, toxicology, product quality control, and teaching at the secondary or university level. Newer opportunities lie in related areas such as library science, market research, patent law, and safety engineering

## Undergraduate Programs

### BS Biochemistry

The Chemistry and Biochemistry Department provides curricula leading to the Bachelor of Science in Biochemistry and the Bachelor of Science in Biochemistry with a concentration in Polymers and Coatings.

The baccalaureate curriculum in biochemistry includes required courses in general chemistry, analytical chemistry, inorganic chemistry, organic chemistry, biochemistry and physical chemistry. Advanced undergraduates choose electives from courses that cover a broad range of specialized topics, such as environmental chemistry, geochemistry, glass chemistry, nutritional biochemistry, advanced organic and physical chemistry, pharmacology, and polymer chemistry. The curriculum emphasizes laboratory work, especially current techniques and the use of instrumentation in all fields of chemistry. The program provides opportunities for independent research under faculty guidance, including a requirement for a senior project. A senior project may consist of pure or applied research in biochemistry, or it may involve interdisciplinary work with another field such as art, biology, agriculture, civil or environmental engineering, psychology, or soil science. Under the department's cooperative education program, bachelor's degree candidates may work full-time in industry or government for one or two quarters, for pay and academic credit.

There is a rapidly increasing number of career opportunities in the expanding fields of biotechnology and polymers and coatings. Students completing a degree in biochemistry or a concentration in

polymers and coatings are prepared for direct entry into these careers, as well as for postgraduate education in a professional specialty.

## Concentration

### Polymers and Coatings Concentration

Students may select the Polymers and Coatings concentration instead of advanced approved biochemistry electives in Major Courses.

The concentration includes the required courses in the biochemistry curriculum and electives in the area of polymers, coatings, surface chemistry and materials engineering. The concentration gives students the background and practical experience to move into a rewarding career in a wide range of fields including textiles, paints and varnishes, rubber, plastics, adhesives and resins.

### BS Chemistry

The Chemistry and Biochemistry Department provides curricula leading to the Bachelor of Science in Chemistry and the Bachelor of Science in Chemistry with a certified concentration in Polymers and Coatings. Both the BS in Chemistry and the concentration in Polymers and Coatings are certified by the American Chemical Society. An option in Chemical Education designed for aspiring teachers in secondary schools is also available.

The baccalaureate curriculum in chemistry includes required courses in general chemistry, analytical chemistry, inorganic chemistry, organic chemistry, biochemistry and physical chemistry. Advanced undergraduates choose electives from courses that cover a broad range of specialized topics, such as environmental chemistry, geochemistry, glass chemistry, nutritional biochemistry, advanced organic and physical chemistry, pharmacology, and polymer chemistry. The curriculum emphasizes laboratory work, especially current techniques and the use of instrumentation in all fields of chemistry. The program provides opportunities for independent research under faculty guidance, including a requirement for a senior project. A senior project may consist of pure or applied research in chemistry, or it may involve interdisciplinary work with another field such as art, biology, agriculture, civil or environmental engineering, psychology, or soil science. Under the department's cooperative education program, bachelor's degree candidates may work full-time in industry or government for one or two quarters, for pay and academic credit.

Career opportunities for chemists are increasing. There are openings in traditional areas such as environmental analysis, the health professions, industrial research and production, pharmacology, toxicology, product quality control, and teaching at the secondary or university level. Newer opportunities lie in related areas such as library science, market research, patent law, and safety engineering.

## Concentration

### Polymers and Coatings Concentration

Students may select the Polymers and Coatings concentration instead of advanced chemistry electives in Major Courses. The concentration includes the required courses in the chemistry curriculum and electives in the area of polymers, coatings, surface chemistry and materials engineering. The concentration gives students the background and practical experience to move into a rewarding career in a wide range of fields including textiles, paints and varnishes, rubber, plastics, adhesives and resins.

## Biotechnology Minor

For information regarding the Biotechnology minor, see the College of Science and Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics>) section of the catalog.

## Graduate Program

### Master of Science Degree in Polymers and Coatings Science

#### General Characteristics

The MS degree in Polymers and Coatings Science offers a unique, focused program closely tied to industry. Students gain academic preparation in polymers and coatings science through lecture and laboratory courses, then undertake a rigorous industrial internship. While on the internship students specialize and develop advanced skills through directed study in areas related to their internship work. The program is designed to prepare students for challenging careers in the polymers and coatings industry. The program also provides excellent background for doctoral studies in areas related to polymer and coatings science. This program is unique in California and relies on the close relationship between the department and the polymers and coatings industry for its success.

#### Prerequisites

Students entering the program must have a bachelor's degree from an accredited institution with a minimum grade point average of 2.5 in the last 90 quarter units attempted. Applicants with majors in chemistry, biochemistry, materials engineering, chemical engineering or related fields generally meet the prerequisites for courses in the program. Applicants with degrees in other areas may need to take supplemental courses in organic and physical chemistry and can be admitted conditionally. For information concerning additional departmental requirements, the student should contact the Graduate Advisor in the Chemistry and Biochemistry Department.

Advancement to candidacy requires completion of 12 units of an approved study plan with a minimum grade point average of 3.0.

### Blended BS + MS Program in Chemistry or Biochemistry (BS) and Polymers and Coatings Science (MS)

The blended program provides motivated students with an accelerated route to the MS in Polymers and Coatings Science, with simultaneous conferring of both bachelor's and master's degrees. Students in the blended program are provided with a seamless process whereby they can progress from undergraduate to graduate status.

#### Eligibility

Students majoring in chemistry or biochemistry may be eligible to pursue the blended program toward the MS in Polymers and Coatings Science. Participation in the program is based on prior academic performance and other measures of professional promise, with a minimum GPA of 2.5 required (3.0 recommended). Students are generally selected for the blended program by a faculty committee during the junior year. Please see the catalog description on Blended Programs for eligibility criteria.

Students may begin taking the required graduate courses in either their junior or senior year depending on their preparation. Students may not pursue both the Concentration in Polymers and Coatings and the MS in Polymers and Coatings Science. Students pursuing the concentration take the 400-level polymers and coatings courses while those pursuing the MS degree take the 500-level polymers and coatings courses. Students cannot receive credit for both 400 and 500-level courses in the same topic.

Students in the blended program are eligible to apply for the Graduate Internship upon completion of the required graduate-level chemistry courses.

## BS Biochemistry

### Program Learning Objectives

1. Understand and apply the fundamental concepts of chemistry in the areas of: calculation and estimation, structure, and properties of atoms, ions and molecules, chemical bonding and chemical reactivity.
2. Use techniques and modern tools to conduct, design, analyze, and interpret experiments in chemistry and biochemistry.
3. Communicate effectively with the scientific community.
4. Apply concepts of math, physical and biological sciences to chemical problems.
5. Integrate the concepts, skills and attitudes from a general education with his/her major program to understand and explain the impact of chemistry, science and technology on issues in global, economic, environmental, and societal contexts.

### Degree Requirements and Curriculum

In addition to the program requirements on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

#### MAJOR COURSES

CHEM 127	General Chemistry for Agriculture and Life Science I (B3 & B4) <sup>1</sup>	4
CHEM 128	General Chemistry II	4
CHEM 129	General Chemistry III	4
CHEM 316	Organic Chemistry I	5
CHEM 317	Organic Chemistry II	5
CHEM 318	Organic Chemistry III	3
CHEM 319	Advanced Organic Chemistry Laboratory	2
CHEM 331	Quantitative Analysis <sup>2</sup>	5
CHEM 351	Physical Chemistry I	3
CHEM 352	Physical Chemistry II	3
CHEM 353	Physical Chemistry III	3
CHEM 354	Physical Chemistry Laboratory	2
CHEM 371	Biochemical Principles	5

CHEM 372	Metabolism	4
CHEM 373	Molecular Biology	3
CHEM/BIO 475	Molecular Biology Laboratory	3
Select from the following:		2
BIO 361	Principles of Physiology <sup>3</sup>	
BIO 476	Gene Expression Laboratory	
CHEM 439	Instrumental Analysis <sup>3</sup>	
CHEM 474	Protein Techniques Laboratory	
Select from the following: <sup>4</sup>		2
CHEM 459	Undergraduate Seminar (2)	
SCM 491	Science Student Teaching Workshop (1, 1)	
CHEM 461	Senior Project Report	1
Select from following Approved Advanced Biochemistry Electives (12 units; one course must be a lecture and at least two courses must be from List A) or Polymers and Coatings Concentration (18 units) to complete major. <sup>5</sup>		12/18
<b>List A (at least two courses):</b>		
CHEM 252	Laboratory Glassblowing	
CHEM 341	Environmental Chemistry: Water Pollution	
CHEM 349	Chemical and Biological Warfare	
CHEM 357	Physical Chemistry III Lab	
CHEM 377	Chemistry of Drugs and Poisons	
CHEM 400	Special Problems for Advanced Undergraduates <sup>6</sup>	
CHEM 401	Advanced Undergraduate Research <sup>7</sup>	
CHEM 405	Advanced Physical Chemistry	
CHEM 414	Advanced Organic Chemistry - Mechanisms	
CHEM 419	Bioorganic Chemistry	
CHEM 420	Advanced Organic Chemistry - Synthesis	
CHEM 439	Instrumental Analysis	
CHEM 441	Bioinformatics Applications	
CHEM 444	Polymers & Coatings I	
CHEM 445	Polymers & Coatings II	
CHEM 446	Surface Chemistry of Materials	
CHEM 447	Polymers and Coatings Laboratory I	
CHEM 448	Polymers and Coatings Laboratory II	
CHEM 449	Polymers and Coatings Internship	
CHEM 450	Polymers and Coatings III	
CHEM 451	Polymers and Coatings Laboratory III	
CHEM 458	Instrumental Organic Qualitative Analysis	
CHEM 463	Honors Research	
CHEM 465	College Teaching Practicum	
CHEM 470	Selected Advanced Topics	
CHEM 474	Protein Techniques Laboratory	
CHEM 477	Biochemical Pharmacology	
CHEM 478	Pharmaceutical Development	
CHEM 481	Inorganic Chemistry	
CHEM 484	Inorganic Chemistry Laboratory	
CHEM 485	Cooperative Education Experience <sup>6</sup>	
CHEM 495	Cooperative Education Experience <sup>6</sup>	
CHEM 528	Nutritional Biochemistry	

SCM 302	The Learn By Doing Lab Teaching Practicum
SCM 325	Genetic Engineering Technology
SCM 451	Ethics in the Sciences

**List B**

BIO 361	Principles of Physiology
BIO 405	Developmental Biology
BIO 432	Vertebrate/Human Anatomy and Physiology I
BIO 452	Cell Biology
MCRO 402	General Virology
MCRO 423	Medical Microbiology
MCRO 424	Microbial Physiology
ZOO 331	Human Anatomy and Physiology I
ZOO 332	Human Anatomy and Physiology II
ZOO 422	Functional Histology

**SUPPORT COURSES**

BIO 161	Introduction to Cell and Molecular Biology (B2) <sup>1</sup>	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III	4
Select one of the following sequences of Physics courses:		12
PHYS 121	College Physics I	
& PHYS 122	and College Physics II	
& PHYS 123	and College Physics III	
PHYS 141	General Physics IA	
& PHYS 132	and General Physics II	
& PHYS 133	and General Physics III	
BIO 452	Cell Biology	4-5
or MCRO 224	General Microbiology I	

**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 56

**FREE ELECTIVES**

Free Electives	11-17
Total units	180

- <sup>1</sup> Required in Major/Support; also satisfies GE.
- <sup>2</sup> Students should take CHEM 331 as soon as possible after completing CHEM 129.
- <sup>3</sup> Excess units count as approved advanced Biochemistry electives.
- <sup>4</sup> SCM 491 only for students pursuing Single-Subject Teaching Credential.
- <sup>5</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>6</sup> No more than 2 units may apply to approved advanced biochemistry electives.
- <sup>7</sup> No more than 4 units may apply to approved advanced biochemistry electives.

**Concentration**

Students may select the following concentration instead of advanced approved biochemistry electives in Major Courses

- Polymers and Coatings (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/>)



collegeofsciencemathematics/chemistrybiochemistry/  
bsbiochemistry/polymersandcoatingsconcentration)

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		56

<sup>1</sup> Required in Major/Support.

## Polymers and Coatings Concentration

CHEM 444	Polymers & Coatings I	3
CHEM 445	Polymers & Coatings II	3
CHEM 446	Surface Chemistry of Materials	3
CHEM 447	Polymers and Coatings Laboratory I	2
CHEM 448	Polymers and Coatings Laboratory II	2
CHEM 450	Polymers and Coatings III	3
Select from the following:		2
CHEM 449	Polymers and Coatings Internship	
CHEM 451	Polymers and Coatings Laboratory III	
Total units		18

## BS Chemistry

### Program Learning Objectives

1. Understand and apply the fundamental concepts of chemistry in the areas of: calculation and estimation, structure and properties of atoms, ions and molecules, chemical bonding and chemical reactivity.
2. Use techniques and modern tools to conduct, design, analyze, and interpret experiments in chemistry and biochemistry.
3. Communicate effectively with the scientific community.
4. Apply concepts of math, physical and biological sciences to chemical problems.
5. Integrate the concepts, skills and attitudes from a general education with his/her major program to understand and explain the impact of chemistry, science and technology on issues in global, economic, environmental, and societal contexts.

### Degree Requirements and Curriculum

In addition to the program requirements on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

CHEM 127	General Chemistry for Agriculture and Life Science I (B3 & B4) <sup>1</sup>	4
CHEM 128	General Chemistry II	4
CHEM 129	General Chemistry III	4
CHEM 316	Organic Chemistry I	5
CHEM 317	Organic Chemistry II	5
CHEM 318	Organic Chemistry III	3
CHEM 319	Advanced Organic Chemistry Laboratory	2
CHEM 331	Quantitative Analysis <sup>2</sup>	5
CHEM 351	Physical Chemistry I	3
CHEM 352	Physical Chemistry II	3
CHEM 353	Physical Chemistry III	3
CHEM 354	Physical Chemistry Laboratory	2
CHEM 357	Physical Chemistry III Lab	1
CHEM 371	Biochemical Principles	5
CHEM 439	Instrumental Analysis	5
Select from the following: <sup>3</sup>		2
CHEM 459	Undergraduate Seminar (2)	
SCM 491	Science Student Teaching Workshop (1, 1)	
CHEM 461	Senior Project Report	1
CHEM 481	Inorganic Chemistry	3
CHEM 484	Inorganic Chemistry Laboratory	2

Select from the following Advanced Chemistry Electives (15 units) 15/18 or Polymers and Coatings Concentration (18 units) to complete major: <sup>4</sup>

<b>Advanced Chemistry Electives</b>	
BIO/CHEM 441	Bioinformatics Applications
BIO/CHEM 475	Molecular Biology Laboratory
CHEM 252	Laboratory Glassblowing
CHEM 341	Environmental Chemistry: Water Pollution
CHEM 349	Chemical and Biological Warfare
CHEM 372	Metabolism
CHEM 373	Molecular Biology
CHEM 377	Chemistry of Drugs and Poisons
CHEM 400	Special Problems for Advanced Undergraduates <sup>5</sup>
CHEM 401	Advanced Undergraduate Research <sup>6</sup>
CHEM 405	Advanced Physical Chemistry
CHEM 414	Advanced Organic Chemistry - Mechanisms
CHEM 419	Bioorganic Chemistry
CHEM 420	Advanced Organic Chemistry - Synthesis
CHEM 444	Polymers & Coatings I
CHEM 445	Polymers & Coatings II
CHEM 446	Surface Chemistry of Materials
CHEM 447	Polymers and Coatings Laboratory I
CHEM 448	Polymers and Coatings Laboratory II
CHEM 449	Polymers and Coatings Internship
CHEM 450	Polymers and Coatings III
CHEM 451	Polymers and Coatings Laboratory III
CHEM 458	Instrumental Organic Qualitative Analysis
CHEM 463	Honors Research
CHEM 465	College Teaching Practicum
CHEM 470	Selected Advanced Topics
CHEM 474	Protein Techniques Laboratory
CHEM 477	Biochemical Pharmacology
CHEM 478	Pharmaceutical Development
CHEM 485	Cooperative Education Experience <sup>5</sup>
CHEM 495	Cooperative Education Experience <sup>5</sup>
CHEM 528	Nutritional Biochemistry
SCM 302	The Learn By Doing Lab Teaching Practicum
SCM 325	Genetic Engineering Technology
SCM 451	Ethics in the Sciences

#### SUPPORT COURSES

BIO 161	Introduction to Cell and Molecular Biology (B2) <sup>1</sup>	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III	4
MATH 241	Calculus IV	4
Select from the following:		3-4
CSC 232	Computer Programming for Scientists and Engineers	

CSC 234	C and Unix	
CSC 235	Fundamentals of Computer Science for Scientists and Engineers I	
MATH 206	Linear Algebra I	
MATH 244	Linear Analysis I	
STAT 218	Applied Statistics for the Life Sciences	
STAT 312	Statistical Methods for Engineers	
PHYS 141	General Physics IA	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
Physics elective (200-level and above)		3
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		56
<b>FREE ELECTIVES</b>		
Free Electives		6-9
<b>Total units</b>		180

- <sup>1</sup> Required in Major/Support; also satisfies GE.
- <sup>2</sup> Students should take CHEM 331 during their second year.
- <sup>3</sup> SCM 491 only for students pursuing Single-Subject Teaching Credential.
- <sup>4</sup> Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- <sup>5</sup> No more than 2 units may apply to approved advanced chemistry electives.
- <sup>6</sup> No more than 4 units may apply to approved advanced chemistry electives.

## Concentration

Students may select the following concentration instead of advanced approved biochemistry electives in Major Courses

- Polymers and Coatings (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/chemistrybiochemistry/biochemistry/polymersandcoatingsconcentration>)

## General Education (GE) Requirements

- 72 units required, 16 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Support) <sup>1</sup>	0
B2	Life Science (4 units in Support) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4

C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		56

<sup>1</sup> Required in Major/Support; also satisfies GE.

## MS Polymers and Coatings Science

### Required Courses

CHEM 544	Polymer Physical Chemistry and Analysis	3
CHEM 545	Polymer Synthesis and Mechanisms	3
CHEM 547	Polymer Characterization and Analysis Laboratory	2
CHEM 548	Polymer Synthesis Laboratory	2
CHEM 550	Coatings Formulation Principles	3
CHEM 551	Coatings Formulation Laboratory	2
CHEM 590	Graduate Seminar in Polymers and Coatings (1, 1, 1)	3
Select from the following:		9
CHEM 598	Graduate Project (3, 3, 3)	
CHEM 599	Graduate Thesis (3, 3, 3)	

### Approved Electives

18 units of advisor-approved electives (at least 3 units must be from 500 level). See department for list.	18
Total units	45

A complete project report or thesis must be submitted to the graduate committee. Guidelines on how to prepare report or thesis are available from the graduate coordinator.

## Kinesiology

Kinesiology Bldg. (43), Room 451

Phone: 805.756.2545

kinesiology.calpoly.edu

stride.calpoly.edu

Department Chair: J. Kevin Taylor

### Academic Programs

Program name	Program type
Kinesiology	BS, MS

The Kinesiology Department offers undergraduate and graduate degree programs in Kinesiology. The department also contributes to the general education and elective needs of all students by providing health education, first aid/CPR courses, two upper-division elective courses in GE Area D5 and other sub-disciplines in kinesiology (e.g., biomechanics, exercise physiology, and motor behavior). The curriculum and coursework in the Kinesiology Department is designed to meet the mission of preparing students to be leaders in the fields of physical activity, health, and disease prevention and treatment. The department sponsors annual professional development workshops for physical education and health teachers and athletic coaches.

The Kinesiology and Recreation Center complex provides laboratory, research and office space for the Kinesiology Department, and provides access to quality physical activity and sport facilities for students, faculty and staff.

The Kinesiology Department is also home to the STRIDE center (Science through Translational Research in Diet and Exercise). STRIDE is a university-wide, multidisciplinary, translational research consortium, initiated in 2007 by the Kinesiology Department. The STRIDE center provides students with unique opportunities to contribute to ongoing research in lifestyle enhancement and health.

### Undergraduate Program

#### BS Kinesiology

The BS in Kinesiology is a broad based program offering students training in the multiple sub-disciplines of kinesiology (biomechanics, exercise physiology, health, motor behavior and sport and exercise psychology/ sociology) and two professional tracks based on a common curriculum that incorporates the scientific and clinical knowledge of exercise science, health promotion, and nutrition as applied in preventive, clinical, commercial fitness, public health and educational settings. The courses in these two professional tracks provide additional depth of knowledge and coursework requirements to meet eligibility in pursuing certification in two different areas. The Exercise Science professional track prepares students for national exams for American College of Sports Medicine (ACSM) Certification. The Health Promotion professional track prepares students to meet the professional practice standards developed by the National Commission for Health Education Credentialing, Inc. and meets the competencies and seven responsibilities for Certified Health Education Specialists (CHES) as identified by the 2010 Health Education Job Analysis. Students who complete this professional track are eligible to take the CHES exam.

### Graduate Program

#### Master of Science Degree in Kinesiology General Characteristics

The degree program offers advanced study in kinesiology to prepare graduates to enter occupations that may require training beyond the bachelor's degree. The program is designed to strengthen the breadth and depth of the student's academic preparation in kinesiology and its sub-disciplines and improve competence for: a) positions in corporate/commercial, community, non-profit or government exercise and health promotion programs, b) teaching physical education, health or exercise science at the community college level, c) positions in obesity, diabetes and heart disease prevention in community, clinical or rehabilitative health care settings, d) independent research in the field of emphasis, and e) continued graduate study at doctoral granting institutions.

Two program options are available:

**Thesis Option:** 39 units of graduate committee approved coursework, 6 units of thesis research/project design, and successful completion of an oral defense of the thesis/project.

**Non-Thesis Option:** 45 units of graduate committee approved coursework and a comprehensive examination.

Most kinesiology graduate courses are offered every other year on a rotational basis. Students admitted with classified graduate standing can typically complete the program within two academic years. Applications to the program are currently accepted for Fall quarter admission only.

#### Prerequisites

Applicants to the program must have a bachelor's degree from an accredited institution with a minimum grade point average of 3.0 in the last 90-quarter units. Letters of recommendation from persons knowledgeable about the applicant's academic achievement and potential as a graduate student are required.

#### Classified Graduate Standing

For admission to the program with classified graduate standing, the applicant must have an undergraduate degree in kinesiology or the equivalent academic preparation as determined by the coordinator of the kinesiology graduate program. Applicants with a grade point average below the required 3.0 and an undergraduate degree in kinesiology may appeal to the graduate coordinator to be "conditionally" accepted. This procedure involves a review process and a specified contract to be successfully completed before admission to classified graduate standing. Special attention is focused upon student performance in undergraduate science and kinesiology coursework for applicants with a GPA below 3.0 requesting to be conditionally accepted.

#### Conditionally Classified Graduate Standing

Applicants to the program without an undergraduate degree in kinesiology or closely related academic preparation may be admitted to the program with conditionally classified graduate standing. Applicants with undergraduate deficiencies must remove these deficiencies through coursework or examination before Advancement to Candidacy and may complete this coursework while enrolled as a graduate student at Cal Poly.

Information regarding specific coursework prerequisites and application procedures for admission to the kinesiology master of science program is available on the department website at <http://kinesiology.calpoly.edu> or from the graduate program coordinator.

## Advancement to Candidacy

For Advancement to Candidacy a student shall have:

- successfully completed all conditionally classified requirements
- successfully completed the Graduation Writing Requirement
- filed a formal study plan
- maintained a minimum 3.0 GPA for all course work completed on the formal study plan

## Requirements for the Degree

The formal study plan must include 45 units of graduate committee approved coursework. The approved coursework on the formal study plan is designed to prepare the student to achieve his/her stated career objective. At least 30 of the units must be completed at the 500 level in Kinesiology.

All candidates must meet the current Graduation Writing Requirement.

Each candidate must successfully complete a comprehensive examination before the degree is granted. The examination can take one of two forms: (1) those students following the thesis option must successfully defend the thesis or project in an oral examination, or (2) those students following the non-thesis option must pass a comprehensive examination dealing with current general knowledge in the discipline of kinesiology and the application of coursework taken on the formal study plan.

*If the degree requirements are not completed within 7 years, the student will need to complete additional requirements as determined by the graduate committee. See the catalog for "Time Limit for Degree" for more information.*

Up to 15 units may be taken in 400/500-level courses outside of the Kinesiology Department with graduate committee approval provided these courses were not required as part of the undergraduate degree program. Only 12 units of 400-level kinesiology courses may be put on the formal study plan.

At least 32 units must be completed in residence and no more than 9 units of graduate committee approved extension courses may be included on the formal study plan.

## BS Kinesiology

### Program Learning Objectives

1. Demonstrate knowledge of the natural sciences within kinesiology, biomechanics, exercise physiology, motor behavior, and health.
2. Demonstrate knowledge of the social sciences within kinesiology, sociology, psychology, community health, and health promotion.
3. Understand and apply the principles of quantitative and qualitative research to the study and practice of human performance, physical activity, and health.
4. Demonstrate an understanding of diversity, social justice, and inclusion as it relates to physical activity and health.
5. Demonstrate proficiency in critical thinking, written and oral communication.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: Up to 4 units of major or support courses may be selected as credit/no credit.

### MAJOR COURSES

KINE 180	Orientation to Kinesiology	3
KINE 181	First Aid/CPR/AED	1
Select from the following:		1
KINE 208	Golf	
KINE 210	Tennis	
KINE 212	Racquetball	
KINE 213	Basketball	
KINE 214	Volleyball	
KINE 216	Wrestling	
KINE 221	Combatives / Self-Defense	
KINE 223	Cross Country and Track Events	
KINE 224	Field Events	
KINE 226	Soccer	
KINE 228	Cooperative Games and Activities	
KINE 229	Badminton	
KINE 230	Aquatic Fitness Activities	1
KINE 231	Leading Group Fitness Activities	2
KINE 250	Healthy Living (D4) <sup>1</sup>	4
or KINE 255	Personal Health: A Multicultural Approach	
or KINE 260	Women's Health Issues	
KINE 265	Introduction to Community and Public Health	4
KINE 266	Introduction to Psycho/Social Aspects of Physical Activity	4
KINE 298	Chronic and Communicable Disease Prevention	4
KINE 301	Functional Muscle Anatomy	2
KINE 302	Biomechanics	4
KINE 303	Physiology of Exercise	4
KINE 304	Pathophysiology and Exercise	3
KINE 311	Strength Training Instruction	1
KINE 319	Introduction to Research Methods in Kinesiology	4
KINE 320	Media and Technology in Science and Human Performance	4
KINE 402	Motor Learning and Control	4
KINE 407	Adapted Physical Activity	4
KINE 408	Exercise and Health Gerontology	4
KINE 434	Health Promotion Program Planning I	4
KINE 449	Exercise Prescription and Leadership	4
KINE 451	Nutrition for Fitness and Sport	3
KINE 452	Exercise Testing and Prescription for Fitness Specialists	4
KINE 453	Lifestyle Prescriptions for Wellness	3



KINE 460 or KINE 461 or KINE 462	Experiential Senior Project Senior Project Report Research Honors Senior Project	1-4
KINE 463	Exercise Science and Health Promotion Fieldwork	1-3

**SUPPORT COURSES**

BIO 111 or BIO 161	General Biology (B2&B4) <sup>1</sup> Introduction to Cell and Molecular Biology	4
CHEM 111 or CHEM 127	Survey of Chemistry (B3&B4) <sup>1</sup> General Chemistry for Agriculture and Life Science I	4-5
FSN 210	Nutrition	4
MATH 119	Precalculus Trigonometry (B1) <sup>1</sup>	4
PHYS 121	College Physics I	4
STAT 217 or STAT 218	Introduction to Statistical Concepts and Methods (B1) <sup>1</sup> Applied Statistics for the Life Sciences	4
ZOO 331	Human Anatomy and Physiology I <sup>2</sup>	5
ZOO 332	Human Anatomy and Physiology II <sup>3</sup>	5
Select from the following approved electives: <sup>4</sup>		3-4
KINE 308	Motor Development	
KINE 406	Neuroanatomy	
KINE 446	Echocardiography	
KINE 454	Exercise Metabolism	

Select one of the following professional preparation tracks: 10-11

Exercise Science Professional Preparation Track <sup>5</sup>	
KINE 308	Motor Development
KINE 401	Managing Kinesiology Programs
KINE 445	Electrocardiography
Health Promotions Professional Preparation Track <sup>6</sup>	
KINE 305	Drug Education
KINE 435	Health Promotion Program Planning II
KINE 450	Worksite Health Promotion Programs

**GENERAL EDUCATION (GE)**

(See GE program requirements below.) 52

**FREE ELECTIVES**

Free Electives	0-3
<b>Total units</b>	<b>180</b>

<sup>1</sup> Required in Major/Support; also satisfies GE.<sup>2</sup> Transfer equivalent is ZOO 231.<sup>3</sup> Transfer equivalent is ZOO 232.<sup>4</sup> KINE majors should select one course from these approved electives in consultation with their academic advisor.<sup>5</sup> Students who are interested in pursuing American College of Sports Medicine (ACSM) Certification should follow this track.<sup>6</sup> Students who are interested in pursuing Certified Health Education Specialist (CHES) Certification should follow this track.**General Education (GE) Requirements**

- 72 units required, 20 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective (no KINE course)	4
Area F	Technology	
F	Upper-division elective	4
<b>Total units</b>		<b>52</b>

<sup>1</sup> Required in Major/Support; also satisfies GE.**MS Kinesiology****Curriculum for MS Kinesiology - Thesis Option****Required Courses**

KINE 501	Evaluation of Literature and Current Trends in Kinesiology	3
KINE 511	Administration and Leadership in Kinesiology	3
KINE 517	Research Methods in Kinesiology	3
Select from the following:		12
KINE 503	Current Health Issues	
KINE 522	Advanced Biomechanics	
KINE 525	Advanced Motor Learning and Control	
KINE 526	Sport and Exercise Psychology	
KINE 530	Advanced Physiology of Exercise	
KINE 539	Effective Practice in Teaching and Coaching	

Approved 400-500 electives	12
Select from the following:	12
KINE 518      Research Prospectus and Proposal Writing	
KINE 599      Thesis or Project (3, 3)	
STAT 513      Applied Experimental Design and Regression Models	
Elective appropriate for thesis research or applied project (4)	
Total units	45

## Curriculum for MS Kinesiology - Non-Thesis Option

### Required Courses

KINE 501	Evaluation of Literature and Current Trends in Kinesiology	3
KINE 511	Administration and Leadership in Kinesiology	3
KINE 517	Research Methods in Kinesiology	3
Select from the following:		12-20
KINE 503	Current Health Issues	
KINE 522	Advanced Biomechanics	
KINE 525	Advanced Motor Learning and Control	
KINE 526	Sport and Exercise Psychology	
KINE 530	Advanced Physiology of Exercise	
KINE 539	Effective Practice in Teaching and Coaching	
Approved 400-500 electives		12-20
STAT 512	Statistical Methods	4
Comprehensive Exam is Required		
<b>Total units</b>		<b>45</b>

For more detailed information or advisement, contact the Kinesiology graduate program coordinator.

# Liberal Studies, an Undergraduate Teacher Preparation Program

Faculty Offices East (Bldg. 25), Room 125B

Phone: 805.756.2935; Fax: 805.756.2967

liberalstudies.calpoly.edu

Department Chair: Lola Berber-Jimenez

## Academic Program

Program name	Program type
Liberal Studies	BS

Liberal Studies is Cal Poly's pre-professional Teacher Preparation Program leading to enrollment in a multiple subject credential program. The mission of Liberal Studies is to ensure that students are prepared to teach competently and professionally each of the seven content areas in the state-mandated curriculum (K-8). These include language arts, mathematics, science, history/social sciences, visual and performing arts, health/physical education and human development. Liberal Studies provides the educational experience and preparation best suited for the prospective elementary teacher.

Faculty from the following disciplines help to offer the required curriculum in the major: Art and Design, Biological Sciences, English, Ethnic Studies, History, Kinesiology, Mathematics, Music, Philosophy, Political Science, Physics, Psychology and Child Development, Social Sciences, Statistics, Theatre, and Education.

## Undergraduate Program

### BS Liberal Studies

A depth of study is required of all students seeking a multiple subject credential by the California Commission on Teaching Credentialing. Liberal Studies majors select one of the following concentrations or, with prior approval from the department chair, an individualized course of study.

- Biology
- Child Development
- English
- History/Social Sciences
- Mathematics
- Physical Sciences
- Spanish
- Teaching English as a Second Language

## BS Liberal Studies

### Program Learning Objectives

Upon graduating, Liberal Studies students will:

1. Demonstrate an understanding of the physical, social and cognitive development of children.
2. Develop a strong understanding of the conceptual foundation of each of the following subjects as well as how knowledge is created and organized: Reading, Language and Literacy,

History and Social Science, Mathematics, Science, Visual and Performing Arts, and Physical Education and Health.

3. Develop knowledge of best teaching and learning practices specific to each discipline with a focus of metacognition.
4. Demonstrate effective oral, written and interpersonal communication skills in a variety of contexts including the use of appropriate technology.
5. Demonstrate the ability to integrate the content of one discipline into another through the development of projects across subject matter areas.
6. Synthesize and integrate information that promotes personal and professional growth in the field of education.
7. Demonstrate ability to engage in change, tolerance and inclusion, advance principles of social justice, equity and ethical practice.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: Up to 4 units of major, support or concentration courses may be selected as credit/no credit.

### MAJOR COURSES

LS 101	Introduction to Liberal Studies	2
LS 211	Visual Arts in the Elementary Classroom	4
LS 214	Constitutional Issues in the History of U.S. and California Education	4
LS 230	Field Experience in the Elementary Classroom I	2
LS 250	Field Experience in the Elementary Classroom II	2
LS/ENGL 260	Children's Literature	4
LS 310	Storytelling: Modern Applications of Traditional Narrative	4
LS 370	Integration of Visual and Performing Arts Standards in the Elementary Classroom	4
LS 410	Subject Matter Seminar	4
or LS 412	Advanced Visual Arts in the Elementary Classroom	
LS 461	Senior Project Seminar	4
or LS 462	Senior Project Research	
ASTR 101	Introduction to the Solar System (B3) <sup>1</sup>	4
BIO 111	General Biology (B2&B4) <sup>1</sup>	4
BIO 211	Biology of Plants and Animals	4
ENGL 391	Topics in Applied Linguistics	4
GEOG 308	Global Geography (D5) <sup>1</sup>	4
HIST 208	Survey of California History (USCP)	4
HIST 210	World History I (D3) <sup>1, 2</sup>	4
KINE 310	Concepts and Applications in Elementary Physical Education	3
KINE 443	Health Education for Teachers	4

MATH 227	Mathematics for Elementary Teaching I (B1) <sup>1</sup>	4
MATH 328	Mathematics for Elementary Teaching II	4
MATH 329	Mathematics for Elementary Teaching III	4
MATH 330	Algebraic Thinking with Technology	4
PSC 101	Matter and Energy (B3&B4) <sup>1</sup>	4
PSC 102	Atoms and Molecules	4
PSC 103	The Physical Environment: Earth	4
PSY 201/202	General Psychology (D4) <sup>1</sup>	4
STAT 130	Statistical Reasoning (B1) <sup>1</sup>	4
or STAT 217	Introduction to Statistical Concepts and Methods	
Concentration or individualized course of study		18-20
<b>SUPPORT COURSES</b>		
CD/EDUC 207	The Learner's Development, Culture and Identity in Educational Settings	4
EDUC 427	Theories, Methods, and Assessment of First and Second Language Acquisition in Schools <sup>3</sup>	4
EDUC 428	Foundations of K-8 Literacy Teaching and Learning in Schools with Diverse Populations <sup>3</sup>	4
<b>GENERAL EDUCATION</b>		
(See GE program requirements below.)		40
<b>FREE ELECTIVES</b>		
Free Electives		3-5
Total units		180

<sup>1</sup> Required in Major; also satisfies GE.

<sup>2</sup> Students in the History/Social Sciences concentration, may substitute with HIST 221.

<sup>3</sup> Prerequisite for Multiple Subject Credential program at Cal Poly. For a credential program elsewhere, check the prerequisites for that institution.

## Concentrations

Students may select one of the following concentrations or the individualized course of study.

- Biology
- Child Development
- English
- History/Social Sciences
- Mathematics
- Physical Sciences
- Spanish
- Teaching English as a Second Language

## Individualized Course of Study

With department chair approval, students may pursue a course of study which meets their individual needs and interests; this must be initiated early and all courses must be pre-approved. The individualized course of study consists of 18-20 units with at least one course at the 300-400 level. Courses are selected by the student in consultation with an advising faculty member. The list of courses is a contract between the student and the department.

## General Education (GE) Requirements

- 72 units required, 32 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

<b>Area A Communication</b>		
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B Science and Mathematics</b>		
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science (4 units in Major) <sup>1</sup>	0
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
B5	Area B elective (select one course from B1-B5) (4 units in Major) <sup>1</sup>	0
<b>Area C Arts and Humanities</b>		
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
<b>Area D/E Society and the Individual</b>		
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions (4 units in Major) <sup>1</sup>	0
D4	Self Development (CSU Area E) (4 units in Major) <sup>1</sup>	0
D5	Upper-division elective (4 units in Major) <sup>1</sup>	0
<b>Area F Technology</b>		
F	Upper-division elective	4
Total units		40

<sup>1</sup> Required in Major; also satisfies GE.

## Courses Needed for Multiple Subject Credential

EDUC 429	Learning to Teach K-8 Literacy in Schools with Diverse Populations	3
EDUC 431	Learning to Teach K-8 Social Studies with Diverse Populations	3
EDUC 435	Learning to Teach K-8 Mathematics with Diverse Populations	3
EDUC 436	Learning to Teach K-8 Science with Diverse Populations	3
EDUC 438	Clinical Practice I	4
EDUC 439	Multiple Subject Clinical Practice Seminar I	2
EDUC 440	Educating Individuals with Exceptional Needs	4
EDUC 450	Teaching Performance Assessment Seminar	1
EDUC 454	Multiple Subject Clinical Practice II	8

EDUC 455	Multiple Subject Clinical Practice Seminar II	3
EDUC 456	Multiple Subject Clinical Practice III	12
EDUC 457	Multiple Subject Clinical Practice Seminar III	3
Total units		49

## Biology Concentration

BIO 302	Human Genetics	4
BOT 326	Plant Ecology	4
MCRO 221	Microbiology	4
Select from the following:		8
BIO 305	Biology of Cancer	
BIO 307	World Aquaculture: Applications, Methodologies and Trends	
BIO 440	Communicating Ocean Sciences to Informal Audiences	
BOT 311	Plants, People and Civilization	
ZOO 331	Human Anatomy and Physiology I	
ZOO 332	Human Anatomy and Physiology II	
ZOO 335	General Entomology	
Total units		20

## Child Development Concentration

CD 305	Early and Middle Childhood Development	4
CD 306	Adolescence	4
CD 350	Developmental Issues in Education	4
CD 424	Children's Learning in Families and Communities	4
Select from the following:		4
PSY 421	Language and Cognitive Development	
PSY 456	Behavioral Disorders in Childhood	
PSY 460	Child Abuse and Neglect	
Total units		20

## English Concentration

ENGL 302 or ENGL 317	Writing: Advanced Composition Technical Editing	4
ENGL 339	Introduction to Shakespeare	4
ENGL 365	Complexities of Literacy in Literature and Non-fiction Text	4
ENGL 390	The Linguistic Structure of Modern English	4
Select from the following:		4
<b>British Literature</b>		
ENGL 330	British Literature in the Age of Belief: to 1485	
ENGL 331	British Literature in the Age of Discovery: 1485-1660	
ENGL 332	British Literature in the Age of Enlightenment: 1660-1798	
ENGL 333	British Literature in the Age of Romanticism: 1798-1832	
ENGL 334	British Literature in the Age of Industrialism: 1832-1914	

ENGL 335	British Literature in the Age of Modernism: 1914-Present	
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### American Literature

ENGL 340	The Literary Sources of the American Character: 1600-1865	
ENGL 341	The Literary Sources of the American Character: 1865-1914	
ENGL 342	The Literary Sources of the American Character: 1914-1956	
ENGL 343	Multiple Voices of Contemporary American Literature	
ENGL 345	Women Writers of the Twentieth Century	
ENGL 346	Ethnic American Literature	
ENGL 347	African American Literature	

### Modern English

ENGL 350	The Modern Novel	
ENGL 351	Modern Poetry	
ENGL 352	Modern Drama	

Total units 20

## History/Social Sciences Concentration

HIST 322	Modern America	4
Select from the following World History courses:		4
HIST 221	World History, Beginnings to 1000 <sup>1</sup>	
HIST 222	World History, 1000 - 1800	
HIST 223	World History, 1800 - Present	
Select from the following U.S. Government courses:		4
POLS 112	American and California Government	
POLS 315	The American Presidency	
POLS 319	United States Congress	
POLS 348	Early American Political Thought	
POLS 349	Contemporary American Political Thought	
Select from the following World Civilization or World Culture courses:		4
HIST 307	European Thought 1800-2000	
HIST 310	East Asian Culture and Civilization	
HIST 314	Middle East	
HIST 316	Modern East Asia	
HIST 319	Modern South and Southeast Asia	
HIST 334	Modern Europe, 1789-1914	
HIST 335	Modern Europe, 1914-Present	
HIST 340	Modern Latin America	
HIST 341	Modern Central America	
Select from the following Sociology courses:		4
SOC 309	The World System and Its Problems	
SOC 315	Global Race and Ethnic Relations	
SOC 316	American Ethnic Minorities	

Total units 20

<sup>1</sup> If course is taken to meet a requirement in the major, it may not be double-counted in the concentration.



## Mathematics Concentration

MATH 141	Calculus I	4
MATH 142	Calculus II	4
MATH 143	Calculus III	4
MATH 248	Methods of Proof in Mathematics	4
Select from the following:		4
MATH 300	Technology in Mathematics Education	
MATH 341	Theory of Numbers	
MATH 419	Introduction to the History of Mathematics	
MATH 442	Euclidean Geometry	
Total units		20

## Physical Sciences Concentration

Students must take at least one course at the 300-400 level in the concentration.

Select from the following Chemistry courses:		4-5
CHEM 111	Survey of Chemistry	
CHEM 124	General Chemistry for the Engineering Disciplines I	
CHEM 127	General Chemistry for Agriculture and Life Science I	
Select from the following Physics courses:		2-4
PHYS 111	Contemporary Physics for Nonscientists	
PHYS 115	Physics of Sound and Music	
PHYS 330	Teaching Physics	
Select courses from one of the following areas:		11-14
Chemistry		
CHEM 312	Survey of Organic Chemistry	
CHEM 313	Survey of Biochemistry and Biotechnology	
CHEM 349	Chemical and Biological Warfare	
CHEM 377	Chemistry of Drugs and Poisons	
Geosciences		
ASTR 102	Introduction to the Stars and Galaxies	
ASTR 324	Longitude, Navigation, and Timekeeping	
ERSC 223	Rocks and Minerals	
GEOL 102	Introduction to Geology	
GEOL 203	Fossils and the History of Life	
GEOL 204	Geologic History of California	
GEOL 205	Earthquakes	
PHYS 107	Introduction to Meteorology	
PSC 201	Physical Oceanography	
Physics		
PHYS 121	College Physics I	
PHYS 122	College Physics II	
PHYS 123	College Physics III	
PSC 320	Energy, Society and the Environment	
Total units		20

## Spanish Concentration

SPAN 202	Intermediate Spanish II	4
SPAN 203	Intermediate Spanish III	4
or SPAN 206	Spanish for Heritage Speakers	
SPAN 233	Introduction to Hispanic Readings	4
Select from the following:		8
SPAN 301	Advanced Composition in Spanish	
SPAN 302	Advanced Conversation and Composition in Spanish	
SPAN 303	Introduction to English-Spanish Translation	
SPAN 305	Significant Works in Spanish	
SPAN 307	Spanish and Latin American Film	
SPAN 340	Chicano/a Authors	
SPAN 350	Hispanic Literature in English Translation	
SPAN 351	Chicano/Latino Writers in the United States	
SPAN 390	Introduction to Creative Writing in Spanish	
SPAN 402	Advanced Linguistics in Spanish	
SPAN 410	Advanced Literature in Spanish	
SPAN 416	Don Quixote	
SPAN 470	Selected Advanced Topics	
HUM 310	Humanities in World Cultures (Topic = Culture of Mexico, Culture of Spain, or Latin American Culture)	
HUM 312	Humanities in Chicano/a Culture	
MLL 470	Selected Advanced Topics	
Total units		20

## Teaching English as a Second Language Concentration

COMS 416	Intercultural Communication	4
ENGL 390	The Linguistic Structure of Modern English	4
ENGL 497	Theories of Language Learning and Teaching	4
ENGL 498	Approaches to Teaching English as a Second Language/Dialect	4
ENGL 499	Practicum in Teaching English as a Second Language/Dialect	2
Total units		18

# Mathematics

Faculty Offices East Bldg. (25), Room 208

Phone: 805.756.2206

[www.math.calpoly.edu](http://www.math.calpoly.edu)

Department Chair: Joseph E. Borzellino

## Academic Programs

Program name	Program type
Mathematics	BS, MS, Minor

The Mathematics Department offers a complete undergraduate program of courses leading to a Bachelor of Science degree in mathematics. It also offers a program of courses for students who wish to minor in mathematics, as well as graduate courses for programs of study leading to a Master of Science degree. The mix of pure and applied mathematics in these courses increases both the usefulness of and the demand for graduates with a degree in mathematics. In addition, the Mathematics Department offers courses that serve all departments in the university.

The rich variety of courses available in the department permits the student not only to obtain a broad exposure to those fields of mathematics which are most useful in the physical sciences and engineering, but also to obtain experience with the mathematics that is used in business, management sciences, and operations research.

Satisfactory completion of the Entry Level Mathematics (ELM) requirement is a prerequisite for enrollment in all mathematics courses except MATH 100 and MATH 104. For additional mathematics placement (MAPE) information visit the Academic Standards and Policies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/academicplacement>) section.

## Undergraduate Programs

### BS Mathematics

The undergraduate program for math majors contains a central core of courses. These courses give a solid basis for advanced work that is tailored to fit the needs and objectives of each individual student. Advanced coursework is chosen in close consultation with faculty advisors.

### Concentrations

The General Curriculum in Mathematics is not a concentration, and is the default curriculum required for students who do not declare a concentration. The general curriculum and all of the concentrations provide a strong mathematical foundation for the student contemplating the pursuit of an advanced degree in mathematics.

### Applied Mathematics

Provides a curriculum with an emphasis on application to the physical sciences and engineering. This concentration benefits students who are interested in the use of mathematics within areas such as engineering, computer science, physics, aeronautics, astronomy, and the geosciences. Potential career paths include pursuit of advanced degrees in any of the above fields or in applied mathematics, as well as industrial jobs where physical processes are modeled by ordinary and partial differential equations.

## Pure Mathematics

A broad and rigorous curriculum designed both for students who will pursue an advanced degree in mathematics as well as those who choose careers requiring significant mathematical training. Graduates of the program are well prepared to enter graduate programs in mathematics and capable of bringing a broad range of mathematical skills and expertise to a wide range of professional careers.

## Mathematics Teaching

Students wishing to prepare for a career teaching mathematics in middle or senior high school should choose the concentration in teaching. The courses in the concentration, coupled with the other required courses in the major, fulfill the prerequisites for the California Commission on Teacher Credentialing.

## Mathematics Minor

Students may earn a minor in mathematics by completing a coordinated course of study. The program consists of a core of required courses, followed by two tracks of advanced work, to be chosen in concert with a student's career objectives. Interested students should contact the Mathematics Department for individual advisement.

## Graduate Program

### Master of Science Degree in Mathematics

#### General Characteristics

The master of science program in mathematics prepares students to enter careers in government, industry or teaching. A student who completes the degree is qualified and eligible to teach at the community college level. Many of the graduates of the program also pursue further graduate study at Ph.D.-granting institutions.

#### Prerequisites

Prerequisite to entering the program with a classified or conditionally classified status, the student must have a bachelor's degree from an accredited institution with a minimum grade point average of 2.5 in the last 90 quarter units attempted. Applicants with majors in other areas or applicants with deficiencies in their undergraduate background may be admitted conditionally. For information concerning additional requirements, the student should contact the Graduate Coordinator in the Mathematics Department.

Advancement to candidacy requires completion of 12 units of an approved study plan with a minimum grade point average of 3.0 and satisfactory completion of the preliminary examinations in analysis and algebra.

## Blended BS+MS Mathematics

The blended program provides motivated students with an efficient way to complete a BS and MS in mathematics with both degrees being conferred simultaneously. Students are provided with ample advising to ensure a seamless transition from undergraduate to graduate status.

### Eligibility

Students majoring in mathematics may apply for the blended program as early as their junior year after completing at least two upper-division mathematics classes and before they have completed 180

units. The Graduate Committee evaluates each applicant individually. Acceptance into the program is based on prior academic performance and the applicant's promise to successfully complete the master's program. See General Policies Governing Graduate Studies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation/#generalpoliciesgoverninggraduatestudies>) for additional eligibility criteria.

## Program of Study

Students must complete the requirements of both the undergraduate and master's program of study for a total of 225 units. However, they are advised to take the undergraduate courses most suitable as preparation for the master's program. They should take the graduate preliminary written examinations at the time they complete the appropriate courses, even possibly before they have graduate status. Finally, the senior project, if sufficiently complex, may be extended into a graduate thesis. This last option is particularly attractive to students participating in one of the many undergraduate summer research programs available at either Cal Poly or other universities, since the research can then be used as a basis for the senior project and master's thesis.

## BS Mathematics

### Program Learning Objectives

1. Understand the nature of mathematical proof and be able to write clear and concise proofs.
2. Develop the ability to read, understand, and use basic definitions in linear and abstract algebra and real analysis, and be able to prove simple consequences of these definitions.
3. Be able to use standard mathematical techniques to solve elementary problems.
4. Be able to communicate effectively in oral and written form.
5. Be able to write simple computer programs to perform mathematical computations.
6. Gain experience exploring open-ended problems, learn to make conjectures, and gather evidence to support or refute these conjectures.
7. Develop the ability to read and to learn mathematics independently.
8. Learn about applications of mathematics in other fields and gain experience in mathematical modeling.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major, support or concentration courses may be taken as credit/no credit.

### MAJOR COURSES

MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III	4
MATH 202	Orientation to Mathematics Major	1
MATH 206	Linear Algebra I	4
MATH 241	Calculus IV	4
MATH 242	Differential Equations I	4
MATH 248	Methods of Proof in Mathematics	4
MATH 306	Linear Algebra II	4
MATH 412	Introduction to Analysis I	4
MATH 459	Senior Seminar	4
or MATH 460	Applied Math Senior Seminar	
MATH 461	Senior Project I	2
MATH 462	Senior Project II	2
MATH 481	Abstract Algebra I	4
PHYS 141	General Physics IA	4
Select from the following: <sup>1</sup>		4
PHYS 132	General Physics II (B3 & B4)	
PHYS 133	General Physics III (B3 & B4)	

General Curriculum or Concentration <sup>2</sup> 48/56/52/52

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 60

### FREE ELECTIVES

Free Electives <sup>2</sup> 15/7/11/11

Total units 180

<sup>1</sup> Required in Major; also satisfies GE.

<sup>2</sup> General Curriculum/Applied Concentration/Pure Concentration/Mathematics Teaching Concentration.

### General Curriculum in Mathematics or Concentrations (select one)

- General Curriculum (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/mathematics/bsmathematics/generalcurriculum>)
- Applied Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/mathematics/bsmathematics/appliedmathematicsconcentration>)
- Pure Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/mathematics/bsmathematics/puremathematicsconcentration>)
- Mathematics Teaching (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/mathematics/bsmathematics/mathematicsteachingconcentration>)

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) .
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Major/Support) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Support) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course <sup>1</sup>	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Major; also satisfies GE.

## General Curriculum in Mathematics

This is the default curriculum required for students who do not declare a concentration.

CSC/CPE 101	Fundamentals of Computer Science I	4
or CSC/CPE 235	Fundamentals of Computer Science for Scientists and Engineers I	
STAT 301	Statistics I	4
or STAT 325	Introduction to Probability Models	
or STAT 425	Probability Theory	
MATH 336	Combinatorial Math	4

### Tracks

Choose three tracks from the following list, with at least one track chosen from the first two tracks listed. A track consists of two paired courses representing depth of study with a particular focus.

MATH 413	Introduction to Analysis II	
& MATH 414	and Introduction to Analysis III	
MATH 406	Linear Algebra III	
& MATH 482	and Abstract Algebra II	
MATH 304	Vector Analysis	
& MATH 404	and Introduction to Differential Geometry	
MATH 335	Graph Theory	
& MATH 435	and Discrete Mathematics with Applications I	
MATH 344	Linear Analysis II	
& MATH 416	and Differential Equations II	
or MATH 418	Partial Differential Equations	
MATH 350	Mathematical Software	
& MATH 341	and Theory of Numbers	
or MATH 344	Linear Analysis II	
MATH 408	Complex Analysis I	
& MATH 409	and Complex Analysis II	
MATH 437	Game Theory	
& MATH 453	and Numerical Optimization	
MATH 440	Topology I	
& MATH 441	and Topology II	
MATH 442	Euclidean Geometry	
& MATH 443	and Modern Geometries	
MATH 451	Numerical Analysis I	
& MATH 452	and Numerical Analysis II	
Select from the following approved electives:		12
MATH 304	Vector Analysis	
MATH 335	Graph Theory	
MATH 341	Theory of Numbers	
MATH 344	Linear Analysis II	
MATH 350	Mathematical Software	
MATH 404	Introduction to Differential Geometry	
MATH 406	Linear Algebra III	
MATH 408	Complex Analysis I	
MATH 409	Complex Analysis II	
MATH 413	Introduction to Analysis II	
MATH 414	Introduction to Analysis III	
MATH 416	Differential Equations II	
MATH 418	Partial Differential Equations	
MATH 419	Introduction to the History of Mathematics	
MATH 435	Discrete Mathematics with Applications I	
MATH 436	Discrete Math with Applications II	
MATH 437	Game Theory	
MATH 440	Topology I	
MATH 441	Topology II	
MATH 442	Euclidean Geometry	
MATH 443	Modern Geometries	
MATH 451	Numerical Analysis I	
MATH 452	Numerical Analysis II	
MATH 453	Numerical Optimization	
MATH 470	Selected Advanced Topics	
MATH 482	Abstract Algebra II	
CSC/CPE 102	Fundamentals of Computer Science II	

CSC/CPE 103	Fundamentals of Computer Science III	
CSC/CPE 236	Fundamentals of Computer Science for Scientists and Engineers II	
CSC/CPE 349	Design and Analysis of Algorithms	
PHYS 132	General Physics II	
PHYS 133	General Physics III	
PHYS 211	Modern Physics I	
PHYS 301	Thermal Physics I	
PHYS 302	Classical Mechanics I	
PHYS 322	Vibrations and Waves	
PHYS 323	Optics	
PHYS 405	Quantum Mechanics I	
PHYS 408	Electromagnetic Fields and Waves I	
STAT 301	Statistics I	
STAT 302	Statistics II	
STAT 325	Introduction to Probability Models	
STAT 425	Probability Theory	
STAT 426	Estimation and Sampling Theory	
STAT 427	Mathematical Statistics	
Total units		48

## Applied Mathematics Concentration

CSC/CPE 101	Fundamentals of Computer Science I	4
or CSC/CPE 235	Fundamentals of Computer Science for Scientists and Engineers I	
MATH 304	Vector Analysis	4
MATH 344	Linear Analysis II	4
MATH 350	Mathematical Software	4
or CSC/CPE 102	Fundamentals of Computer Science II	
or CSC/CPE 236	Fundamentals of Computer Science for Scientists and Engineers II	
MATH 413	Introduction to Analysis II	4
MATH 451	Numerical Analysis I	4
STAT 301	Statistics I	4
or STAT 325	Introduction to Probability Models	
or STAT 425	Probability Theory	
Choose two tracks from the following list. A track consists of two paired courses representing depth of study with a particular focus.		16
MATH 408 & MATH 409	Complex Analysis I and Complex Analysis II	
MATH 416 & MATH 418	Differential Equations II and Partial Differential Equations	
MATH 452 & MATH 453	Numerical Analysis II and Numerical Optimization	
Approved Electives <sup>1</sup>		12

Select one of the following categories, with at least one course at the 300 level or above. <sup>2</sup>

### Category 1:

ASTR 301 The Solar System

ASTR 302	Stars and Galaxies
ASTR 326	Cosmology
PHYS 132	General Physics II
PHYS 133	General Physics III
PHYS 211	Modern Physics I
PHYS 301	Thermal Physics I
PHYS 302	Classical Mechanics I
PHYS 303	Classical Mechanics II
PHYS 317	Special Theory Relativity
PHYS 322	Vibrations and Waves
PHYS 323	Optics
PHYS 405	Quantum Mechanics I
PHYS 408	Electromagnetic Fields and Waves I
PHYS 412	Solid State Physics
PHYS 417	Nonlinear Dynamical Systems

### Category 2:

STAT 302	Statistics II
STAT 323	Design and Analysis of Experiments I
STAT 324	Applied Regression Analysis
STAT 325	Introduction to Probability Models
STAT 330	Statistical Computing with SAS
STAT 331	Statistical Computing with R
STAT 416	Statistical Analysis of Time Series
STAT 417	Survival Analysis Methods
STAT 418	Analysis of Cross-Classified Data
STAT 419	Applied Multivariate Statistics
STAT 421	Survey Sampling and Methodology
STAT 423	Design and Analysis of Experiments II
STAT 425	Probability Theory
STAT 426	Estimation and Sampling Theory
STAT 427	Mathematical Statistics

### Category 3:

CSC/CPE 102	Fundamentals of Computer Science II
or CSC/CPE 236	Fundamentals of Computer Science for Scientists and Engineers II
CSC/CPE 103	Fundamentals of Computer Science III
CSC/CPE 225	Introduction to Computer Organization
CSC/CPE 349	Design and Analysis of Algorithms
CSC/CPE 357	Systems Programming
CSC/CPE 448	Bioinformatics Algorithms

### Category 4:

ME 211	Engineering Statics
ME 212	Engineering Dynamics
ME 302	Thermodynamics I
ME 326	Intermediate Dynamics
ME 341	Fluid Mechanics I

### Category 5:



ECON 311	Intermediate Microeconomics I	
ECON 313	Intermediate Macroeconomics	
ECON 408	Mathematical Economics	
Total units		56

- 1 Consultation with advisor is recommended prior to selecting approved electives; bear in mind your selections may impact pursuit of post-baccalaureate studies and/or goals.
- 2 Other choices are also possible, and should be pre-approved in consultation with academic advisor. Approved electives are to be taken outside of the Mathematics department and should have significant applications to mathematics.

## Mathematics Teaching Concentration

CSC/CPE 101	Fundamentals of Computer Science I	4
or CSC/CPE 235	Fundamentals of Computer Science for Scientists and Engineers I	
SCM 300	Early Field Experience	4
MATH 300	Technology in Mathematics Education	4
STAT 301	Statistics I	4
STAT 302	Statistics II	4
or STAT 325	Introduction to Probability Models	
or STAT 425	Probability Theory	
MATH 336	Combinatorial Math	4
MATH 341	Theory of Numbers	4
MATH 419	Introduction to the History of Mathematics	4
MATH 423	Advanced Mathematics for Teaching	4
MATH 442	Euclidean Geometry	4
MATH 443	Modern Geometries	4
MATH 482	Abstract Algebra II	4
Select from the following:		4
CSC/CPE 102	Fundamentals of Computer Science II	
CSC/CPE 236	Fundamentals of Computer Science for Scientists and Engineers II	
MATH 304	Vector Analysis	
MATH 335	Graph Theory	
MATH 344	Linear Analysis II	
MATH 406	Linear Algebra III	
MATH 408	Complex Analysis I	
MATH 413	Introduction to Analysis II	
MATH 416	Differential Equations II	
MATH 435	Discrete Mathematics with Applications I	
MATH 437	Game Theory	
MATH 440	Topology I	
MATH 451	Numerical Analysis I	
MATH 470	Selected Advanced Topics	
PHYS 132	General Physics II	
PHYS 133	General Physics III	
PHYS 302	Classical Mechanics I	
Total units		52

## Pure Mathematics Concentration

MATH 336	Combinatorial Math	4
MATH 408	Complex Analysis I	4
MATH 413	Introduction to Analysis II	4
MATH 440	Topology I	4
MATH 482	Abstract Algebra II	4
Select from the following:		12
MATH 406	Linear Algebra III	
MATH 409	Complex Analysis II	
MATH 414	Introduction to Analysis III	
MATH 435	Discrete Mathematics with Applications I	
MATH 441	Topology II	
Select from the following:		8
CSC/CPE 101	Fundamentals of Computer Science I	
or CSC/CPE 235	Fundamentals of Computer Science for Scientists and Engineers I	
MATH 350	Mathematical Software	
STAT 301	Statistics I	
or STAT 325	Introduction to Probability Models	
or STAT 425	Probability Theory	
Select from the following:		12
MATH 304	Vector Analysis	
MATH 335	Graph Theory	
MATH 341	Theory of Numbers	
MATH 344	Linear Analysis II	
MATH 350	Mathematical Software	
MATH 404	Introduction to Differential Geometry	
MATH 406	Linear Algebra III	
MATH 409	Complex Analysis II	
MATH 414	Introduction to Analysis III	
MATH 416	Differential Equations II	
MATH 418	Partial Differential Equations	
MATH 435	Discrete Mathematics with Applications I	
MATH 436	Discrete Math with Applications II	
MATH 437	Game Theory	
MATH 441	Topology II	
MATH 451	Numerical Analysis I	
MATH 452	Numerical Analysis II	
MATH 453	Numerical Optimization	
MATH 470	Selected Advanced Topics	

Total units 52

## Mathematics Minor

### Required Courses

MATH 206	Linear Algebra I	4
or MATH 244	Linear Analysis I	
MATH 248	Methods of Proof in Mathematics	4

### Complete two tracks

A track consists of two courses from one of the groups A-L. Completion of four courses in either group A, H, or L is considered two tracks. Some tracks have additional mathematics prerequisites.

16

Group A	
MATH 304	Vector Analysis
MATH 344	Linear Analysis II
MATH 350	Mathematical Software
MATH 416	Differential Equations II
MATH 418	Partial Differential Equations
Group B	
MATH 304	Vector Analysis
MATH 404	Introduction to Differential Geometry
Group C	
MATH 306	Linear Algebra II
MATH 406	Linear Algebra III
Group D	
MATH 335	Graph Theory
MATH 336	Combinatorial Math
MATH 437	Game Theory
Group E	
MATH 408	Complex Analysis I
MATH 409	Complex Analysis II
Group F	
MATH 412	Introduction to Analysis I
MATH 413	Introduction to Analysis II
Group G	
MATH 435	Discrete Mathematics with Applications I
MATH 436	Discrete Math with Applications II
Group H	
MATH 306	Linear Algebra II
MATH 437	Game Theory
MATH 451	Numerical Analysis I
MATH 453	Numerical Optimization
Group I	
MATH 440	Topology I
MATH 441	Topology II
Group J	
MATH 442	Euclidean Geometry
MATH 443	Modern Geometries
Group K	
MATH 451	Numerical Analysis I
MATH 452	Numerical Analysis II
Group L	
MATH 341	Theory of Numbers
MATH 419	Introduction to the History of Mathematics
MATH 481	Abstract Algebra I
MATH 482	Abstract Algebra II
Mathematics Electives	
Electives	
MATH 142	Calculus II
& MATH 143	and Calculus III

6

Or other course(s) as approved by advisor

Total units 30

## MS Mathematics

### Required Courses

MATH 520	Applied Analysis I	4
MATH 521	Applied Analysis II	4
MATH 530	Discrete Mathematics with Applications I	4
MATH 531	Discrete Mathematics with Applications II	4
MATH 540	Topology I	4
MATH 541	Topology II	4
MATH 550	Real Analysis	4
MATH 560	Field Theory	4

Electives 13

Select additional units at the 400 or 500 level as approved by the Graduate Committee.

### Satisfactory completion of the comprehensive examinations.

Total units 45

# Physics

Baker Center for Sciences and Mathematics Bldg. (180), Room 204  
Phone: 805.756.2448; Fax: 805.756.2435

<http://physics.calpoly.edu/>

[physics@calpoly.edu](mailto:physics@calpoly.edu)

Department Chair: Nilgun Sungar

## Academic Programs

Program name	Program type
Physics	BA, BS, Minor
Astronomy	Minor
Geology	Minor

The Physics Department offers the Bachelor of Arts and the Bachelor of Science degrees in Physics.

The department provides a comprehensive laboratory program. Facilities include specialized laboratories in electrical measurements, optics, solid state physics, nuclear and atomic physics. Student activities include a chapter of the national Society of Physics Students and a chapter of the national physics honor society, Sigma Pi Sigma.

High school students planning to major in physics should include in their high school program as much as possible of the following: eight semesters of college preparatory mathematics, two of physics, and two of chemistry.

## Preparation for Middle or High School Teaching

Teaching middle or high school physics in public schools requires a physics teaching credential, usually obtained after graduation. The courses EDUC 300 and KINE 250 are required for entrance into most teacher credential programs. Teachers must also be subject-matter certified, which can be done by taking subject-matter exams. Students interested in a teaching career should talk to the single-subject advisor and can find more information at the Physics Department web site.

## Undergraduate Programs

### BA Physics

The BA in Physics provides the student with a solid foundation in physics. Its primary purpose is to serve students who plan to pursue careers teaching science at the high school level and in science related fields for which a physics background is an asset. Students considering a career in teaching should consult with the department advisor early.

The curriculum has fewer required upper division courses than the BS, which allows the student to choose from an extensive list of electives in consultation with an academic advisor. In addition, the BA provides an attractive option for students in related disciplines who wish to pursue a double major.

### BS Physics

The BS in Physics is the appropriate choice for those students planning a career involving physics in industry or government laboratories, as well as those seeking a strong foundation in physics for graduate study.

**NOTE: As of April 18, 2013, the Electronics and Electro-optics concentrations are under review by the Physics department and no students are being accepted into the concentrations at this time.**

## Concentrations

Students have the choice of selecting one of the specialized concentrations or following the general physics curriculum, which offers a variety of elective coursework. All offer good preparation for graduate study in physics.

### Electronics

The Electronics concentration is designed for students wishing to acquire a working knowledge of electronics to use in experimental physics.

### Electro-optics

The Electro-optics concentration provides a background in optical devices and techniques used in this rapidly expanding field.

## Astronomy Minor

The Astronomy Minor provides students an opportunity to learn about and analyze astronomical phenomena and processes. A minor in astronomy provides a background for graduate-level studies in astronomy or work in related fields. Interested students should see an Astronomy Minor advisor.

## Geology Minor

The Geology Minor is offered in conjunction with the Natural Resources Management and Environmental Sciences Department. It provides a background useful for careers in environmental consulting or geotechnical fields. Interested students should consult with a Geology Minor advisor. This minor is not open to students in the Earth Sciences' Geology concentration. For more information about that concentration, please see the Earth Sciences program in the Natural Resources Management and Environmental Sciences Department (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences>).

**Prerequisites** for the Geology minor are SS 121, CHEM 111 or CHEM 128, and PHYS 132.

## Physics Minor

The Physics Minor provides students with the opportunity to build on their introductory physics courses with a coordinated set of electives based on interests and career objectives selected in consultation with a physics advisor.

Students may earn a minor in Physics by completing a course of study consisting of 24 units in physics and astronomy, of which 12 units must be upper division, and no more than 4 units may be from astronomy courses.

## BA Physics

## Program Learning Objectives

1. Demonstrate a good understanding of both the theoretical concepts and mathematical techniques of the major fields of physics: classical mechanics, electromagnetism, thermodynamics, and quantum physics.

2. Work safely with modern laboratory equipment to carry out measurements and analyze data.
3. Use computers to perform numerical computations, to simulate physical phenomena, and to collect and analyze data in the laboratory.
4. Communicate effectively, both orally and in writing.
5. Move successfully into graduate school or industry.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: Major courses with lab component may not be taken credit/no credit.<sup>1</sup>

### MAJOR COURSES

PHYS 141	General Physics IA	4
PHYS 132	General Physics II (B3 & B4) <sup>2</sup>	4
PHYS 133	General Physics III	4
PHYS 206	Experimental Physics	3
PHYS 211	Modern Physics I	4
PHYS 212	Modern Physics II	4
PHYS 256	Electrical Measurements Laboratory	1
PHYS 301	Thermal Physics I	4
PHYS 302	Classical Mechanics I	4
PHYS 322	Vibrations and Waves	3
PHYS 405	Quantum Mechanics I	3-4
or PHYS 412	Solid State Physics	
PHYS 461	Senior Project I	2
or PHYS 463	Senior Project - Laboratory Research I	
Select from the following:		3-4
HIST 350	The Scientific Revolution, c. 1500-1800 (D5)	
PHIL 321	Philosophy of Science (C4)	
PHIL 421	Philosophy of Space, Time and Matter	
SCM 451	Ethics in the Sciences	
CHEM 127	General Chemistry for Agriculture and Life Science I	4
CHEM 128	General Chemistry II	4
MATH 141	Calculus I (B1) <sup>2</sup>	4
MATH 142	Calculus II (B1) <sup>2</sup>	4
MATH 143	Calculus III	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
MATH/STAT elective (300-400 level; MATH 344 recommended)		4
Physics elective (300-400 level) <sup>3</sup>		16

### GENERAL EDUCATION (GE)

(See GE program requirements below.) 60

### FREE ELECTIVES

Free Electives <sup>4</sup>	27-29
<b>Total Hours</b>	<b>180</b>

- <sup>1</sup> The following major courses cannot be taken as CR/NC grading: PHYS 132, PHYS 133, PHYS 256, PHYS 323, PHYS 340, PHYS 341, PHYS 342, PHYS 357, PHYS 417, PHYS 422, PHYS 423, PHYS 452, ASTR 444.
- <sup>2</sup> Required in Major; also satisfies GE.
- <sup>3</sup> Select at least one of the following: PHYS 323, PHYS 340, PHYS 341, PHYS 357, PHYS 417, PHYS 422, PHYS 423, PHYS 452, ASTR 444.  
In addition, choose courses with the prefixes PHYS, ASTR or GEOL (but no more than 6 units from each of ASTR and GEOL).
- <sup>4</sup> Care must be taken when selecting electives to ensure compliance with the "60 units upper division" requirement.

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
Area D/E	Society and the Individual	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
Area F	Technology	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Major.

# BS Physics

## Program Learning Objectives

1. Demonstrate a good understanding of both the theoretical concepts and mathematical techniques of the major fields of physics: classical mechanics, electromagnetism, thermodynamics, and quantum physics.
2. Work safely with modern laboratory equipment to carry out measurements and analyze data.
3. Use computers to perform numerical computations, to simulate physical phenomena, and to collect and analyze data in the laboratory.
4. Communicate effectively, both orally and in writing.
5. Move successfully into graduate school or industry.

## Degree Requirements and Curriculum

In addition to the program requirements on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: Major courses with lab component may not be taken credit/no credit.<sup>1</sup>

### MAJOR COURSES

PHYS 141	General Physics IA	4
PHYS 132	General Physics II (B3 & B4) <sup>2</sup>	4
PHYS 133	General Physics III	4
PHYS 202	Physics on the Computer	4
PHYS 206	Experimental Physics	3
PHYS 211	Modern Physics I	4
PHYS 212	Modern Physics II	4
PHYS 256	Electrical Measurements Laboratory	1
PHYS 301	Thermal Physics I	4
PHYS 302	Classical Mechanics I	4
PHYS 322	Vibrations and Waves <sup>3</sup>	3
PHYS 340	Quantum Physics Laboratory I	2
PHYS 341	Quantum Physics Laboratory II	2
PHYS 405	Quantum Mechanics I	4
PHYS 408	Electromagnetic Fields and Waves I	4
PHYS 461	Senior Project I	2
or PHYS 463	Senior Project - Laboratory Research I	
PHYS 462	Senior Project II	2
or PHYS 464	Senior Project - Laboratory Research II	
CHEM 127	General Chemistry for Agriculture and Life Science I	4
CHEM 128	General Chemistry II	4
MATH 141	Calculus I (B1) <sup>2</sup>	4

MATH 142	Calculus II (B1) <sup>2</sup>	4
MATH 143	Calculus III	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
MATH 304	Vector Analysis	4
MATH 344	Linear Analysis II	4
Advanced Physics electives or Concentration courses (see below)		21
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		60
<b>FREE ELECTIVES</b>		
Free Electives		8
Total units		180

- 1 The following major courses cannot be taken as CR/NC grading: PHYS 132, PHYS 133, PHYS 256, PHYS 323, PHYS 340, PHYS 341, PHYS 342, PHYS 357, PHYS 417, PHYS 422, PHYS 423, PHYS 452, ASTR 444.
- 2 Required in Major; also satisfies GE.
- 3 Students in Electro-optics Concentration should take PHYS 323 instead of PHYS 322.

## Advanced Physics Electives or Concentrations (select one)

**NOTE: As of April 18, 2013, the Electronics and Electro-optics concentrations are under review by the Physics department and no students are being accepted into the concentrations at this time.**

- Advanced Physics Electives (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/physics/bsphysics/advancedphysicsselectives>)
- Electronics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/physics/bsphysics/electronicconcentration>)
- Electro-optics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/physics/bsphysics/electroopticsconcentration>)

## General Education (GE) Requirements

- 72 units required, 12 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

Area A	Communication	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
Area B	Science and Mathematics	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science (4 units in Major) <sup>1</sup>	0
B4	One lab taken with either a B2 or B3 course	
Area C	Arts and Humanities	



C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		60

<sup>1</sup> Required in Major.

## Advanced Physics Electives

This is the default curriculum required for students who do not declare a concentration.

Select two of the following:	2-8
PHYS 323 Optics	
PHYS 342 Quantum Physics Laboratory III	
PHYS 357 Advanced Instrumentation in Experimental Physics	
PHYS 417 Nonlinear Dynamical Systems	
PHYS 422 Polymer Electronics Laboratory	
PHYS 423 Advanced Optics	
PHYS 452 Solid State Physics Laboratory	
ASTR 444 Observational Astronomy	
Select one from the following:	3-4
PHYS 424 Theoretical Physics	
MATH 418 Partial Differential Equations	
PHYS 300-400 level elective (minimum)	9
Additional 300 or 400 level elective units (if needed) <sup>1</sup>	0-7
Total units	21

For students anticipating an industrial career, PHYS 323, PHYS 357, PHYS 412, PHYS 413, PHYS 423, and PHYS 452 are suggested.

For students anticipating graduate work in physics, PHYS 303, PHYS 401, PHYS 406, PHYS 409, PHYS 424, and MATH 408 are suggested. PHYS 357 is suggested for students who anticipate becoming experimental physicists.

<sup>1</sup> PHYS/ASTR/GEOL/MATH/STAT/CSC prefix (excludes ASTR 324; CSC 302, CSC 310); CSC 101, CSC 231, CSC 234, CSC 235

## Electro-optics Concentration

**NOTE: As of April 18, 2013, the Electro-optics concentration is under review by the Physics department and no students are being accepted into the concentration at this time.**

PHYS 357	Advanced Instrumentation in Experimental Physics	3
PHYS 423	Advanced Optics	4
EE 228	Continuous-Time Signals and Systems <sup>1</sup>	4
EE 403	Fiber Optic Communication	3
EE 418	Photonic Engineering	3
EE 443	Fiber Optics Laboratory	1
EE 458	Photonic Engineering Laboratory	1
Elective chosen from list of Advanced Physics Electives (See link under BS Physics curriculum.)		2
Total units		21

<sup>1</sup> Students are not allowed to enroll in EE 228 until they have 1) completed PHYS 357 and MATH 344, and 2) received approval of advisors in both Physics and Electrical Engineering. Students are then allowed to enroll in EE courses with physics courses substituting for EE prerequisites.

## Electronics Concentration

**NOTE: As of April 18, 2013, the Electronics concentration is under review by the Physics department and no students are being accepted into the concentration at this time.**

PHYS 357	Advanced Instrumentation in Experimental Physics	3
EE 228	Continuous-Time Signals and Systems <sup>1</sup>	4
EE 302	Classical Control Systems	3
EE 328	Discrete Time Signals and Systems	3
EE 342	Classical Control Systems Laboratory	1
EE 368	Signals and Systems Laboratory	1
Select from the following:		4
EE 336	Microprocessor System Design	
EE 306 & EE 346	Semiconductor Device Electronics and Semiconductor Device Electronics Laboratory	
Elective chosen from Advanced Physics Electives (See list under BS Physics curriculum.)		2
Total units		21

<sup>1</sup> Students are not allowed to enroll in EE 228 until they have 1) completed PHYS 357 and MATH 344, and 2) received the approval of advisors in both Physics and Electrical Engineering. Students are then allowed to enroll in EE courses with physics courses substituting for EE prerequisites.

## Astronomy Minor

### Required Courses

PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
PHYS 211	Modern Physics I	4
ASTR 301	The Solar System	3
ASTR 302	Stars and Galaxies	3
ASTR 326	Cosmology	3
ASTR 444	Observational Astronomy	4

Select from the following: 3-4

ASTR 470	Selected Advanced Topics	
ASTR 471	Selected Advanced Laboratory	
AERO 351	Introduction to Orbital Mechanics	
PHYS 302	Classical Mechanics I	
PHYS 303	Classical Mechanics II	
PHYS 313	Introduction to Atmospheric Physics	
PHYS 317	Special Theory Relativity	
PHYS 323	Optics	
PHYS 410	Physics of Solid Earth	
GEOL 415	Structural Geology	

Total units 28-29

## Geology Minor

### Required Courses

GEOL 201	Physical Geology	3
GEOL 241	Physical Geology Laboratory	1
GEOL 305	Fundamentals of Seismology	4
GEOL 415	Structural Geology	4
GEOL/ERSC 401	Field-Geology Methods	4
GEOL/ERSC 402	Geologic Mapping	4
ERSC 223	Rocks and Minerals	4
ERSC 323	Geomorphology	4

Total units 28

## Physics Minor

### Required Courses

PHYS 133	General Physics III	4
PHYS 211	Modern Physics I	4

**Physics/Astronomy Electives**<sup>1</sup> 16

PHYS 202 Physics on the Computer

or PHYS 212 Modern Physics II

Any upper division PHYS course (300-400 level)

Must include at least one of the following courses:

PHYS 301	Thermal Physics I	
PHYS 302	Classical Mechanics I	
PHYS 322	Vibrations and Waves	
PHYS 323	Optics	
PHYS 405	Quantum Mechanics I	

PHYS 408 Electromagnetic Fields and Waves I

PHYS 412 Solid State Physics

Students may also select a maximum of 4 units from:

ASTR 301 The Solar System

ASTR 302 Stars and Galaxies

ASTR 326 Cosmology

ASTR 444 Observational Astronomy

Total units 24

<sup>1</sup> A minimum of 12 units must be upper division.

## School of Education

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Education Bldg. (02), Room 120  
805.756.2126  
soe.calpoly.edu ; soe@calpoly.edu

Dean: Jon Margerum-Leys

### Vision Mission and Programs

**Vision:** The School of Education programs foster the development of qualified, competent, and caring education professionals who prepare a diverse student population to become active and thoughtful participants in a democratic society.

**Mission:** The School of Education leads the campus in an all-university approach to preparing education professionals. These professionals create, assess and modify environments, practices, and policies to foster the achievement of each and every learner; they strive for equity in schools and society; and they are committed to inquiry and professional growth for themselves and the advancement of P-20 education.

School of Education faculty model leadership in their teaching, scholarship, and service through a grounded, reflective *learn-by-doing* approach and through sustained collaborations with their education partners: P-12 schools, families, community colleges, universities, and local, state, and national agencies.

**Learning Outcomes:** All candidates who complete a credential or master's degree in the School of Education will:

- *Be Qualified, Competent, and Caring Professional Educators*
- *Integrate Principles and Practices of Professional Fields to Support Student Learning*
- *Engage in Cross-Disciplinary and Collaborative Practices*
- *Demonstrate Authentic Assessment Practices Designed for Student Success, Individual Growth, and Program Improvement*
- *Effect Sustainable Communities in a Multicultural Environment*
- *Engage in Professional Practices*

**Programs:** The School offers a wide variety of courses and programs leading to careers in education. Common to all programs is a commitment to excellence, to partnerships and collaboration, and to preparation for future educational challenges. As the state's population grows, enrollments in grades P-12 increase and with them the demand for well-prepared teachers, and for specialists in administration, special education, and counseling/guidance.

To meet the need for excellence in the field, the School seeks talented, creative students who are committed to a long-term career in education and to the improvement of educational processes and institutions.

The School offers programs that lead to a preliminary credential in Multiple Subject or Single Subject teaching, in Administrative Services or as an Education or Agriculture Specialist. Supplementary and subject matter authorizations are available in a variety of subject areas.

The School offers a Master of Arts in Education degree with specializations in Counseling and Guidance, Educational Leadership and Administration, and Special Education.

Stressing the "learn by doing" philosophy, the School provides opportunities for extensive on-site observation, tutoring, and fieldwork in educational settings. Cal Poly maintains cooperative relations with

surrounding school districts and area educational agencies. Within our service area, teacher candidates and master's students can learn in cross-cultural, city and rural settings.

### Teacher Education

Education Bldg. (02), Room 120  
805.756.2126

The following credential programs are accredited by the California Commission on Teacher Credentialing (CTC) and the National Council for Accreditation of Teacher Education (NCATE) to prepare candidates and recommend for these credentials.

### Teaching Credential Programs

- Agriculture Specialist
- Multiple Subject: English Learner Authorization
- Single Subject: Agriculture
- Single Subject: Biological Science Instruction
- Single Subject: Chemistry
- Single Subject: English
- Single Subject: Geosciences
- Single Subject: Mathematics
- Single Subject: Social Science
- Single Subject: Physics
- Bilingual Authorization
- Education Specialist: Mild/Moderate Disabilities (see Graduate section in School of Education)

Credential programs consist of coursework and field experiences, including the clinical practice known as student teaching, that are required to obtain a preliminary teaching credential in California. Coursework in credential programs in the state of California is required to fit within one year of full-time study. In some instances, candidates are able to take prerequisite courses and enter a credential program prior to the completion of their undergraduate degree.

Application deadlines are established for each specific program. Detailed information about application deadlines and other requirements is available on the School of Education website at [www.soe.calpoly.edu](http://www.soe.calpoly.edu).

### Multiple Subject Teaching

Multiple Subject teaching refers to instruction in a self-contained classroom, such as an elementary school, and certification at this level permits K-8 instruction in such settings. A student may begin coursework toward a Multiple Subject credential upon completion of an undergraduate degree, as a graduate student, or as a Cal Poly undergraduate in any program leading to a baccalaureate degree. There are several requirements for acceptance into the credential program and some prerequisite courses have specific requirements for enrollment (e.g. senior or graduate standing). Thus, early advising is critical and interested individuals are encouraged to contact the credential office.

During the program, candidates take courses in educational foundations and methods of teaching specific subject matter areas, and they engage in clinical practice (student teaching) in area

elementary schools. Special attention is paid to learning how to teach students whose first language is not English. Upon successful completion of the program, candidates are recommended for a Preliminary Multiple Subject Teaching Credential.

Detailed information about requirements for a Multiple Subject Credential is available on the School of Education website at [www.soe.calpoly.edu](http://www.soe.calpoly.edu).

## Single Subject Teaching

The Single Subject Teaching Credential is for candidates who wish to teach a specific content area at the secondary level. Single subject candidates must demonstrate subject matter competency by completing an approved subject matter course work program in that subject matter area or provide evidence of passing the appropriate California Subject Examinations for Teachers (CSET) specialty area test(s). Demonstration of subject matter competency must be completed before candidates begin their student teaching experience.

Candidates for the Single Subject teaching credential in Agriculture or the Agricultural Specialist credential complete their preparation program through the Agricultural Education and Communication Department at Cal Poly and should communicate with the department credential advisor for further information or advisement (Dr. Bill Kellogg, at 805-756-2803 or [bkelllogg@calpoly.edu](mailto:bkelllogg@calpoly.edu)).

**NOTE:** Credential requirements are subject to change. Please check with program advisors for up-to-date information.

## Admission Requirements

Details concerning specific requirements are available from the appropriate advisor, the advisement handbook, or at [www.soe.calpoly.edu](http://www.soe.calpoly.edu).

The requirements for admission to Cal Poly to pursue a Multiple Subject credential differ slightly from those for the Single Subject credential. All applicants must first apply for admission to graduate studies in Education at Cal Poly by completing an application at [www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>).

## Preliminary Credential

California has a two-tiered credentialing system. Cal Poly offers a preliminary credential program and upon completion of basic state requirements, a preliminary credential is issued. Admission to the university or completion of an undergraduate degree does not guarantee admission to a credential program. Contact the credential office for program specific admission requirements, which include obtaining a Certificate of Clearance.

To make successful progress through a credential program, teacher candidates must maintain a B average in all professional education courses and complete additional application steps at specified transition points. Check with the pertinent credential program advisor, the credential program handbook, and [www.soe.calpoly.edu](http://www.soe.calpoly.edu) to determine all requirements to be completed for a specific credential program.

## Clear Credential

California Senate Bill 2042 transferred the recommending of clear multiple subject and single subject teaching credential recommendations to school district-based Induction Programs. Graduates obtaining their preliminary credential from Cal Poly should consult the school district employing them, whether in San Luis Obispo County or elsewhere in California, for information about Induction Programs and obtaining a clear credential.

## Supplementary and Subject Matter Authorizations

A basic teaching credential can be enhanced by adding supplementary and/or subject matter authorizations. These authorizations allow teachers to teach additional subjects without completing a full professional preparation program for that credential and we encourage candidates to consider whether it is possible to add these as part of completing their preliminary credential. To earn an authorization, students must complete a specific number of course credits in the new content area. See [www.ctc.ca.gov](http://www.ctc.ca.gov) (<http://www.ctc.ca.gov>) for specific information on these authorizations and consult with your credential advisor to plan your coursework in order to meet the necessary requirements for any additional authorizations desired.

## Graduate Programs Credential Programs

Credential programs are accredited by the California Commission on Teacher Credentialing (CTC) and the National Council for Accreditation of Teacher Education (NCATE) to prepare candidates and recommend for these credentials.

## Admission

Details concerning specific requirements are available from the appropriate advisor, the advisement handbook, or at [www.soe.calpoly.edu](http://www.soe.calpoly.edu).

## Administrative Services

- Preliminary (Tier I)
- Administrative Intern

The Educational Leadership and Administration Program offers the California Preliminary Administrative Services Credential for eligible candidates who hold a valid CLEAR California teaching or service credential and who have completed five (5) years of full-time teaching/service with this credential. The Administrative Internship Program is an option for those who are requested by their employing district to concurrently serve in an administrative position while completing the requirements for the California Preliminary Administrative Services Credential.

## California Preliminary Administrative Services

This program emphasizes a comprehensive knowledge of K-12 school administration including applied theory, administration and leadership, schools in contemporary society, and effective management related to educational outcomes. As a basis for credential recommendation, the preliminary program emphasizes applied theory with actual experience

in fieldwork assignments and an evaluation of administrative competence.

The credential program requires 58 quarter units, all of which are applicable to the MA in Education with a Specialization in Leadership and Administration. The Preliminary Administrative Services Credential authorizes service in any administrative position at any grade level (K-12) in California.

## Administrative Intern

This program supports districts that have an immediate need for an administrator and are without suitable candidates. Candidates earn the Preliminary Administrative Services Credential as they serve in an administrative capacity within a one year time frame.

## Education Specialist (Mild/Moderate Disabilities)

- Preliminary

This credential authorizes the holder to teach in the following settings: special day classes, special schools, home/hospital settings, correctional facilities, nonpublic schools and agencies, and resource rooms.

The program is designed to prepare candidates to work with pupils with mild/moderate disabilities, which include specific learning disabilities; mild to moderate mental retardation (intellectual disabilities); attention deficit and attention deficit and hyperactivity disorders; and serious emotional disturbances, and authorizes serving individuals in K-12, and in classes organized for adults through age 22.

A full-time candidate may complete the requirements in one calendar year. The Education Specialist program is heavily field based and requires 62 quarter units, most of which are applicable to the MA in Education with a Specialization in Special Education.

A Multiple or Single Subject teaching credential is *not* required for admission. However, some coursework taken for the Single Subject or Multiple Subject Credential program may meet prerequisite course requirements for the Education Specialist Credential program.

## Master of Arts in Education

### General Characteristics

The Master of Arts degree program in Education is designed to provide a broad-based perspective of education. Specializations within this degree program, are closely related to the occupational and professional requirements of a variety of pursuits in the fields of education, college student affairs, and agencies involved with community affairs.

### Admission

Admission to the MA in Education degree program minimally requires the following:

- 3.0 GPA in last 90 quarter units
- Letters of recommendation
- Bachelors degree from a regionally accredited college/university

Each specialization below may include additional requirements for the specific program (see the Graduate section (<http://catalog.calpoly.edu/previouscatalogs/2013-15/graduateeducation>) of this catalog for additional information on admission).

## Program of Study

All specializations require a minimum of 45 quarter units of graduate work, with at least 40 units of 500-level Education (EDUC) courses. Courses taken in these specializations may also be applied toward related credentials.

Candidates must earn a grade of C- or better in all courses, maintain an overall grade point average of 3.0 or better, and remain in good professional standing within their specialization. All candidates must meet the Graduation Writing Requirement.

Credits earned in student teaching are not accepted toward completion of any specialization within the MA Education. At least 36 program-required units shall be completed in residence. Transfer and/or extension credits are only accepted when the credits are acceptable for master's degree credit by the offering institution in its own programs. Transfer credits are not accepted for the MA in Education with a specialization in Educational Leadership and Administration.

## Advising

The candidate must meet with his/her advisor on a regular basis. Continued consultation with the advisor assists a smooth progression toward completion of the degree.

## Formal Study Plan

The candidate is required to file a Formal Study Plan prior to completion of 12 units in his/her program. This plan is completed in consultation with the program advisor and helps the candidate to schedule courses in a sequence that results in timely completion of the program. A Formal Study Plan is required prior to Advancement to Candidacy.

## Advancement to Candidacy

Advancement to master's degree candidacy requires:

- Completing at least 24 units of program-required courses in residence, specified in a formal program of study, with minimum GPA of 3.0;
- Meeting the university Graduation Writing Requirement;
- Receiving formal recommendation of the graduate faculty;
- Earning a GPA of 3.0 in all coursework included on the formal program of study, and in all coursework completed subsequent to admission to post baccalaureate standing; and
- Meeting all conditions of admission.

## Culminating Experience

Depending on the specialization, final assessment of a candidate's progress shall include a comprehensive written examination and EDUC 590 Research Application in Education, *or* the completion of a thesis/project. Students must enroll in EDUC 599 Thesis or Project for every quarter in which they are receiving related advisement.

## MA Education, Specialization in Counseling & Guidance

This program prepares students for careers as student affairs professionals and counselors in higher education settings. Admission to the program, which occurs **only** in spring quarter, requires references, an auto-biographical statement, and an interview. Students who have career goals of working in clinical counseling in agency settings or in private practice should refer to the MS



Psychology in the College of Liberal Arts (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts>) .

Degree Requirements and Curriculum (p. 367)

## MA Education, Specialization in Educational Leadership and Administration

The fast-track M.A. and Preliminary Administrative Services Credential program allows students to complete their master's degree and/or credential in 16 weekends (Friday evenings and all day Saturdays) and one summer session during an 11-month period. This rigorous, practical program is designed for those seeking leadership positions in K-12 schools, community colleges, universities, government agencies, and educationally related organizations. Students are admitted once each year in the fall, and they progress through the program as a cohort. The application deadline is MARCH 1. The fast-track program emphasizes applied theories of educational leadership, mastery of practical skills required for effective school administration, and competence in research methods necessary for understanding and assessing learning organizations. While designed primarily for K-16 leaders, the program is beneficial for leaders from other fields. Individuals interested in leading nonprofit organizations are encouraged to apply.

Degree Requirements and Curriculum (p. 367)

## MA Education, Specialization in Special Education

Applicants who enroll in this specialization must meet personal and professional standards, including necessary qualifying examinations, presentation of personal recommendations, and a personal interview. Approved units for the master's degree program can be applied towards the requirements for a Preliminary Level I Education Specialist Credential. It is also possible for qualified students to complete the requirements for the Specialist Credential while pursuing the requirements for the Master of Arts degree in Education.

Degree Requirements and Curriculum (p. 367)

## MA Education, Specialization in Counseling and Guidance

### Required Education Courses

EDUC 586	Introduction to Inquiry in Education	4
EDUC 587	Educational Foundations and Current Issues	4
EDUC 588	Education, Culture, and Learning	4
EDUC 589	Educational Research Methods	4

Select from the following: 4-6

EDUC 590 Research Application in Education (and comprehensive exam)

EDUC 599 Thesis or Project (3, 3)

### Required in the Area of Specialization

EDUC 555	Introduction to the Counseling Profession	4
EDUC 556	Multicultural Counseling	4
EDUC 557	Career Counseling	4
EDUC 560	Counseling Theories	4
EDUC 561	Group Counseling	4

EDUC 562	Student Development - Higher Education	4
EDUC 564	Legal and Ethical Issues in Counseling	4
EDUC 565	Counseling Measurement and Assessment	4
EDUC 566	Leadership and Consultation in Counseling	4
EDUC 568	Individual Counseling Techniques	4
EDUC 573	Field Experience, Counseling	12
Total units		72-74

## MA Education, Specialization in Educational Leadership and Administration

### Fall Quarter - Organizational Leadership

EDUC 586	Introduction to Inquiry in Education	4
EDUC 512	Education Organization and Management	4
EDUC 513	Education Planning and Decision Making	4
EDUC 518	Administrative Services Fieldwork <sup>1</sup>	3

### Winter Quarter - Instructional Leadership

EDUC 515	Educational Program Management and Evaluation	4
EDUC 516	Educational Personnel Supervision and Evaluation	4
EDUC 589	Educational Research Methods	4
EDUC 518	Administrative Services Fieldwork <sup>1</sup>	3

### Spring Quarter - Managerial Leadership

EDUC 510	Education Finance and Resource Allocation	4
EDUC 511	Educational Law and Governance	4
EDUC 519	Professional e-Portfolios for Educational Leaders	1
EDUC 542	Administration of Special Programs and Services	4
EDUC 518	Administrative Services Fieldwork <sup>1</sup>	3

### Summer Session - Community Leadership

EDUC 587	Educational Foundations and Current Issues	4
EDUC 588	Education, Culture, and Learning	4
EDUC 590	Research Application in Education <sup>2</sup>	4

Total units <sup>3</sup> 49/58

<sup>1</sup> Administrative services credential candidates only.

<sup>2</sup> All students are required to complete a comprehensive electronic portfolio and pass an oral examination at the end of the program.

<sup>3</sup> M.A. degree only requires 49 units minimum;  
M.A. degree and credential require 58 units minimum

## MA Education, Specialization in Special Education

### Required Courses

EDUC 586	Introduction to Inquiry in Education	4
EDUC 587	Educational Foundations and Current Issues	4
EDUC 588	Education, Culture, and Learning	4
EDUC 589	Educational Research Methods	4
EDUC 590	Research Application in Education	4

### Required in Area of Specialization

EDUC 544	Advanced Collaboration and Consultation for Teachers of Students with Special Needs	5
EDUC 545	Characteristics and Instruction of Pupils with Mild/Moderate Disabilities	5
EDUC 550	Assessment Strategies for Special Education	5
<b>Electives</b>		
Selected with advisor's approval		10
Total units		45

## Statistics

Faculty Offices East (25), Room 107D  
Phone: 805.756.2709

Department Chair: Allan J. Rossman

### ACADEMIC PROGRAMS

Program name	Program type
Statistics	BS, Minor

The Statistics Department has two primary purposes - to offer introductory statistics courses to students from many different majors at Cal Poly, and to offer a curriculum of diverse statistics courses for those students pursuing a Bachelor of Science degree in Statistics or a minor in the discipline.

In this age of high technology it has become increasingly easy to record and store information resulting from experiments, surveys, and historical studies. It is the responsibility of the professional statistician to determine the best ways to collect, summarize and analyze these data. Because of the increasing number of quantitative studies that are conducted in fields ranging from medicine to agriculture to business, the professional statistician is in great demand.

It has been projected that the job market for those with substantial statistical training remains healthy into the foreseeable future. Recent graduates of the program at Cal Poly are working for companies in fields as varied as insurance, aircraft manufacturing, banking, computer manufacturing, and pharmaceutical development.

### Undergraduate Programs

#### BS Statistics

The statistics degree program requires students to have a solid foundation in mathematics and computer science. With this basis the students take courses in the following areas: analysis of variance, regression analysis, statistical computing, sampling methods, experimental design, analysis of categorical data, multivariate analysis, time series and forecasting, survival analysis, probability, and mathematical statistics.

Throughout the program faculty encourage students to work on practical, realistic problems that require the understanding of all aspects of the data acquisition and analysis process.

#### Actuarial Preparation Minor

For information regarding the Actuarial Preparation Minor, please see College of Science and Mathematics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics>) section.

#### Statistics Minor

The Statistics minor program allows students from across the University to acquire substantial statistical skills that can be applied in their own disciplines.

## BS Statistics

### Program Learning Objectives

1. Have good working knowledge of the most commonly used statistical methods, including statistical modeling and omnipresent role of variability, efficient design of studies and construction of effective sampling plans, exploratory data analysis, and formal inference process.
2. Have background in probability, statistical theory, and mathematics, including especially calculus, linear algebra and symbolic and abstract thinking.
3. Be able to synthesize and apply knowledge of common inferential methods, understanding the limitations of procedures and appropriate conclusions.
4. Communicate effectively (written and oral) with skills in collaboration (within and between disciplines) and teamwork, and in organizing and managing projects.
5. Have a good mastery of several standard statistical software packages and facility with data management strategies.
6. Have a focused concentration in an area of application outside the discipline of statistics.

### Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No course with a STAT prefix may be taken as credit/no credit.

#### MAJOR COURSES

STAT 150	Introduction to Statistical Investigations	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III	4
MATH 206	Linear Algebra I	4
MATH 241	Calculus IV	4
STAT 301	Statistics I	4
STAT 302	Statistics II	4
STAT 323	Design and Analysis of Experiments I	4
STAT 324	Applied Regression Analysis	4
STAT 325	Introduction to Probability Models	4
STAT 330	Statistical Computing with SAS	4
STAT 331	Statistical Computing with R	4
STAT 425	Probability Theory	4
STAT 426	Estimation and Sampling Theory	4
STAT 427	Mathematical Statistics	4
STAT 461	Senior Project I	1
STAT 462	Senior Project II	2

STAT 465	Statistical Communication and Consulting	4
Statistics Electives:		20
Any 400-level STAT course		
A maximum of 8 units can also be selected from the following:		
CSC/CPE 102	Fundamentals of Computer Science II	
CSC/CPE 103	Fundamentals of Computer Science III	
CSC/CPE 236	Fundamentals of Computer Science for Scientists and Engineers II	
IME 430	Quality Engineering	
MATH 242	Differential Equations I	
MATH 306	Linear Algebra II	
MATH 335	Graph Theory	
MATH 336	Combinatorial Math	
MATH 406	Linear Algebra III	
MATH 412	Introduction to Analysis I	
MATH 437	Game Theory	
MATH 451	Numerical Analysis I	
MATH 452	Numerical Analysis II	

**SUPPORT COURSES**

Select from the following:		4
CSC/CPE 235	Fundamentals of Computer Science for Scientists and Engineers I	
CSC/CPE 101	Fundamentals of Computer Science I	
MATH 248	Methods of Proof in Mathematics	4
Approved support electives <sup>2</sup>		8
<b>GENERAL EDUCATION (GE)</b>		
(See GE program requirements below.)		64
<b>FREE ELECTIVES</b>		
Free Electives		9
Total units		180

<sup>1</sup> Required in Major; also satisfies GE.

<sup>2</sup> Consultation with faculty advisor is required of students, to select and obtain approval for these courses. Students are requested to consult their advisors before the start of their junior year.

**General Education (GE) Requirements**

- 72 units required, 8 of which are specified in Major and/or Support.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300 level.

<b>Area A</b>	<b>Communication</b>	
A1	Expository Writing	4
A2	Oral Communication	4
A3	Reasoning, Argumentation and Writing	4
<b>Area B</b>	<b>Science and Mathematics</b>	
B1	Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2	Life Science	4
B3	Physical Science	4

B4 One lab taken with either a B2 or B3 course

<b>Area C</b>	<b>Arts and Humanities</b>	
C1	Literature	4
C2	Philosophy	4
C3	Fine/Performing Arts	4
C4	Upper-division elective	4
Area C elective	(Choose one course from C1-C5)	4
<b>Area D/E</b>	<b>Society and the Individual</b>	
D1	The American Experience (Title 5, Section 40404 requirement)	4
D2	Political Economy	4
D3	Comparative Social Institutions	4
D4	Self Development (CSU Area E)	4
D5	Upper-division elective	4
<b>Area F</b>	<b>Technology</b>	
F	Upper-division elective	4
Total units		64

<sup>1</sup> Required in Major.

**Statistics Minor**

Select one of the following introductory sequences: 8-9

STAT 217 & STAT 313	Introduction to Statistical Concepts and Methods and Applied Experimental Design and Regression Models	
STAT 218 & STAT 313	Applied Statistics for the Life Sciences and Applied Experimental Design and Regression Models	
STAT 251 & STAT 252	Statistical Inference for Management I and Statistical Inference for Management II	
STAT 301 & STAT 302	Statistics I and Statistics II	
STAT 312 & STAT 313	Statistical Methods for Engineers and Applied Experimental Design and Regression Models	

Select from the following: 16

STAT 323	Design and Analysis of Experiments I	
STAT 324	Applied Regression Analysis	
STAT 325	Introduction to Probability Models <sup>1</sup>	
STAT 330	Statistical Computing with SAS	
STAT 331	Statistical Computing with R	
STAT 416	Statistical Analysis of Time Series	
STAT 417	Survival Analysis Methods	
STAT 418	Analysis of Cross-Classified Data	
STAT 419	Applied Multivariate Statistics	
STAT 421	Survey Sampling and Methodology	
STAT 423	Design and Analysis of Experiments II	
STAT 425	Probability Theory <sup>1</sup>	
STAT 426	Estimation and Sampling Theory	
STAT 427	Mathematical Statistics	

Total units 24-25

- <sup>1</sup> Students may only count STAT 325 or STAT 425, not both, for credit in the minor.



## **Interdisciplinary Degree Programs**

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A degree that is jointly offered by different colleges is known as an interdisciplinary program. Cal Poly offers the following interdisciplinary degree programs.

1. BA Liberal Arts and Engineering Studies
2. MBA/MS Engineering
3. MCRP/MS Engineering with a specialization in Transportation Planning

# BA Liberal Arts and Engineering Studies

laes@calpoly.edu  
http://laes.calpoly.edu

Program Co-Director: David D. Gillette  
Phone: 805.756.2331  
ddgillet@calpoly.edu

Program Co-Director: Michael L. Haungs  
Phone: 805.756.5531  
mhaungs@calpoly.edu

## Academic Programs

Program name	Program type
Liberal Arts & Engineering Studies	BA

The BA degree program in Liberal Arts and Engineering Studies (LAES) is jointly offered by the colleges of Liberal Arts and Engineering. This program prepares students for a wide range of innovative careers in emerging professional fields that combine skills and interests in the arts, technology and culture, and also prepares them for further study in graduate school. This program, which only accepts students as internal transfers after the first year, is open to all students at Cal Poly. This program is not intended to be an ABET-accredited engineering program.

The curriculum allows Liberal Arts and Engineering Studies students, in collaboration with students from all other Cal Poly majors, to participate in development teams working on national and international technology and cultural projects. To further prepare students for work with diverse teams that include participants from across the globe, the program strongly encourages students to spend three to six months studying and/or working abroad.

The BA in Liberal Arts and Engineering Studies leads to careers such as:

- audio technology
- digital media production and management
- digital publishing
- environmental technology education
- film and television production
- government policy making/analysis
- international technology management
- science education, such as science instrumentation and systems procurement
- sustainable community development
- technical communications
- technology services and management

## Undergraduate Program

### Program Learning Objectives

Graduates of the Liberal Arts and Engineering Studies program receive a solid foundation in engineering and scientific principles, as well as a cultural appreciation that supports them in careers requiring significant levels of technical and cultural fluency. To support these goals, the primary learning objectives are to:

1. Think critically and creatively in the process of solving techno-social problems considering philosophical, aesthetic and expressive concerns.
2. Communicate effectively through a variety of media in diverse, multicultural perspectives and facilitate communication between technical and non-technical collaborators.
3. Use mathematics, science, and engineering principles to produce solutions to problems within the student's Liberal Arts and Engineering concentrations.
4. Function effectively as a member of interdisciplinary or international teams, formulating sustainable solutions to problems at the intersection of technology and society.
5. Demonstrate ethical and professional responsibilities associated with the creation, use and integration of technology.
6. Serve as informed and responsible citizens in a global culture and remain involved with learning and helping society improve.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- 2.0 GPA
- Graduation Writing Requirement (GWR)
- U.S. Cultural Pluralism (USCP)

*Note: No major, support or concentration courses may be taken as credit/no credit.*

### MAJOR COURSES

CHEM 124	General Chemistry for the Engineering Disciplines I (B3/B4) <sup>1</sup>	4
ENGL 149	Technical Writing for Engineers (A3) <sup>1</sup>	4
LAES 301	Project-Based Learning in Liberal Arts and Engineering Studies	4
LAES 302	Advanced Project-Based Learning in Liberal Arts and Engineering Studies	4
LAES 461	Senior Project in Liberal Arts and Engineering Studies (or other approved senior project course)	4
LAES 462	Capstone Senior Seminar in Liberal Arts and Engineering Studies	4
MATH 141	Calculus I (B1) <sup>1</sup>	4
MATH 142	Calculus II (B1) <sup>1</sup>	4
MATH 143	Calculus III (B5) <sup>1</sup>	4
MATH 241	Calculus IV	4
MATH 244	Linear Analysis I	4
PHYS 141	General Physics IA	4
PHYS 132	General Physics II	4
PHYS 133	General Physics III	4
STAT 312	Statistical Methods for Engineers	4
or STAT 321	Probability and Statistics for Engineers and Scientists	
or STAT 350	Probability and Random Processes for Engineers	

**Engineering Concentration**

Minimum 8 units at 300-400 level	34-35
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**Liberal Arts Concentration or Individualized Course of Study**

Minimum 12 units at 300-400 level	24
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**Study Abroad or Global Perspectives courses**

300-400 level	8
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**GENERAL EDUCATION (GE)**

(See GE program requirements below.)	40-52
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**FREE ELECTIVES**

Free Electives	1-14
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Total units	180
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<sup>1</sup> Required in Major; also satisfies GE

**Concentrations**

LAES students must select *one* concentration from Engineering and *one* from Liberal Arts. Students may choose to follow an individualized course of study in the Liberal Arts constructed in consultation with LAES advisors.

**Engineering (select one)**

- Computer Graphics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/computergraphicsconcentration>)
- Electrical Engineering (Power) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/electricalengineeringpowerconcentration>)
- Industrial/Manufacturing Engineering - System Design (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/systemdesignconcentration>)

**Liberal Arts (select one)**

- Culture, Society and Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/culturesocietyandtechnologyconcentration>)
- Interactive Communication - Cinematic Focus (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/interactivecommunicationcinemaconcentration>)
- Interactive Communication - Theatrical Focus (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/interactivecommunicationtheatreconcentration>)
- Publishing Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/publishingtechnologyconcentration>)
- Technical Communication (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/baliberalartsandengineeringstudies/technicalcommunicationconcentration>)

**Individualized Course of Study**

Consists of 24 units of an advisor-approved integrated course of study from courses offered in the College of Liberal Arts designed to meet the LAES learning objectives, with at least half of the units at the upper division level or an approved minor program in the College of Liberal Arts selected from pre-approved minors<sup>2</sup>.

**General Education (GE) Requirements**

- 72 units required, 20-32 of which are specified in Major, depending on concentration.
- See the complete GE course listing (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>).
- Minimum of 12 units required at the 300-400 level.

**Area A Communication**

A1 Expository Writing	4
A2 Oral Communication	4
A3 Reasoning, Argumentation, and Writing (4 units in Major) <sup>1</sup>	0

**Area B Science and Mathematics**

B1 Mathematics/Statistics (8 units in Major) <sup>1</sup>	0
B2 Life Science	4
B3 Physical Science (4 units in Major) <sup>1</sup>	0
B4 One lab taken with either a B2 or B3 course	
B5 (4 units in Major) <sup>1</sup>	0

**Area C Arts and Humanities**

C1 Literature	4
C2 Philosophy	4
C3 Fine/Performing Arts (may be in concentration)	0-4
C4 Upper-division elective (may be in concentration)	0-4

**Area D/E Society and the Individual**

D1 The American Experience (Title 5, Section 40404 requirement)	4
D2 Political Economy	4
D3 Comparative Social Institutions	4
D4 Self Development (CSU Area E)	4
D5 Upper-division elective	4

**Area F Technology Elective**

F Upper-division elective (may be in concentration)	0-4
Total units	40-52

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> Contact advising for list of minors

**LAES - Engineering - Computer Graphics Concentration**

CSC/CPE 123	Introduction to Computing	4
CSC/CPE 101	Fundamentals of Computer Science I	4
CSC/CPE 102	Fundamentals of Computer Science II	4
CSC/CPE 103	Fundamentals of Computer Science III	4
CSC 141	Discrete Structures I	4
CSC/CPE 225	Introduction to Computer Organization	4
CSC 303	Teaching Computer Science	2
CSC/CPE 357	Systems Programming	4

CSC/CPE 471	Introduction to Computer Graphics	4
Total units		34

## LAES - Engineering - Electrical Engineering (Power) Concentration

EE 111	Introduction to Electrical Engineering	1
EE 151	Introduction to Electrical Engineering Laboratory	1
EE 112	Electric Circuit Analysis I	2
EE 211	Electric Circuit Analysis II	3
EE 241	Electric Circuit Analysis Laboratory II	1
EE 212	Electric Circuit Analysis III	3
EE 242	Electric Circuit Analysis Laboratory III	1
EE 255	Energy Conversion Electromagnetics	3
EE 295	Energy Conversion Electromagnetics Laboratory	1
EE 335	Electromagnetic Fields and Transmission	4
EE 375	Electromagnetic Fields and Transmission Laboratory	1
EE 406	Power Systems Analysis I	4
EE 407	Power Systems Analysis II	4
EE 444	Power Systems Laboratory	1
Advisor approved power technical elective		4
Total units		34

## LAES - Engineering - Industrial/Manufacturing Engineering - System Design Concentration

IME 101	Introduction to Industrial and Manufacturing Engineering	1
IME 223	Process Improvement Fundamentals	4
IME 239	Industrial Costs and Controls	3
IME 301	Operations Research I	4
IME 303	Project Organization and Management	4
IME 314	Engineering Economics	3
IME 319	Human Factors Engineering (IME 320 - Area F) <sup>1</sup>	3-4
or IME 320	Human Factors and Technology	
IME 326	Engineering Test Design and Analysis	4
IME 420	Simulation	4
IME 443	Facilities Planning and Design	4
Total units		34-35

<sup>1</sup> Required in Major; also satisfies GE

## LAES - Liberal Arts - Culture, Society and Technology Concentration

ES/WGS 350	Gender, Race, Science and Technology (Area F) (USCP) <sup>1</sup>	4
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HUM 303	Values and Technology (C4) <sup>1</sup>	4
or PHIL 341	Professional Ethics	
or PHIL 337	Business Ethics	
POLS 451	Technology and Public Policy	4

### Approved Electives

Select from the following:		12
ANT 360	Human Cultural Adaptations	
COMS 317	Technology and Human Communication	
GEOG 318	Applications in GIS	
GEOG 333	Human Impact on the Earth	
HIST 354	History of Network Technology	
HIST 359	Living in a Material World	
JOUR 331	Contemporary Advertising	
JOUR 470	Selected Advanced Topics	
PHIL 322	Philosophy of Technology	
PHIL 340	Environmental Ethics	
POLS 328	Politics of Developing Areas	
POLS 333	World Food Systems	
POLS 346	Politics in Literature	
POLS 347	Politics and Popular Culture	
POLS 470	Selected Advanced Topics	
PSY 311	Environmental Psychology	

Total units		24
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<sup>1</sup> Required in Major; also satisfies GE

## LAES - Liberal Arts - Interactive Communication-Cinematic Focus Concentration

TH 210	Introduction to Theatre (C3) <sup>1</sup>	4
ENGL 371	Film Styles and Genres (C4) <sup>1</sup>	4
ENGL 411	New Media Arts I	4

### Approved Electives

Select from the following:		12
ENGL 210	New Media Technology	
ENGL 370	World Cinema	
ENGL 372	Film Directors	
ENGL 412	New Media Arts II	
ENGL 416	New Media Study	
ENGL 419	Multimedia Projects	
COMS 311	Communication Theory	
COMS 385	Media Criticism	
COMS 419	Media Effects	
POLS 470	Selected Advanced Topics	

Total units		24
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<sup>1</sup> Required in Major; also satisfies GE

## LAES - Liberal Arts - Interactive Communication-Theatrical Focus Concentration

TH 210	Introduction to Theatre (C3) <sup>1</sup>	4
TH 227	Theatre History I	4
or TH 228	Theatre History II	
ENGL 411	New Media Arts I	4
<b>Approved Electives</b>		
Select from the following: <sup>2</sup>		12
ENGL 210	New Media Technology	
ENGL 412	New Media Arts II	
TH 220	Acting Methods	
TH 230	Stagecraft I	
TH 310	Women's Theatre	
or TH 320	Black Theatre	
or TH 360	Theatre in the United States	
or TH 390	Global Theatre and Performance	
TH 330	Stagecraft II	
TH 430	Scenic Design	
TH 434	Lighting Design	
HUM 320	Values, Media, and Culture	
Total units		24

<sup>1</sup> Required in Major; also satisfies GE

<sup>2</sup> No more than one lower division course

## LAES - Liberal Arts - Publishing Technology Concentration

GRC 101	Introduction to Graphic Communication	3
GRC 201	Digital Publishing System	3
GRC 211	Substrates, Inks and Toners	4
HUM 303	Values and Technology (C4) <sup>1</sup>	4
or PHIL 341	Professional Ethics	
or PHIL 337	Business Ethics	
<b>Approved Electives</b>		
Select from the following:		10
COMS 317	Technology and Human Communication	
GRC 316	Flexographic Printing Technology	
GRC 328	Sheetfed Printing Technology	
GRC 329	Web Offset and Gravure Printing Technologies	
GRC 402	Digital Printing and Emerging Technologies in Graphic Communication	
Total units		24

<sup>1</sup> Required in Major; also satisfies GE

## LAES - Liberal Arts - Technical Communication Concentration

ENGL 317	Technical Editing	4
ENGL 319	Information Design and Production	4
COMS 317	Technology and Human Communication	4
<b>Approved Electives</b>		
Select from the following:		12
ENGL 210	New Media Technology	
ENGL 310	Corporate Communication	
ENGL 418	Technical Communication Practicum	
or ENGL 420	Client-Based Technical Communication	
HUM 303	Values and Technology	
PHIL 337	Business Ethics	
or PHIL 341	Professional Ethics	
COMS 213	Organizational Communication	
COMS 301	Business and Professional Communication	
Total units		24



## MBA/MS Engineering

Orfalea College of Business  
Bradford P. Anderson, Associate Dean  
Business Bldg. (03), Room 409  
Phone: 805.756.2637

College of Engineering  
Engineering Bldg. IV (192), Room 301  
Phone: 805.756.2131

mba@calpoly.edu  
<http://mba.calpoly.edu/>

### Academic Programs

Program name	Program type
Engineering Management	MBA/MS Engineering

The dual-degree Engineering Management Program (EMP) is an interdisciplinary program linking the MBA and MS in Engineering degree programs. It is a cooperative effort between the Orfalea College of Business and the Cal Poly College of Engineering (Industrial and Manufacturing Engineering Department). Students are required to have a prerequisite undergraduate bachelor's degree in engineering, computer science, or equivalent technical degree to be admitted to both the College of Engineering and the Orfalea College of Business, and to be enrolled in both degree programs. Successful participants are awarded both MBA and MS in Engineering degrees, each with a specialization in Engineering Management.

The mission of the EMP is to develop high quality industry-ready graduates who will be facilitators of change and integrators of engineering, business, and people issues.

### Prerequisites

Students are required to possess an undergraduate bachelor's degree from an accredited program in engineering, computer science, or equivalent technical degree.

### Admission/Acceptance Requirements

Admission to the EMP is based upon:

- successful completion of an accredited undergraduate program of study
- prior academic performance with particular emphasis placed on the last 90 quarter units (60 semester units)
- achievement on the Graduate Management Admission Test (GMAT) or Graduate Records Examination general test (GRE), with particular emphasis placed on performance on the quantitative portion
- prior work experience (desirable).

### Culminating Experience

In order to satisfy the culminating experience requirement, students must satisfactorily complete a required assigned comprehensive examination or project in the MBA program *and* satisfactorily complete a comprehensive project in IME 596. A comprehensive examination or other options may be available, but must be approved in advance by the Orfalea College of Business Associate Dean and by the College of Engineering, Engineering Management Program Coordinator.

### Formal Study Plan

The development and approval of two study plans, that together fulfill the dual degree requirements, is obligatory. Students will work with the 1) College of Engineering advisor to develop a plan to fulfill the requirements for the MS portion and the 2) Orfalea College of Business advisor to develop a plan that to fulfill the requirements for the MBA portion of this dual degree program. Graduate students must file the study plans, no later than the end of the quarter in which twelve aggregate total units of courses are completed.

## MBA/MS Engineering, Specialization in Engineering Management

### Program Learning Objectives

#### Master of Business Administration

The learning objectives of the MBA programs are for students to be able to:

- 1.1 Demonstrate competency in the following areas of business: management, quantitative methods, economics, accounting, finance, marketing, operations, and strategy.
- 1.2 Demonstrate strategic integration of the above areas.
- 1.3 Demonstrate the ability to apply analytics to decision making.
- 2.1 Recognize issues and create solutions using an approach that reflects ethical values.
- 3.1 Demonstrate knowledge of the issues involved in conducting business in a diverse, global environment.
- 4.1 Demonstrate professional written communication skills.
- 4.2 Demonstrate professional oral communication and presentation skills.
- 5.1 Recognize leadership skills and link to leadership theory.
- 5.2 Demonstrate effective team behaviors.

### Engineering Management Program (EMP)

The learning objectives for the EMP include the learning objectives of the MBA program and the MS Engineering program (Industrial and Manufacturing Engineering Department). Three additional objectives of this program are to:

1. integrate knowledge and skills from engineering and business disciplines for effective responses to rapidly changing technological and business environments;
2. prepare engineers for effective participation in the management of technology, management of technology-based organizations, and management of technological change; and
3. take advantage of the unique background of program participants and the unique strengths of Cal Poly.

#### Required Courses

GSB 511	Accounting for Managers	4
GSB 513	Organizational Behavior	4
GSB 523	Managerial Economics	4
GSB 524	Marketing Management	4
or GSB 573	Marketing Research	
GSB 531	Managerial Finance	4
GSB 533	Aggregate Economics Analysis and Policy	4
GSB 562	Seminar in General Management and Strategy	4
IME 503	Applied Statistical Methods in Engineering	4
IME 507	Graduate Seminar (2) (2)	4

IME 556	Technological Project Management	4
IME 580	Manufacturing Systems	4
IME 596	Team Project/Internship	10
<b>College of Engineering</b>		
Approved Electives		20
<b>Other Advisor Approved Electives</b>		
Approved Electives		16
Total units		90

## MCRP/MS Engineering, Transportation Planning

College of Engineering  
Engineering Bldg. (13), Room 266  
Phone: 805.756.2131

City and Regional Planning  
Architecture & Environmental Design Bldg. (05), Room 313  
Phone: 805.756.1315  
<http://planning.calpoly.edu/>

### Academic Programs

Program name	Program type
Transportation Planning	MCRP/MS Engineering

The Transportation Planning Specialization is a joint interdisciplinary program between the College of Engineering and the City and Regional Planning Department of the College of Architecture and Environmental Design. Participation in the program requires enrollment in both Colleges. Participants successfully completing the program are awarded both the MCRP and the MS in Engineering, each with a Specialization in Transportation Planning.

### MCRP/MS Engineering, Specialization in Transportation Planning

The major objectives of this joint program are to:

1. Provide an interdisciplinary graduate program which combines elements of transportation planning with city and regional planning to address a need for professionals who understand the technology of transportation planning and the importance of transportation within the urban environment. The required master's project enables students to integrate their work through directed study applied to special areas of their choosing.
2. Provide planners with courses essential to understanding the technologies of transportation planning. Provide engineers with a broad background in urban studies and knowledge of contemporary environmental issues.
3. Take advantage of the backgrounds of program participants. The graduate students of both sponsoring departments include both mature professionals returning for advanced degrees and recent graduates with diversity of specializations.

### Prerequisites

Applicants must have satisfactorily completed courses that cover the following or equivalent subject areas:

- CE 321 Fundamentals of Transportation Engineering or CRP 435 Transportation Theory
- COMS 101 Public Speaking
- ECON 201 Survey of Economics or ECON 222 Macroeconomics
- ENGL 148 Reasoning, Argumentation and Professional Writing or ENGL 149 Technical Writing for Engineers
- MATH 142 Calculus II
- PHYS 141 General Physics IA
- STAT 312 Statistical Methods for Engineers or STAT 321 Probability and Statistics for Engineers and Scientists

Applicants for admission are expected to:

1. Have earned a bachelor's degree from an accredited university or college,
2. Have attained a grade point average of 3.0 in last 90 units of undergraduate work,
3. Provide results of the Graduate Record Examination (GRE) Aptitude Test to the Admissions Committee (GRE requirement may be waived for Cal Poly bachelor of science graduates and applicants with superior academic records).
4. Give indications of motivation, maturity, and high standards of academic involvement through work and references (three letters required) and submission of a project or paper demonstrating writing ability,
5. Provide a current résumé.

Applicants lacking prerequisites or other background requirements for classified standing may be admitted on a conditionally classified basis, depending on the results of an individual analysis of their applications.

### Degree Requirements and Curriculum

#### Core Courses

CE 523	Transportation Systems Planning	4
CE 528	Transportation Economics and Analysis	4
or CE 421	Traffic Engineering	
CE 591	Graduate Seminar I	1
CRP 435	Transportation Theory	4
CRP 501	Foundations of Cities and Planning	4
CRP 504	Sustainable Communities	4
CRP 510	Planning Theory	4
CRP 513	Planning Research and Analysis	4
CRP 516	Demographic and Analytic Tools	4
CRP 518	Policy Development	4
CRP 525	Plan Implementation	4
CRP 530	Planning Agency Management	4
CRP 535	Land Use and Planning Law	4
CRP 552	Community and Regional Planning Studio I	4
CRP 553	Project Planning and Design Studio	4
CRP 554	Community and Regional Planning Studio II	4

Advisor Approved Electives 3-5

#### Culminating Experience (choose one)

Select from the following: 4-6

CE 599	Design Project (Thesis) (2, 2, 2)
CRP 599	Thesis (2, 2, 2)
CRP 596	Professional Project (2, 2, 2)
CRP 556	Community and Regional Planning Studio III (4)

#### Approved CE/ENVE electives

Select from the following: 20

CE 421	Traffic Engineering
CE 422	Highway Geometrics and Design
CE 423	Intelligent Transportation Systems
CE 424	Public Transportation
CE 500	Individual Study
CE 521	Highway Pavement Designs
CE 524	Pavement Performance and Management Systems

CE 525	Airport Planning and Design
CE 526	Transportation Safety
CE 527	Sustainable Mobility
CE 528	Transportation Economics and Analysis
CE 529	Modeling and Simulation in Transportation
CE 570	Selected Advanced Topics
CE 571	Selected Advanced Laboratory
ENVE 411	Air Pollution Control
other advisor approved CE/ENVE courses	
<hr/>	
Total units	90

# Graduate Education

Graduate Education

Science Bldg. (52), Room E47

Phone: 805.756.2328; Fax: 805.756.2299

## Application for Admission

An application for admission to a Master's program may be obtained from the Admissions Office of any CSU campus. The application form and official transcripts should be sent directly to the Admissions Office at Cal Poly. An electronic version of the CSU graduate application is available on the World Wide Web at [www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>). The CSU Mentor system allows students to browse through general information about CSU's twenty-three campuses, view multimedia campus presentations, send and receive electronic responses to specific questions, and apply for admission and financial aid.

All graduate and post-baccalaureate applicants (e.g., master's degree applicants, those seeking educational credentials, or graduate certificates, and where permitted, holders of baccalaureate degrees interested in taking courses for personal or professional growth) must file a complete graduate application as described in the graduate and post-baccalaureate admission materials at [www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>). Applicants who completed undergraduate degree requirements on a CSU campus and graduated the preceding term are also required to complete and submit an application and the \$55 nonrefundable application fee. Since applicants for post-baccalaureate programs may be limited to the choice of a single campus on each application, rerouting to alternative campuses or later change of campus choice is not guaranteed. To be assured of initial consideration by more than one campus, it is necessary to submit separate applications (including fees) to each. Applications submitted by way of [www.csumentor.edu](http://www.csumentor.edu) (<http://www.csumentor.edu>) are expected unless submission of an electronic application is impossible.

The CSU advises prospective students that they must supply complete and accurate information on the application for admission, residence questionnaire, and financial aid forms. Further, applicants must submit authentic and certified transcripts of all previous academic work attempted. Transcripts must be official and sent directly from the issuing institution in a sealed envelope. Failure to file complete, accurate, and authentic application documents may result in denial of admission, cancellation of academic credit, suspension, or expulsion (Section 41301, Article 1.1, Title 5, *California Code of Regulations*).

All master's, credential, and graduate certificate applicants must submit the following documents to the Office of Admissions to establish their admission portfolio:

- Application for graduate admission
- \$55 application fee
- Certified transcripts from all schools attended

Applicants for graduate certificate programs should contact the specific department for application requirements and deadlines.

## Graduate and Postbaccalaureate Admission Requirements

Graduate and post-baccalaureate applicants may apply for a degree objective, a credential or certificate objective. Depending on the objective, the CSU considers an application for admission as follows:

- **General Requirements** -- The minimum requirements for admission to graduate and post-baccalaureate studies at a California State University campus are in accordance with university regulations as well as Title 5, chapter 1, sub-chapter 3 of the *California Code of Regulations*.
- Specifically, a student shall at the time of enrollment:
  1. have completed a four-year college course of study and hold an acceptable baccalaureate degree from an institution accredited by a regional accrediting association, or shall have completed equivalent academic preparation as determined by appropriate campus authorities;
  2. be in good standing at the last college or university attended;
  3. have attained a grade point average of at least 2.5 (A = 4.0) in the last 60 semester (90 quarter) units attempted or have earned a grade point average of at least 2.5 on the last degree completed by the candidate; and
  4. satisfactorily meet the professional, personal, scholastic, and other standards for graduate study, including qualifying examinations, as appropriate campus authorities may prescribe. In unusual circumstances, a campus may make exceptions to these criteria.
- A student who meets the minimum requirements for graduate and post-baccalaureate studies may be considered for admission in one of the four following categories:
  - **Graduate Classified** -- To pursue a graduate degree, candidates are required to fulfill all of the professional, personal, scholastic, and other standards, including qualifying examinations, prescribed by the campus.
  - **Graduate Conditionally Classified** -- Candidates may be admitted to a graduate degree program in this category if, in the opinion of appropriate campus authority, deficiencies can be remedied by additional preparation.
  - **Post-Baccalaureate Classified, e.g., admission to an education credential program** -- Candidates who wish to enroll in a credential or certificate program are required to satisfy additional professional, personal, scholastic, and other standards, including qualifying examinations, prescribed by the campus.
  - **Post-Baccalaureate Unclassified** -- To enroll in undergraduate courses as preparation for advanced degree programs or to enroll in graduate courses for professional or personal growth, a candidate must be admitted as a post-baccalaureate unclassified student. By meeting the minimum requirements, the candidate is eligible for admission as a post-baccalaureate unclassified student. Admission in this status does not constitute admission to, or assurance of consideration for admission to, any graduate degree or credential program, and requires approval from the Director of Graduate Education.

If your transcript is not received by the Admissions Office prior to the first day of what would be your second quarter, or if your degree was not awarded for a preceding term, you are required to reapply for a subsequent quarter. A second application and fee to a post-baccalaureate program are not accepted or processed until an official



transcript is provided showing that your undergraduate degree has been awarded. Unless proof of an undergraduate degree is provided by the registration date for your second quarter, you will not be allowed to register.

Under special circumstances graduate coordinators may recommend admission of applicants who do not meet eligibility requirements. The Director of Graduate Education acts on these recommendations.

## Residency Status Determination

The campus Admissions Office determines the residency status of all new and returning students for nonresident tuition purposes. Responses to the application for admission and, if necessary, other evidence furnished by the student are used in making this determination. A student who fails to submit adequate information to establish a right to classification as a California resident is classified as a nonresident. For detailed explanation please refer to Determination of Residence for Nonresident Tuition Purposes (<http://catalog.calpoly.edu/previouscatalogs/2013-15/financialinformaton>) .

## International (Foreign) Student Admission Requirements

International master's and credential applicants must file an application for admission with the Office of Admissions. For this purpose, "foreign students" include those who hold U.S. temporary visas as students, exchange visitors, or in other non-immigrant classifications. The application may be filed at any time, but in order to be considered for admission in the targeted quarter the portfolio must be completed by the dates listed below.

Term	Application Filing Period	File Completion Deadline
Fall Quarter	November 30	April 1st
Winter Quarter	June 30	September 1st

All master's and credential applicants must submit the following documents to establish their admission portfolio:

- Application form, Parts A and B
- \$55 application fee
- Certified transcripts from all schools attended, showing coursework. All official documents must be accompanied by a certified English translation from one of the following
  - Institute for International Education (IIE)
  - AMIDEAST
  - Saudi Arabian Education Mission
  - United States Embassy or Consulate
- Confidential financial statement
- Promissory note agreeing to purchase required health insurance
- International Educational Background form
- AACRAO credential analysis fee of \$75 in the form of a U.S. Postal Money Order or an International Money Order, made payable to "AACRAO" (American Association of Collegiate Registrars and Admissions Officers)
- Spouse/Dependent Declaration form

International graduate certificate applicants must contact their specific department for application requirements and deadlines.

All graduate and post-baccalaureate applicants, regardless of citizenship, whose native language is not English and whose preparatory education was principally in a language other than English

must demonstrate competence in English. Those who do not possess a bachelor's degree from a post-secondary institution where English is the principal language of instruction must take either the Test of English as a Foreign Language (TOEFL) or the International English Language Testing system (IELTS) exam.

The TOEFL must have been taken within the last two years with a minimum score of 550 (paper version), 213 (computerized version) or 80 (internet based). The minimum score for the IELTS is 6.0, although individual programs may require higher scores. Applicants are advised to review program-specific information.

The TOEFL or IELTS requirement is waived for applicants whose native language is English. Applicants from countries listed on the following website will be considered native English speakers. <http://admissions.calpoly.edu/apply/toefl>

The Office of Admissions completes an initial portfolio review that includes verification of an equivalent B.A./B.S. degree, a determination of the appropriate level of study and a narrative evaluation of all work completed. Copies are included in the applicant's file.

The Office of Admissions notifies all applicants of the documents needed to complete their portfolios. Graduate coordinators may require additional documentation to assist them in determining an applicant's suitability for the program of study.

International applicants for graduate study can receive either conditional or classified admission. The graduate coordinators make all recommendations to the Director of Admissions for conditional and classified admissions to the graduate program.

## Health Screening

All new and readmitted students must provide proof of full immunization against measles and rubella prior to enrollment. All students 18 years of age or younger at the start of their first term must provide proof of full immunization against Hepatitis B before enrolling. These are *not* admission requirements, but are required of students as conditions of enrollment in CSU. Proof of measles and rubella immunizations is also required for certain groups of enrolled students who have increased exposure to these diseases. See Academic Requirements and Policies (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/registration>) for more information, or contact Health Services at 805.756.1211) or visit [www.hcs.calpoly.edu/](http://www.hcs.calpoly.edu/) .

## Deadlines

Master's and credential applicants may file an application for admission at any time. In order to be considered for admission in the "targeted" quarter, the portfolio must be completed by the dates provided at the following websites:

- Application deadlines for graduate programs are available at <http://admissions.calpoly.edu/apply/gprograms> .
- Application deadlines for credential programs are available at <http://soe.calpoly.edu> .
- Application deadlines for graduate certificate programs are available at <http://www.extended.calpoly.edu/>

## Master's Degree Programs

- Accounting, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/#graduatetext>)
  - Financial Accounting Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/msaccountingspecializationinfinancialaccounting>)
  - Tax Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/msaccountingspecializationintax>)
- Aerospace Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/#graduatetext>)<sup>1</sup>
  - Research Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/msaerospaceengineeringspecializationinresearch>)
  - Space Systems Engineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/msaerospaceengineeringspecializationinspacesystemsengineering>)
- Agribusiness, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agribusiness/msagribusiness>)
- Agricultural Education, Master of (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agriculturaleducationcommunication/masterofagriculturaleducation>)
- Agriculture, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/#graduatetext>)
  - Agricultural Engineering Technology Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/agriculturalengineeringtechnology>)
  - Animal Science Specialization ([http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/ms\\_animalscience](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/ms_animalscience))
  - Crop Science Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/cropspecialization>)
  - Dairy Products Technology Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/dairyproductstechnology>)
  - Environmental Horticulture Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/environmentalhorticulturalscience>)
  - Food Science and Nutrition Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/foodscienceandnutrition>)
  - Irrigation Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/irrigation>)
  - Plant Protection Science Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/plantprotectionscience>)
  - Recreation, Parks, and Tourism Management Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/recreationparksandtourismmanagement>)
  - Soil Science Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/soilscience>)
- Architecture, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/architecture/masterofscienceinarchitecture>)
  - Architectural Engineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/architecture/msarchitecturespecializationinarchitecturalengineering>)
- Biological Sciences, MA (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/mabiologicalsciences>) , MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/biologicalsciences/msbiologicalsciences>)
- Biomedical Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/biomedicalgeneralengineering/msbiomedicalengineering>)
- Business Administration, MBA (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/#graduatetext>)
  - Agribusiness Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/agribusinessspecialization>)
  - General Management Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/generalmanagement>)
  - Graphic Communication Document Systems Management Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/graphiccommunication>)
- Business and Technology, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/msbusinessandtechnology>)
- City and Regional Planning, MCRP (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/cityregionalplanning/masterofcityandregionalplanning>)

- Civil and Environmental Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/civilenvironmentalengineering/mscivilandenvironmentalengineering>)
  - Computer Science, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/computerscience/mscomputerscience>)
  - Dairy Products Technology, MPS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/dairyscience/mpsdairyproductstechnology>)
  - Education, MA ([http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/#master\\_of\\_arts\\_in\\_education](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/#master_of_arts_in_education))
    - Counseling and Guidance Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/maeducationspecializationincounselingandguidance>)
    - Educational Leadership and Administration Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/maeducationspecializationineducationalleadershipandadministration>)
    - Special Education Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/schoolofeducation/maeducationspecializationinspecialeducation>)
  - Electrical Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/electricalengineering/mselectricalengineering>)<sup>1</sup>
  - Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/#graduatetext>)
    - Biochemical Engineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msengineeringsspecializationinbiochemicalengineering>)<sup>1</sup>
    - Bioengineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msengineeringsspecializationinbioengineering>)<sup>1</sup>
    - Biomedical Engineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msengineeringsspecializationinbiomedicalengineering>)<sup>1</sup>
    - Integrated Technology Management Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msengineeringsspecializationinintegratedtechnologymanagement>)<sup>1</sup>
    - Materials Engineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msengineeringsspecializationinmaterialsengineering>)<sup>1</sup>
    - Water Engineering Specialization (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msengineeringsspecializationinwaterengineering>)
  - English, MA (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/english/maenglish>)
  - Fire Protection Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/msfireprotectionengineering>)
  - Forestry Sciences, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/naturalresourcesmanagementenvironmentalsciences/msforestrysciences>)
  - History, MA (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/history/mahistory>)
  - Industrial Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/industrialmanufacturingengineering/msindustrialengineering>)<sup>1</sup>
  - Kinesiology, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/kinesiology/mskinesiology>)
  - Mathematics, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/mathematics/msmathematics>)<sup>1</sup>
  - Mechanical Engineering, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/mechanicalengineering/msmechanicalengineering>)<sup>1</sup>
  - Polymers and Coatings Science, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofsciencemathematics/chemistrybiochemistry/msinpolymersandcoatingsscience>)
  - Printed Electronics and Functional Imaging, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/graphiccommunication/msprintedelectronicsandfunctionalimaging>)
  - Psychology, MS (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/psychologychilddevelopment/mspsychology>)
  - Public Policy, MPP (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/politicalscience/masterofpublicpolicy>)
  - MCRP/MS Engineering, Specialization in Transportation Planning (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/interdisciplinaryprograms/mcrpmsengineeringtransportationplanning/#graduatetext>)
- <sup>1</sup> Blended BS+MS programs available. See individual program for information.

## Graduate Certificate Programs

- Facilities Management and Operations (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/constructionmanagement/facilitiesmanagementandoperationsgraduatecertificate>)

- Fire Protection Engineering Applications (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/fireprotectionengineeringapplicationsgraduatecertificate>)
- Fire Protection Engineering Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/fireprotectionengineeringssciencegraduatecertificate>)
- Space Systems Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/spacesystemstechnologygraduatecertificate>)

Cal Poly offers studies leading to advanced degrees and graduate certificates through its instructional departments. University policy governing graduate study emphasizes the need for students to demonstrate maturity, responsibility and scholarly integrity. Graduate students should have a command of the basic knowledge, techniques, and skills essential for independent and self-directed study.

In graduate courses, students cope with more complex ideas, problems, techniques and materials than in undergraduate courses. Graduate study requires searching and exhaustive analysis, identification and investigation of theories and principles; application of theory to new ideas, problems, and materials; extensive use of bibliographic and other resource materials, with emphasis on primary sources for data; and demonstration of competence in scholarly presentation of the results of independent study.

Regulations governing fees, grading, and financial aid are located elsewhere in the catalog. This section of the catalog reviews university policy and minimum requirements governing graduate studies. It is not, however, all inclusive.

*Within these general requirements there are specific departmental requirements for each degree. These are found in the descriptions of master's degree programs within each school's description. It is important that graduate students, in consultation with their advisors, familiarize themselves with these requirements. Failure to do so may result in a substantial delay in progress towards the degree and graduation. It is the responsibility of the student to ascertain and comply with all university, college and departmental procedures and requirements.*

## Academic Requirements

The following conditions and requirements are common to all master's degrees:

- All students shall attempt to satisfy the graduation writing requirement during the first quarter of enrollment.
- A student shall file an approved formal study plan before the twelfth unit of graduate study is completed.
- A student shall maintain a grade point average of 3.0 (grade of B on a scale where A = 4.0), or better, in all courses in the formal program of study for the degree. A course in which no letter grade is assigned shall not be used in computing the grade point average.
- A student shall maintain satisfactory scholarship and professional standards. Only those graduate students who continue to demonstrate a satisfactory level of scholastic competence and fitness, as determined by the appropriate university authorities, shall be eligible to continue in such curricula. Students whose performance is judged to be unsatisfactory by the authorities of the

University may be required to withdraw from all graduate degree curricula offered by the University.

- A student shall successfully complete a culminating experience (thesis, project and/or comprehensive examination).
- A student shall complete all of the graduate work in the formal study plan within the seven-year period preceding the date when all the requirements for the degree have been met.
- A student may elect to meet the graduation requirements in effect in the catalog either at the time the student was admitted to graduate standing (conditional or classified) provided that continuous enrollment was maintained, or at the time of graduation. The student may be required to make substitutions for discontinued courses.

## Graduate Student Continuous Enrollment Policy

Effective Fall Quarter 2009, graduate students are required to maintain continuous enrollment from the time of first enrollment in a graduate program until completion of the degree. Continuous enrollment is defined as being enrolled during Fall, Winter, and Spring quarters each year. All graduate students must be enrolled during the quarter in which they graduate. Therefore, a student graduating summer quarter must be enrolled during the summer. Students can maintain continuous enrollment by being enrolled as regular students; obtaining approval for an education or medical leave prior to the quarter when such a leave would begin; or registering in a special course designated for this purpose, during quarters in which they are not regularly enrolled. The special course, GS 597, is listed in the University catalog and is taken through Cal Poly Extended Education. GS 597 is a one-unit course, offered credit/no credit; credits in GS 597 do not count toward meeting degree requirements. Students who fail to fulfill this continuous enrollment requirement will be not be permitted to graduate—even if all degree requirements have been completed—until payment has been made for all quarters of non-enrollment. This requirement is not retroactive to terms prior to Fall 2009.

For further information and a registration form, visit the Extended Education website at: <http://www.extended.calpoly.edu/academic/continuous-enrollment.html>

## Academic Probation

A student who is enrolled in a graduate degree program in conditionally classified or classified standing shall be placed on academic probation for failure to maintain a cumulative grade point average of at least 3.0 (grade of B on a scale where A = 4.0) in all courses in the formal program of study for the degree.

A student who has been admitted as post-baccalaureate classified in order to pursue a credential program shall be subject to academic probation for failure to maintain a cumulative grade point average of at least 3.0 in all units taken in the credential program.

A post-baccalaureate unclassified student (one who has not been admitted to either a credential or graduate degree program) shall be subject to academic probation for failure to maintain a cumulative grade point average of at least 2.5 in all units attempted subsequent to admission to post-baccalaureate standing.

## Academic Disqualification

A graduate or post-baccalaureate student shall be subject to disqualification if while on probation the student fails to achieve a sufficient grade point average to be removed from probationary status.



Disqualification may be either from further registration in the program or from further enrollment at the University as determined by the student's college dean. Notification of disqualification is made by the college dean.

## Administrative Academic Disqualification

A graduate student may also be placed on probation or may be disqualified by appropriate campus authorities for unsatisfactory scholastic progress regardless of grade point average. Such actions shall be limited to those arising from repeated withdrawal, failure to progress toward an educational objective or noncompliance with an academic requirement, and shall be consistent with guidelines issued by the Chancellor's Office.

## Advancement to Candidacy

Advancement to candidacy recognizes that the student has demonstrated the ability to operate at and sustain a level of scholarly competence that is satisfactory for successful completion of the degree requirements. The student is then cleared for the final stages of the program, which, in addition to any remaining coursework, includes the thesis, project, and/or comprehensive examination.

The student may request advancement to candidacy only after a formal program of study has been submitted, the graduation writing requirement has been satisfied, and sufficient coursework has been completed to allow the department to make a judgment about the student's potential to complete the program.

## Advisement

Soon after enrollment, students should contact the department for the assignment of an advisor in their area of study. Students should meet with their advisors prior to registration, for information concerning prerequisites, courses to be taken, and to develop an informal study plan. An informal study plan is a projection of initial coursework, including prerequisites, that the student undertakes prior to filing a formal study plan, or in lieu of the formal program of study, if the student is a post-baccalaureate student without credential or degree objective.

Departmental advisors and graduate coordinators share the responsibility for advising master's degree students throughout their work toward a degree. Students are urged to maintain a personal file of transcripts and other records of all undergraduate and graduate work undertaken, and to make this file available whenever they seek advising.

## Blended BS+MS Programs Academic Objectives

Blended programs provide an accelerated route to a graduate professional degree, with simultaneous conferring of both bachelor's and master's degrees. Most blended programs allow for the possibility of students' earning graduate credit for several of their senior electives, effectively decreasing the summed unit requirements for both degrees. Blended programs provide a seamless process whereby students can progress from undergraduate to graduate status without having to apply through the Admissions Office (thereby eliminating the need to pay the application fee). In addition, blended BS+MS programs provide a meaningful capstone experience that in most cases integrates the senior project with the graduate thesis/project.

## Process for Changing Status

Students who are interested in pursuing blended programs should submit a request to the department head or graduate coordinator for a change of degree objective.

The department head/graduate coordinator, with assistance of the Evaluations Office, determines whether students meet the eligibility criteria (see below). If criteria are met, the coordinator sends a change of degree objective form to Evaluations. Students are notified of their acceptance upon receipt of the signed Change of Objective form.

## Eligibility for Blended Programs

The following are minimum eligibility criteria; *individual departments may have more stringent requirements.*

1. Students must successfully complete a minimum of 180 units / maximum 192 units (for engineering programs the maximum number of units is 205). These units must count toward one or the other of the two degrees (BS or MS) that ultimately are awarded in the blended program; they are not restricted to those counting toward the undergraduate degree alone.
2. Students cannot enter the blended BS+MS program if they have exceeded the maximum number of units as defined in #1, above.
3. Students must have a minimum 2.5 GPA in the last 90 quarter units attempted. (*Note that students, once admitted to graduate standing, must maintain a 3.0 GPA or better in courses counting toward the graduate degree.*)

In addition, students are strongly encouraged to complete the Graduation Writing Requirement (GWR).

## Process to Graduate with Both Degrees

1. Students must be enrolled in BMS status for a minimum of two quarters prior to graduation.
2. Students must submit the Formal Study Plan to Graduate Education (only for courses counting toward MS); request Advancement to Candidacy; and maintain a minimum 3.0 GPA for courses counting toward MS.
3. When all requirements are met for both the undergraduate and graduate programs, both degrees will be awarded at the same time and graduation ceremony.
4. If a student fails to complete the MS program requirements, the BS degree may be granted when all requirements for that degree are met.

## Change of Post-Baccalaureate Objective

If students wish to change their post-baccalaureate objective, they must formally file this intention by obtaining a Post-baccalaureate Change of Objective form, available in Graduate Education or at [www.grad.calpoly.edu](http://www.grad.calpoly.edu). This form cannot be processed by the Evaluations Unit until the student is in her/his second quarter of enrollment.

## Comprehensive Examination

A comprehensive examination is one of the possible culminating experiences for the master's degree and assesses the student's ability to integrate knowledge, show critical and independent thinking, and demonstrate mastery of the subject matter. The results of the examination should provide evidence of these abilities and



achievement. A record of the examination questions and responses is maintained.

## Courses Counting Towards Graduation and Credit/No Credit Grading

Only those letter-graded courses in which an A, B, or C is earned (C- is acceptable) count towards satisfying the total unit requirement for the degree. Courses which are offered only on a credit/no credit basis also satisfy the unit requirement if a credit grade is earned. The equivalent of an A or a B is required to earn credit in such courses.

Graduate students may elect to take courses that are not part of their formal program of study on a credit/no credit basis.

## Credit by Exam for Coursework

See Evaluation of Transfer Credit (<http://catalog.calpoly.edu/previouscatalogs/2013-15/academicstandardsandpolicies/evaluationoftransfercredit>) .

## Culminating Experience

The culminating experience for the granting of a graduate degree is the successful completion of a thesis, project or comprehensive examination. The quality of work accomplished, including the quality of the writing, is the major consideration in judging the acceptability of the thesis, project, or comprehensive examination. The student must successfully complete the culminating experience required by the specific program to be granted a graduate degree.

## Enrollment in Graduate Courses

To enroll in 500-level graduate courses a student must have post-baccalaureate standing, graduate standing, or permission of the instructor.

## Formal Study Plan

The student should make an appointment with the advisor before the 12th unit of work is completed to develop a formal program of study for the master's degree. A formal study plan is an agreement between the student and the college on the specific coursework to be completed in order to fulfill the requirements for the master's degree. A copy of the study plan must be submitted to Graduate Education for review and final approval.

Certain 400-series courses may be completed by the graduate student as part of the degree program when this is consistent with university requirements, departmental master's degree specifications, and the candidate's formal program of study. The student should always consult the advisor to make certain that only approved courses are selected, since departmental requirements vary and some courses are excluded. No fewer than one-half of the units required for the degree shall be in courses organized primarily for graduate students (500-level).

Only 400- and 500-level courses are allowed in an approved graduate plan of study. In those programs where specific courses below the 400-level may be essential for a student's success, the student may be conditionally accepted to the program contingent upon completing those courses. Courses below the 400-level may not constitute any part of the approved units in the plan of graduate study.

No fewer than 32 quarter units of a 45-unit program shall be completed in residence. In programs with more than 45 units an equivalent proportion (32/45) of units must be taken "in residence". A course taught "in residence" is normally a catalog offering taught by a Cal

Poly faculty member. Extended Education courses may not be used to fulfill the residency requirement. However, summer session courses, and up to 12 units taken through Open University, can be counted as courses in residence. Petitioned graduate courses taken at Cal Poly as an undergraduate count as taken in residence. Courses for which students received credit by examination may be petitioned to count as taken in residence. These situations are explained further below.

No more than 13 quarter units of approved Extended Education courses shall be accepted for the master's degree. Regular Extended Education courses may not be used to satisfy the residency requirement, but grades earned in these courses count in calculation of the student's grade point average if they are part of the formal study plan.

No more than 12 Open University quarter units shall be approved in the submission of a formal study plan. Open University courses are counted for "in residence" credit.

In addition to the above rules governing "in-residence" courses, the following apply to courses included on the formal study plan:

- No more than nine quarter units shall be in student teaching.
- No more than nine quarter units shall be allowed for a thesis or project.
- No more than 12 quarter units of approved post-baccalaureate (unclassified) course credit may be accepted for the master's degree.

## Full-Time Graduate Student Status

A full-time graduate student is defined as one taking 8 or more units in a quarter. Students receiving financial aid may need to meet different requirements to be considered full-time and should consult with the Financial Aid Office. Normally students are not permitted to enroll in more than 16 units each quarter.

## Grade Point Calculation for Graduate Degree

Satisfaction of the GPA requirement for the conferring of the master's degree requires a GPA of 3.0 or more in the courses taken in the formal study plan. Repeating a course does not remove a lower letter grade from the overall GPA calculation on the student's transcript.

## Graduate Certificate Programs

An academic graduate certificate program declares that a student has satisfactorily completed a sequence of advanced academic courses that provide instruction in a stand-alone, coherent body of specialized knowledge. It is designed to meet requirements for professional competence, expand access to specialized knowledge, or meet occupational needs for advanced interdisciplinary work.

Specific Requirements:

- Admission to a graduate certificate program requires a bachelor's degree from an accredited institution with a major in a relevant field of study. The applicant must have attained a minimum GPA of 2.5 in the last 90 units attempted or have earned a GPA of at least 2.5 in the last degree completed. Work experience may substitute (at the discretion of the program) for the relevancy of the bachelor's degree and for the minimum GPA requirements.
- Courses taken to satisfy the requirements of a graduate certificate program may be applied to the requirements of a graduate degree program; however, students must apply separately for admission

into a graduate degree program. No course-work for the certificate may be below the 400 level. One 4-unit course in transfer credit may be allowed as determined by the graduate certificate program advisor.

- A minimum GPA of 3.0 is required for successful completion of a graduate certificate program. Students may not elect to take courses required for the certificate as credit/no credit. A graduate certificate program must be completed within three years.
- Students who are enrolled only in a graduate certificate program are exempt from the continuous enrollment requirement for graduate students.

## Graduate Courses Taken by Undergraduates for Graduate Credit

Cal Poly undergraduates may take courses in the 400 or 500 series for graduate credit while still undergraduates. If they subsequently enter a Cal Poly master's or credential program, they may petition to have such course credit applied toward their master's degree or credential program, if the units were not used for the baccalaureate degree. The mechanism for petitioning is a Graduate Petition for Special Consideration, with the signatures that correspond to the student's graduate program of study.

## Graduation

A student planning to graduate should request a final graduation evaluation from the Evaluations Office approximately two quarters prior to the anticipated date of degree completion. The Request for Graduation Evaluation is submitted to Graduate Education after both the Formal Study Plan and Advancement to Candidacy have been approved. A student cannot graduate without this evaluation.

## Graduation with Distinction

Some, but not all, graduate programs choose to confer the honor "graduation with distinction" on outstanding students. To be eligible for this recognition, students must have a GPA of 3.75 or better and meet specific program criteria.

## Graduation Requirement in Writing Proficiency

The Board of Trustees of the California State University has mandated that all students earning undergraduate or graduate degrees in the CSU must be certified as proficient in writing. In accordance with this mandate, all Cal Poly students must demonstrate competency in writing skills as a requirement for graduation.

Graduate students seeking a Master's Degree should attempt to fulfill the GWR during their first quarter of residency. (Note: Students who do not complete the GWR will not be advanced to candidacy.)

To fulfill the GWR, graduate students should review their program requirements and determine which of the following three options is appropriate:

1. Pass the Writing Proficiency Exam (WPE).
2. Earn both a grade of C or better (C- or below does not qualify) AND certification of writing proficiency based on a 500 to 800 word in-class essay in a GWR-approved upper-division course selected from the eligible classes listed on PASS. The GWR-approved course may be taken on a CR/NC basis, but the required final course grade of C or better must still be earned in order to satisfy the GWR component of the class.

3. Document that the GWR was met as part of an undergraduate program of study at Cal Poly or another CSU campus within seven years of matriculation as a graduate student.

The Graduation Writing Requirement may be waived, at the discretion of campus authorities, in the following circumstances:

1. An equivalent upper-division, graduation writing requirement was satisfied at another 4-year college or university. Again, no more than seven (7) years may elapse between meeting the requirement elsewhere and beginning graduate study at Cal Poly. Students requesting a waiver must complete the "Application Process and Checklist for a GWR Waiver at Cal Poly" (available on the Writing Skills Program webpage, <http://writingskills.calpoly.edu>) before presenting their official, dated documentation to the Writing Skills Program Office, Agriculture Building 10, Room 130.
2. An advanced degree at least equivalent to a Master's was earned. **Supporting documentation, such as a transcript showing the graduation date, must be presented to the Writing Skills Program Office.**

Further information on the GWR may be obtained from the Writing Skills Program Office, Agriculture Building (10) Room 130, Phone: 805.756.2067, or on the Writing Skills Program webpage, <http://writingskills.calpoly.edu>.

## Leaves of Absence

See undergraduate section (<http://catalog.calpoly.edu/previouscatalogs/2013-15/universypolicies>).

## Prerequisites

Each master's degree program has specific prerequisites, both in courses and in grade-point average. Deficiencies in prerequisites must be removed prior to advancement to classified graduate status. Courses taken for this purpose normally do not count toward fulfillment of the unit requirement for the degree.

## Registration

The schedule and instructions for registration and payment of fees are available through the registration and enrollment tab at the MyCalPoly web portal. Detailed descriptions of courses are found in the back of this catalog.

## Repeating a Course

Students may enroll in a course for credit more than once only if the catalog course description states that the course may be repeated for credit. An exception to this policy allows the repeating of a course in cases where a grade of D or F was received.

## Research Involving Special Conditions

Research that involves the use of human subjects, vertebrate animals, hazardous materials, or information and materials subject to export-control regulations requires special campus review before the study begins. If your research involves any of these special conditions, check with your graduate coordinator and Graduate Education for procedures.

## Residence Courses

See "Formal Study Plan" section above.

## Returning Students

Matriculated students who have not registered for three consecutive quarters and have not been on an approved leave of absence must file an application for readmission before the deadline dates listed below. The application fee must accompany the application for readmission.

Matriculated students who have not registered for one quarter or two consecutive quarters are entitled to their registration priority without applying for readmission. Summer Quarter is a regular quarter and is counted in determining the length of absence.

### Application Deadlines for Returning Students

Quarter	Date
Summer Quarter	April 1
Fall Quarter	July 1
Winter Quarter	October 1
Spring Quarter	February 1

## Second Master's Degree

A student can earn only one master's degree in any one of the graduate programs offered. A student who wishes to complete a second master's degree in another discipline, or two master's degrees simultaneously, must complete all requirements for both degrees.

Of the units required in common for each degree, no more than nine quarter units of coursework may be used to satisfy requirements in both master's degree programs.

## Thesis or Project Report Requirements

A thesis is the written product of a systematic study of a significant problem. It identifies the problem, states the major assumptions, explains the significance of the undertaking, sets forth the sources for and methods of gathering information, analyzes the data, and offers a conclusion or recommendation. The finished product evidences originality, critical and independent thinking, appropriate organization and format, and thorough documentation. Normally, an oral defense of the thesis is required.

A project is a significant undertaking appropriate to the fine and applied arts or to professional fields. It evidences originality and independent thinking, appropriate form and organization, and a rationale. It is described and summarized in a written report that includes the project's significance, objectives, methodology, and a conclusion or recommendation. An oral defense of the project may be required.

The following are requirements for a thesis/project committee: 1) that the graduate student have a thesis/project advisor who is a permanent full-time faculty member from the student's program; 2) that the thesis/ project advisor and the student recommend, for approval by the graduate coordinator and/or department head, a thesis/project committee comprising at least three faculty members; 3) that two of these members, one of which is the committee chair, be from the student's program. Exceptions to the thesis/ project committee composition must be approved by Graduate Education.

If a thesis or project report is required in a master's degree program, a committee-approved copy must be completed in accordance with university specifications. Guidelines to be followed in preparing final copy for filing with the University can be obtained from Graduate Education, or online at [www.grad.calpoly.edu](http://www.grad.calpoly.edu).

A copy of the thesis or project report must be received and reviewed by the Thesis Editor in Graduate Education. Upon completion of

any required corrections, the student submits the electronic thesis/ project report to the [DigitalCommons@CalPoly](mailto:DigitalCommons@CalPoly), a digital archive for the University. These steps must be completed before the degree is awarded.

## Time Limit for Degree

The time allowed to complete all coursework in the formal study plan, including thesis and project courses, is seven years. The University, at its option, and in exceptional cases, may extend the time frame. Students who wish to extend the seven-year limit must file a petition for special consideration with Graduate Education, explaining the reasons why the extension is necessary; what courses are requested for inclusion in the study plan that will be over seven years old at the proposed time of graduation; and what evidence is offered to support claims of currency in that coursework.

# Extended Education

Jespersen Hall (116), Room 101  
Phone: 805.756.2053  
extended@calpoly.edu

Vice Provost International, Graduate and Extended Education: Brian C. Tietje  
Director of Academic Programs: Patricia-Ann Stoneman  
Director of Business Services: John P. Lyons  
Director of Marketing Services: Elaine Sullivan

## Programs

Program name	Program type
Interdisciplinary Studies	BA
Accounting	MS
Economics	MS
Fire Protection Engineering	MS
Printed Electronics and Functional Imaging	MS
Dairy Products Technology	MPS
Facilities Management and Operations	Graduate Certificate
Fire Protection Engineering Applications	Graduate Certificate
Fire Protection Engineering Science	Graduate Certificate
Space Systems Technology	Graduate Certificate
Organizational Leadership	Certificate
Wine Industry	Certificate
Printed Electronics and Functional Imaging	Professional Certificate
Systems Integration Engineering	Professional Certificate

Extended Education advances the academic and public service mission of Cal Poly beyond the traditional undergraduate and graduate college experience. Its goal is to increase access to the intellectual resources of the University by developing and offering a wide range of innovative lifelong learning opportunities to the citizens of California and the nation. Educational programs are offered in a variety of learning formats including classroom instruction, distance learning, and client centered services both on- and off-campus.

Information on programs and current offerings is listed in the Extended Education catalog, which is published four times a year, and at <http://www.extended.calpoly.edu>

## Academic Credit

### Open University

This option enables adequately prepared members of the community to enroll in regular Cal Poly courses on a space available basis. Open University is a *non-degree* registration option. Limits as to the number of credits earned through Open University may apply when seeking admission to a degree program. Enrollment forms and guidelines for registering may be obtained from Extended Education two weeks prior to the beginning of each quarter. To view further details and calendar deadlines, please visit <http://www.openuniversity.calpoly.edu>

## Graduate Degrees

The following programs are offered in cooperation with:

Orfalea College of Business:

- MS Accounting, Specialization in Taxation (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/msaccountingspecializationintax>)
- MS Accounting, Specialization in Financial Accounting (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/msaccountingspecializationinfinancialaccounting>)
- MS Economics (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/orfaleacollegeofbusiness/mseconomics>)

For further MS Accounting details visit [http://www.mba.calpoly.edu/ms\\_accounting\\_overview.html](http://www.mba.calpoly.edu/ms_accounting_overview.html).

College of Agriculture, Food and Environmental Sciences:

- MPS Dairy Products (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofagriculturefoodenvironmentalsciences/dairyscience/mpsdairyproductstechnology>)

College of Engineering:

- MS Fire Protection Engineering ([http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/#MS\\_Fire\\_Protection\\_Engineering](http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/#MS_Fire_Protection_Engineering))

For further details and to apply online, please visit <http://www.fpe.calpoly.edu>.

College of Liberal Arts:

- MS Printed Electronics and Functional Imaging (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofliberalarts/graphiccommunication/msprintedelectronicsandfunctionalimaging>)

## Graduate Certificates

The following graduate certificates are offered in cooperation with:

College of Architecture and Environmental Design:

- Graduate Certificate in Facilities Management and Operations (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofarchitectureandenvironmentaldesign/constructionmanagement/facilitiesmanagementandoperationsgraduatecertificate>)

College of Engineering:

- Graduate Certificate in Fire Protection Applications (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/fireprotectionengineeringapplicationsgraduatecertificate>)
- Graduate Certificate in Fire Protection Science (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/fireprotectionengineeringssciencegraduatecertificate>)
- Graduate Certificate in Space Systems Technology (<http://catalog.calpoly.edu/previouscatalogs/2013-15/collegesandprograms/collegeofengineering/aerospaceengineering/spacesystemstechnologygraduatecertificate>)

These certificates are offered online. In 2013, US News and World Report ranked Cal Poly in the top 50 best online Engineering Graduate programs.



## Professional Advancement

For those desiring to upgrade their skills or knowledge, Extended Education offers a wide range of educational opportunities ranging from complete certificate programs to one-day seminars. Certificate programs are offered in Microsoft certifications, supervision, technical communications and the wine industry. New certificates are being planned; updated information is available on the web site.

## Distance Learning

Challenges of time and distance often make it impractical for individuals to travel to campus for classroom-based education opportunities. To address this problem, Extended Education offers many programs in a distance learning format. These programs cover a wide range of subjects including applied technology, graphic communications, business, medical office training, teacher training and math preparation. They are offered online and some are still available in CD format. A complete listing of programs and courses is available at <http://www.extended.calpoly.edu>

## Corporate and Organizational Training

Extended Education will customize training to meet the specific needs of a business, corporation, or organization. This process starts with a needs assessment and continues through design, implementation and evaluation. Past clients include PG&E, the State of California, and the CA Forest Service.

## BA Interdisciplinary Studies

**NOTE: The Adult Degree Program (ADP), which offers the Bachelor of Arts in Interdisciplinary Studies, is presently not accepting applications.**

The curriculum consists of three major parts: interdisciplinary studies courses; major courses from other academic departments; and 12 units of upper-division General Education courses. Students must complete a total of at least 180 units, of which a minimum of 50 upper-division units must be taken through the Adult Degree Program at Cal Poly.

### Credit for Prior College-Level Learning

Students in the Adult Degree Program can earn academic credit toward their degrees for college-level learning acquired outside a traditional college classroom. Earning academic credit for prior college-level learning can reduce a student's time to degree completion. Students can receive Cal Poly academic credit for training or educational programs that they completed and that are included in the American Council on Education's:

- Educational Credits and Credentials' Guide to Evaluation of Educational Experiences in the Armed Services, and/or
- National Guide to Educational Credit for Training Programs.

Credit can also be awarded for successful completion of subject examinations through the:

- College-Level Examination Program (CLEP), and the
- University's challenge examination program.

In addition, ADP students can complete a Prior College-level Learning Portfolio. Portfolios must be completed and submitted within one year of being admitted to the ADP. For complete information and guidelines on obtaining academic credit through any of the above, students

should consult with the ADP Coordinator and/or the Prior College-level Learning Student Handbook.

## Degree Requirements and Curriculum

In addition to the program requirements listed on this page, students must also satisfy requirements outlined in more detail in the Minimum Requirements for Graduation (<http://catalog.calpoly.edu/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of this catalog, including:

- 60 units of upper division courses
- Graduation Writing Requirement (GWR)
- 2.0 GPA
- U.S. Cultural Pluralism (USCP)

Note: No major courses may be taken as credit/no credit.

### Major Courses

IS 101	Interdisciplinary Studies	4
IS 301	Critical Issues Seminar (4,4)	8
IS 302	Analytical Skills Seminar	4
IS 450	Advanced Investigation Seminar	4
IS 460	Capstone Project	4

Select one course from each of the following eight areas (at least seven courses must be upper division) 32

Applied Technology (4)	
Business (4)	
Communications/English (4)	
Ethnic Studies/US Cultural Pluralism (4)	
Fine and Performing Arts (4)	
Philosophy/Religion (4)	
Science or Nutrition (4)	
Social Science (4)	
Five additional courses approved for use in the Adult Degree Program	22

### Upper Division General Education Courses <sup>1</sup>

Arts and Humanities (C4)	4
Society/Individual (D5)	4
Technology (Area F)	4
<b>Transferred Units</b>	<b>90</b>
<b>Total units</b>	<b>180</b>

<sup>1</sup> For complete listing of GE courses, see the General Education (<http://catalog.calpoly.edu/academicstandardsandpolicies/generalrequirementsbachelorsdegree/#generaleducationtext>) section of the catalog.



## Academic Advising

### Our Vision and Mission

Cal Poly strives to provide effective academic advising in an encouraging and welcoming atmosphere to support students as they navigate their undergraduate academic experience and learn to value their education, in order to foster individual academic success.

Academic Advising at Cal Poly is an on-going, intentional, educational partnership dedicated to student success. Cal Poly is committed to building collaborative relationships and a structure that guides students to discover and pursue life goals, support diverse and equitable educational experiences, advance students' intellectual and cultural development, and teach students to become engaged, self-directed learners and competent decisionmakers.

### Which Academic Advisor You Should See

#### Faculty Advisor

- Advising for major and support courses
- Concentration and elective selection
- Interpretation of courses
- Senior project
- Mentorship
- Internships
- Career/graduate school selection
- Referral to appropriate support services

#### College Professional Advisor

- Academic policy and procedure
- Overall degree requirements
- Students on academic probation and other specific student populations with specific needs
- Referral to appropriate support services

### How to Maximize Your Advising Experience

- Think through what questions you have and contact the appropriate advisor.
- Take the initiative to meet with your academic advisor regularly and follow through with recommendations.
- When you email faculty or staff members, use your Cal Poly email account (@calpoly.edu) and be sure to sign your name. Be professional. Be sure to clearly explain questions or requests.
- Check your Cal Poly email daily, and reply in a timely manner to all correspondence methods (both email and phone calls).
- Silence your cell phone prior to advising appointments.

### What We Expect of You, the Student

You are responsible for fulfilling all the requirements of the curriculum in which you are enrolled. Be an active learner by fully engaging in the advising process. Students share responsibility for a successful university experience and are expected to contribute to effective advising experiences by doing the following:

- Be on time for your scheduled appointments and cancel or reschedule if necessary.

- Be prepared to discuss your goals and educational plans during meetings with advisors.
- Keep and organize personal copies of all important documents relevant to your academic career and progress to degree.
- Become knowledgeable of the university catalog, campus-/college-/major-specific academic policies and procedures, academic calendar deadlines and degree or program requirements.
- Review your Degree Progress Report (DPR) each quarter and seek assistance to resolve any errors or questions in a timely manner.
- Inform an advisor of any concerns, special needs, deficiencies, or barriers that might affect academic success.
- Attend advising appointments and programs.
- Be open and willing to consider advice from advisors, faculty, and other mentors.
- Accept responsibility for your decisions and your actions (or inactions) that affect your educational progress and goals.

### What You Can Expect of Your Advisors

Advisors share responsibility for a successful university experience and are expected to contribute to effective advising experiences by doing the following:

- Provide a respectful and confidential environment where you can comfortably discuss academic, career, and personal goals and freely express your concerns.
- Understand and effectively communicate the curriculum, degree/college requirements, graduation requirements, and university policies and procedures.
- Assist you in defining your academic, career, and personal goals, and empower you to create an educational plan that is consistent with those goals.
- Actively listen to your concerns, respect your individual values and choices, and empower you to make informed decisions.
- Serve as an advocate and mentor to promote your success.
- Encourage and support you as you gain the skills and knowledge necessary for success.
- Respond to your questions through meetings, phone calls, or email in a timely manner during regular business hours.
- Collaborate with and refer you to campus resources to enhance your success.
- Maintain confidentiality of your student records and interactions.
- Keep regular office hours and be available to meet with you.
- Participate in evaluating and assessing advising programs and services to better serve you.

### Contact Information for College Advising Centers

Contact	Phone #
Agriculture, Food & Environmental Sciences	Contact Department Offices
Architecture & Environmental Design	805.756.1325
Business	805.756.2601
Engineering	805.756.1461
Liberal Arts	805.756.6200
Science and Mathematics	805.756.2615

## Other Academic Advising Services

Contact	Phone #
Academic Skills Center	805.756.1256
Admissions Office	805.756.2311
Athletics Advising	805.756.2762
Disability Resource Center	805.756.1395
Educational Opportunity Program	805.756.2301
Entry Level Mathematics (ELM, MAPE)	805.756.2268
General Education Program	805.756.2228
Graduate Program	805.756.1508
Health Professionals	805.756.2615
Student Academic Services	805.756.2301
Student Support Services	805.756.1395
Writing Skills Program (EPT, GWR)	805.756.2067

For more information, a list of advising resources, and an advising handbook, go to <http://www.advising.calpoly.edu/>.

## Cal Poly International Center

International Students and Scholars

Study Abroad Programs

Cari Moore, Director  
Bldg 38, Room 145  
Phone: 805.756.1477

<http://www.international.calpoly.edu>

The primary mission of the Cal Poly International Center (IC) is to provide leadership and coordination for Cal Poly international activities and to serve as the principal catalyst for internationalization efforts at Cal Poly. Cal Poly's International Center supports the vision and mission of the University by providing programs and services for both international students studying on campus and students preparing to study abroad. College graduates in the twenty-first century are citizens of a world in which communicating in other languages and understanding other cultures are requirements for successful careers. Many Cal Poly colleges and departments encourage students to pursue overseas study opportunities.

### International Students and Scholars

The International Center provides services and programs aimed at meeting the unique needs of international students and scholars throughout their academic careers at Cal Poly.

We help prepare international students and scholars for their Cal Poly experience by providing immigration advising and documents, pre-arrival information, and assistance. Our staff welcomes newcomers upon their arrival and offers quarterly arrival workshops, visa advising, and seminars.

The International Center is the first point of contact for inviting international visitors to Cal Poly to foster collaboration and cross cultural exchange. We work with academic departments and Dean's offices to produce visa documentation appropriate to the purpose and nature of each academic objective.

Cal Poly International Exchange Programs are centrally managed by the International Center with assistance from Cal Poly Exchange

Coordinators to ensure reciprocity and compliance with the U.S. Department of State and California State University regulations.

The International Peer Contact Program brings international and American students together to share their culture and develop friendships. Cal Poly International Peer Contacts (IPCs) provide a support system to assist new international students with adapting to the "SLO Life." In return, the IPCs receive invaluable experience learning about life in other countries, make many new friends, and create long-lasting relationships with people around the globe.

The Cal Poly International Club is open to international and American students interested in making new friends, sharing culture, language, food, and exploring the USA together.

Find more information for International Students and International Scholars online.

## Study Abroad Programs

Students interested in studying abroad should begin by visiting the International Center web site and coming to the International Center (38-145), Cal Poly's clearinghouse for information on all study abroad programs. A resource center provides students with printed material and web resources on study abroad. Study abroad advisers are available to provide guidance and suggestions.

### Study Abroad and Exchange Eligibility Requirements

Students must be in good academic and disciplinary standing at Cal Poly in order to be eligible to participate in a study abroad or exchange program. In addition, students must meet the eligibility requirements of their chosen programs. Academic eligibility standards vary by program and most require a minimum GPA and at least one letter of recommendation. Participants may not study abroad during their first quarter at Cal Poly. Students who are on Academic Probation or Disciplinary Probation at the time of application, or the term prior to studying abroad, must notify the International Center. Normally, such students will be considered ineligible to participate in the program unless extenuating circumstances exist, and the International Center gives its approval. Students are strongly encouraged to seek pre-approval for courses prior to departing for their terms abroad. If a program is located in a country where there is a U.S. Department of State Travel Warning, Cal Poly may not provide the approval to participate in the program, or provide pre-approval for the transfer of credits.

### Cal Poly Global Programs

**Cal Poly Global Programs** are quarter-long study abroad programs that offer students a unique international experience. Planned with a focus on general education and major classes, these programs are open to all majors. Check our website for additional major specific offerings.

### Cal Poly in Australia

A study program led by Cal Poly faculty at the University of Adelaide campus in Adelaide during Winter Quarter. Courses focus on Agribusiness and Wine & Viticulture with GE augmentation. The study program includes seven weeks of classes with field trips to nearby sites, including wine regions, Kangaroo Island, and a national wildlife park.

## Cal Poly in London

A six-week summer program that immerses students in the arts, humanities, and social sciences while using London as a laboratory. While the program is planned primarily for general education experiences in the liberal arts, the program draws students from all majors. Students take numerous field trips, visiting London's concert halls, theaters, museums, cathedrals, and halls of government.

## Cal Poly in Peru

One of the most unique study abroad programs offered by Cal Poly. The five –week summer program gives students a chance to live with a host family in Cuzco, Peru. Students study Spanish and take Cal Poly general education courses that incorporate hands-on community-based development work. Excursions include trips to Machu Picchu, the Sacred Valley, Lake Titicaca, and the Amazon rainforest.

## Cal Poly in Spain

Summer and Fall Study Program – Students are immersed in Spanish life and culture in the city of Valladolid in northern Spain. Students live with a Spanish family and take Spanish classes from local professors at the University of Valladolid. Cal Poly general education classes highlight Spanish history and culture. Students choose between a 4-week summer immersion program or a 12-week fall quarter program. Excursions include day trips to Salamanca, Segovia, Burgos (Fall) and Santander (Summer).

## Cal Poly in Thailand

In this six-week summer program, students study at Chiang Mai University in Chiang Mai, northern Thailand. Students get a brief introduction to the Thai language and learn how to cook famous Thai dishes, while taking Cal Poly general education classes. Excursions include trips to the Hill Tribe, Bangkok, and Angkor Wat in Cambodia.

## Exchange Programs

Cal Poly has exchange agreements with other universities, either through individual Colleges or academic departments like the Cal Poly Exchanges, or through consortium arrangements such as National Student Exchange or the California State University System. Exchanges rely on a balance of Cal Poly students studying away and students from the partner universities coming to Cal Poly for one, two, or three quarters. Because of this, exchange programs offer affordable options for students wanting to study abroad.

## Cal Poly International Exchange Programs

A number of Cal Poly colleges and departments have individual exchange agreements with a variety of universities around the world. Students in colleges or departments with exchange agreements have an opportunity for a low-cost, easily arranged study abroad experience within their own academic discipline. If students qualify for one of these exchanges, they pay Cal Poly tuition fees and an International Center fee. Students can spend up to one year at an overseas university as regularly enrolled students.

## National Student Exchange (NSE) Consortium

Since its founding in 1968, more than 100,000 students have had the opportunity to study away through the National Student Exchange (NSE). Undergraduate students are able to spend up to one calendar year at another NSE member college or university in The United States, Canada, and the U.S. Territories (Puerto Rico, Guam, and U.S. Virgin Islands.)

## CSU International Programs

Developing intercultural communication skills and international understanding among its students is a vital mission of the California State University (CSU). Since its inception in 1963, the CSU International Programs has contributed to this effort by providing qualified students an affordable opportunity to continue their studies abroad for a full academic year. More than 20,000 CSU students have taken advantage of this unique study option.

International Programs participants earn resident academic credit at their CSU campuses while they pursue full-time study at a host university or special study center abroad for an academic year. The International Programs serves the needs of students in over 100 designated academic majors. Affiliated with more than 50 recognized universities and institutions of higher education in 18 countries, the International Programs also offers a wide selection of study abroad destinations and learning environments.

## Programs

Australia	Griffith University, Macquarie University, Queensland University of Technology, University of Queensland, University of Western Sydney, Victoria University
Canada	Concordia University (Montréal)
Chile	Pontificia Universidad Católica de Chile (Santiago)
China	Peking University (Beijing)
Denmark	Danish Institute for Study Abroad (international education affiliate of the University of Copenhagen)
France	Institut Catholique de Paris, Université d'Aix-Marseille (Aix-en-Provence), Universités de Paris I, III, IV, VI, VII, VIII, X, XI, XII, XIII, Université Paris-Est Marne-la-Vallée, Université d'Evry Val d'Essonne, and Université de Versailles Saint-Quentin-en-Yvelines
Germany	University of Tübingen and a number of institutions of higher education in the Federal state of Baden-Württemberg
Ghana	University of Ghana, Legon
Israel	University of Haifa
Italy	CSU Study Center (Florence), Università degli Studi di Firenze, Accademia di Belle Arti Firenze
Japan	Waseda University (Tokyo), University of Tsukuba
Korea	Yonsei University (Seoul)
Mexico	Instituto Tecnológico y de Estudios Superiores de Monterrey, Campus Querétaro
South Africa	Nelson Mandela Metropolitan University, Port Elizabeth

Spain	Universidad Complutense de Madrid, Universidad de Granada, Universidad de Jaén
Sweden	Uppsala University
Taiwan	National Taiwan University (Taipei), National Tsing Hua University (Hsinchu)
United Kingdom	Bradford University, Bristol University, Hull University, Kingston University, Swansea University

International Programs pays tuition and administrative costs abroad for participating California resident students to a similar extent that such funds would be expended to support similar costs in California. Participants are responsible for all CSU tuition and program fees, personal costs, such as transportation, room and board, and living expenses.

The estimated cost for participation in the CSU International Programs varies from country to country, but, on average, the cost to spend a year abroad on IP is comparable to studying at the CSU for a year. Financial aid, with the exception of Federal Work-Study, is available to qualified students.

Most programs require that students have upper division or graduate standing at a CSU campus by the time of departure. Students at the sophomore level may, however, participate in the intensive language acquisition programs or courses in Canada, China, France, Germany, Korea, Mexico, Spain, Sweden and Taiwan. California Community Colleges transfer students are eligible to apply directly from their community colleges. Students must also possess a current cumulative grade point average of 2.75 or 3.0, depending on the program for which they apply, and must fulfill all coursework prerequisites.

Additional information about specific programs and answers to questions regarding the application materials may be obtained from the IP Coordinator at Cal Poly (38-106), visiting the web page or by writing to the California State University International Programs, 401 Golden Shore, 6th Floor, Long Beach, California 90802-4210.

## Cal Poly Partner Programs

Cal Poly has formal partnership contracts with several private sector and consortium program providers to place Cal Poly students in reputable study situations, usually cooperating universities or specialized study centers. Each partner has specializations and a variety of locations, so be sure to check with a partner website and visit with an Affiliated Partner adviser in the International Center.

## Global Links

Cal Poly has a university-wide affiliation agreement with GlobalLinks Learning Abroad for providing direct enrollment study abroad opportunities in Australia, New Zealand, and Fiji. The 21 Australian and 8 New Zealand universities that work with GlobalLinks have unique academic programs with the highest standard of service. AsiaLearn brings Asia within reach of students from all academic areas with opportunities for study abroad at universities in mainland China, Hong Kong, Japan, Malaysia, Singapore, and South Korea. EuroLearn offers programs in locations such as Greece, Germany, and Wales. International internships are also available in any field of study in Australia, New Zealand, Hong Kong, Shanghai, China, and Valencia, Spain. Programs are available in 6-week, 10-week, or custom lengths. Orientation program is included and scholarships are available.

GlobalLinks serves as the liaison between the host universities and Cal Poly regarding credit transfer, financial aid, and academic issues. The overseas host universities issue the transcripts to Cal Poly. Cal Poly students will receive transfer credit for pre-approved courses and will be considered for GlobalLinks scholarships. Cal Poly will disburse financial aid to eligible students. The Cal Poly affiliation agreement includes all programs in Australia, New Zealand, Fiji, Asia (excluding Thailand), the American College of Thessaloniki in Greece, Freie Universität Berlin, Germany, Swansea University in Wales, University of Manchester in England and the EuroScholars program.

## CEA Global Education

CEA sends thousands of students on study abroad programs in multiple locations in Asia, Europe, South Africa, South America, and the UK.

## Danish Institute For Study Abroad

Cal Poly has a university-wide affiliation agreement with DIS that provides students from any major with the option of enrolling in any of the following academic tracks offered for a semester or summer program: Architecture, Biomedicine, Child Diversity & Development, Communication, European Humanities, European Politics, Global Economics, Graphic Design, International Business, Justice & Human Rights, Medical Practice & Policy, Neuroscience, Prostitution & the Sex Trade, Public Health, Science & the Environment, Sociology, Sustainability in Europe, Urban Design and Urban Studies in Europe.

## Universities Study Abroad Consortium (USAC)

Cal Poly joins 29 members that participate within the University Studies Abroad Consortium (USAC). Since 1983, thousands of students from more than 500 U.S. and foreign universities have joined in USAC programs. USAC offers 30 study abroad programs at host universities in 23 countries including summer, semester, and yearlong programs. Students come from over 500 universities worldwide. USAC offers two types of programs. The language programs focus on language immersion and cultural studies, whereas the partnership programs offer direct enrollment in international partner universities offering a full curriculum of studies. USAC offers study abroad opportunities for some underrepresented disciplines such as Education, Engineering, Computer Science, Viticulture, and Women's Studies, along with internship, field studies, and community-involved programs.

## Intercollegiate Athletics

Mott Athletic Center/Physical Education Bldg. 42, Room 207

Phone: 805.756.2924

Athletic Advising: 805.756.2762

Director of Athletics: Don Oberhelman

Intercollegiate Athletics is administered as a separate department, though students participating on its teams receive academic credit for their efforts in courses offered through the Kinesiology Department. For further information about the athletics department, including information on individual teams and conference information, please refer to [www.calpoly.com](http://www.calpoly.com) (<http://www.calpoly.edu>).

All twenty teams compete at the NCAA Division I level.

The California State University is committed to providing equal opportunities to men and women CSU students in all campus programs, including intercollegiate athletics.



## Library Services

Anna Gold, University Librarian  
Robert E. Kennedy Library (Bldg 35)  
Phone: 805.756.2598 (Hours); 805.756.2029 (Circulation)  
lib.calpoly.edu

The Kennedy Library supports Cal Poly's mission by promoting open and informed inquiry, fostering collaboration and innovation, supporting the unique needs of every student and scholar at Cal Poly, and contributing to the cultural life of San Luis Obispo. In support of its mission, the library selects and delivers quality information in all formats, provides active learning environments, promotes the skills that are needed for student success, and collects and preserves unique collections.

### Services

The library offers consultative and instructional services delivered by expert library faculty based in each of Cal Poly's colleges as well as in areas that serve the entire academic community, such as digital scholarship and special collections. In addition, the library provides students with print and electronic access to selected course materials through its course reserves service; and rapid access to books and articles held by other regional libraries through its interlibrary borrowing service. Reference assistance is provided at service desks and via instant messaging. The Kennedy Library opens at 7 am on weekdays and is open until 2 am Sunday through Thursday.

### Instruction

Kennedy librarians partner with faculty to help students develop research skills relevant to all disciplines. They work with students to ensure they acquire and practice the skills they need to succeed in a complex information environment. This includes finding quality information and using it to communicate skillfully through a variety of media. Kennedy librarians and a team of peer-to-peer student assistants teach more than 400 courses each year and provide web-based resources to supplement in-class teaching.

### Technology

In partnership with Information Technology Services, the library offers students, faculty, and staff many free services including access to the campus high-speed wireless network, check-out of laptops, iPads, Kindles, cameras, camcorders and tripods, scanners, and 300 computers with over 120 software applications. Oversized and specialty (CAD) printing services are also available for a fee from the campus print and copy service located in the library. Student technicians are on staff to help.

**Assistive Technology.** The Kennedy Library provides general-use assistive technology/collaboration stations throughout the building, featuring a range of assistive software applications - including screen readers - as well as dual displays and height adjustable tables. The Kennedy Library partners with the campus Disability Resource Center and has its own Accessibility Advocate.

### Electronic and Print Resources

The Kennedy Library provides access to 32,000 electronic scholarly journal titles, as well as to major online indexes and full text databases. These electronic resources are available to Cal Poly students, faculty and staff any time and anywhere. The library also hosts a physical collection of over 500,000 print volumes, and a significant number of other items, including maps, government documents, senior projects and master's theses.

### Special Collections and University Archives

The Kennedy Library's Special Collections include more than a hundred unique collections in many formats, including manuscripts, correspondence, business records, architectural drawings, photographs and online collections. Collection strengths include architectural records and drawings, fine printing and graphic arts, regional and California history. Featured holdings include the Julia Morgan papers, the San Luis Obispo Environmental Archives, and the Central Coast Farm Labor Organizing Collection. The University Archives houses materials that document the history, growth and development of Cal Poly, including campus records, publications such as Cal Poly's yearbook, *El Rodeo*, photographs, plans, blueprints, and ephemera dating from the founding of the university in 1901 to the present.

### DigitalCommons@CalPoly

One of the first and largest institutional digital archives in the California State University system, DigitalCommons@CalPoly promotes discovery, research, cross-disciplinary collaboration and instruction by collecting, preserving and providing online access to scholarly work created at Cal Poly. DigitalCommons@CalPoly archives faculty research and student-generated scholarship including theses, graduate internship reports and senior projects. The service also provides access to relevant documents created by Cal Poly administrative offices, departments and programs. Members of the Cal Poly academic community are invited to contribute completed scholarship for long-term preservation and worldwide electronic access through DigitalCommons@CalPoly.

### The Data Studio

The Data Studio, which opened in 2012, is an incubator for students surrounding the discovery, exploration, creation, and sharing of data. With dedicated, software specific computers, large screen monitors, and GIS and statistics tutors on-site, the Data Studio provides an ideal environment for students to experiment and develop their skills surrounding the manipulation and visualization of data.

### Facilities

The building offers a variety of seating and study spaces on five floors, with ample natural light and views of the surrounding hills. In addition to twelve large collaboration rooms, the library offers seven group study rooms and two dedicated graduate student study rooms; all are equipped with large screen monitors and whiteboards. The library has a total of 2000 seats, 300 computer workstations, on-site specialty printing and copying services and an on-site café. A popular feature is the library's atrium, which includes a landscaped patio and shaded seating on four upper balconies. The Kennedy Library is visited over 1.3 million times a year and has been voted "Best Study Spot" by students since 2006.

### Events and Exhibits

Kennedy Library offers a number of ongoing events and exhibits. Events include Cal Poly Science Cafe, which was started in 2008 to inspire casual interdisciplinary and interactive experiences; Conversations with Cal Poly Authors, which celebrates books published by Cal Poly faculty; and the Data Studio Presents, a series of talks and events related to data resources and tools. Exhibits are produced in partnership with Cal Poly students and faculty, as well as members of the Cal Poly community, and often feature unique holdings of the library's Special Collections and University Archives.

### Partners



The Kennedy Library is proud to partner with programs that support student learning. Among the partners located in the library are the Academic Skills Center; the Center for Teaching, Learning and Technology; Julian's Café and Patisserie; Student Ombuds Services; Cal Poly Print and Copy; Research Scholars in Residence; and the University Honors Program.

## Pre-Health Career Advising

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College of Science and Mathematics Advising Center  
Bldg. 53, Room 211  
Phone: 805.756.2615  
prehealth@calpoly.edu  
<http://prehealth.calpoly.edu>

Cal Poly State University offers excellent advising and resources for all university students and alumni who are interested in preparing for a career within a health professions field. The College of Science and Mathematics Advising Center is dedicated to mentoring students throughout their college career, helping them to prepare for post-baccalaureate studies in the health professions. Due to the competitive nature of these programs, it is strongly recommended that students plan to seek advice early in their college career to gain an understanding of the components needed to build a competitive applicant profile.

### Pre-Health Career Advising

Pre-health career advising is designed to help students explore the health professions as a possible career and enhance a student's competitiveness for admission into a graduate and/or post-baccalaureate program in the health professions. Students should meet with a Pre-Health peer advisor to learn about health career options, required coursework, gaining experience in health care, and other aspects of becoming a competitive candidate. Professional staff provide specific, detailed application advising for students in their application year including personal statement development, interview preparation and more, all targeted at developing the most competitive, well rounded applicants.

### Pre-Health Professions Poly Learn Course

The advising center maintains an internal Pre-Health Professions Poly Learn course as a means to share important information about informational handouts, upcoming events, summer internships, research opportunities and visiting guest speakers. Currently enrolled students may request access by sending an email to prehealth@calpoly.edu

### Pre-Health Related Courses

Cal Poly offers health-related courses to assist students who are interested in exploring a health professions career. Please see course descriptions below.

SCM 101 Introduction to the Health Professions

BIO 253 Orientation to Health Professions

SCM 363 Health Professions Internships

## Service Learning and Civic Engagement

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Student Life & Leadership, University Union, Bldg 65, Room 217  
Phone: 805.756.6749

[www.studentlife.calpoly.edu/communitycenter](http://www.studentlife.calpoly.edu/communitycenter) and  
[www.civic.calpoly.edu](http://www.civic.calpoly.edu)

Service learning provides students an opportunity to participate in a structured learning experience that combines service to the community with explicit learning objectives, preparation, reflection, and evaluation. Students enrolled in service learning courses provide direct service in areas identified by the community. The students learn about the context in which the service is provided, the connection between the service and their academic coursework, and their roles as citizens. Each quarter, hundreds of students participate in service learning classes and volunteer to provide thousands of hours of service to homeless shelters, low-income families, youth, and disabled individuals.

Service learning workshops are offered quarterly through the Center for Teaching and Learning to support faculty development of service learning classes. As part of the strategic plan supported by the Chancellor's Office of Community Service Learning, Cal Poly is working towards extending the influence and resources of the University beyond the campus through quality service learning opportunities.

## Student Academic Services

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Hillcrest (Bldg. 81)  
Phone: 805.756.2301  
[www.sas.calpoly.edu/](http://www.sas.calpoly.edu/)

Student Academic Services (SAS) offers comprehensive programs that directly support academic excellence. Program services include academic and personal advising, admissions and transition services, new student first-year seminars, supplemental workshops and study group assistance. Advising services are focused on students from backgrounds that have been traditionally underrepresented in the California State University System. Academic advisors work with each of the academic colleges to provide academic and personal advising assistance to students with class scheduling, assessment of academic skills, graduation planning, career clarification and related learning and study skills.

Supplemental workshops and study sessions are available for key content courses in first- and second-year curricula.

The goal of SAS is to ensure that all students have equal opportunity to achieve academic success and graduation. Student Academic Services incorporates the following:

### Academic Skills Center

Kennedy Library (35), Room 112  
Phone: 805.756.1256  
[www.sas.calpoly.edu/asc/index.html](http://www.sas.calpoly.edu/asc/index.html)

The Academic Skills Center (ASC) offers a variety of academic retention programs and campus support services, including study skills seminars, study sessions, an on-line study skills library and tutor referral services.

### Connections for Academic Success

University Union (65), Room 217A-2  
Phone: 805.756.6774  
[www.sas.calpoly.edu/cas/index.html](http://www.sas.calpoly.edu/cas/index.html)

The Connections for Academic Success (CAS) program provides support services to CAS program participants, the University Partners Program, as well as outreach to affinity clubs and organizations in

support of transition and retention. CAS was originally established via a joint venture between the University and Cal Poly's student government, ASI (Associated Students, Incorporated). The program offers services to help students plan and achieve their academic and personal goals.

#### **Educational Opportunity Program (EOP)**

Hillcrest (81)  
Phone: 805.756.2301  
[www.sas.calpoly.edu/eop/index.html](http://www.sas.calpoly.edu/eop/index.html)

EOP provides admissions and academic support programs for low-income, historically disadvantaged students. EOP offers academic and personal advising, study sessions, academic orientation courses, career and post-graduate advising, and referrals to campus resources.

#### **Educational Talent Search**

Hillcrest (81)  
Phone: 805.756.2301  
[www.sas.calpoly.edu/ets/index.html](http://www.sas.calpoly.edu/ets/index.html)

Cal Poly Educational Talent Search (ETS) is a federally funded program that serves low-income and/or potential first-generation students in grades 7 through 12 in local targeted area schools. The goal of ETS is to assist students to graduate from high school and enter college. ETS offers interactive school site workshops and informational sessions led by program staff, University field trips, parent information workshops and pre-college advising focused on college entrance requirements and financial aid.

#### **Student Support Services**

Student Services Bldg (124), Room 119  
Phone: 805.756.1395  
[www.sas.calpoly.edu/sss/index.html](http://www.sas.calpoly.edu/sss/index.html)

Student Support Services program, a federally funded TRIO program of the U.S. Department of Education, is designed to assist program participants (low-income, first-generation or disabled college students) with enhancing their academic skills, increasing their retention and graduation rates, and promoting graduate and professional school programs.

#### **Summer Institute**

Hillcrest (81)  
Phone: 805.756.2301  
[www.sas.calpoly.edu/si/index.html](http://www.sas.calpoly.edu/si/index.html)

Summer Institute (SI) is an academic orientation program held annually for newly-admitted EOP freshmen. Selected SI students have the opportunity to participate in a mini-academic quarter residential program focused on helping to make a successful transition from high school to Cal Poly.

#### **Upward Bound**

Hillcrest (81)  
Phone: 805.756.2301  
[www.sas.calpoly.edu/ub/index.html](http://www.sas.calpoly.edu/ub/index.html)

Upward Bound (UB) is a federally funded TRIO program which provides a college preparatory program for low-income and/or potential first-generation college students. This program motivates and academically prepares local target area high school students for college. The academic program and residential summer school

session at Cal Poly offer tutoring, career advising and supplemental instruction, as well as cultural and recreational activities.

## **Testing Services**

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Student Services (Bldg. 124), Room 121  
Phone: 805.756.1551

Testing Services administers standardized tests of admission, placement and certification, such as the Law School Admission Test (LSAT) and Medical College Admission Test (MCAT), and coordinates the administration of the CSU English Placement (EPT) and Entry Level Math (ELM) test programs. Testing Services also provides general proctoring services for students enrolled in distance learning programs and operates an ETS Computer-Based Testing Center that offers such tests as the GRE, TOEFL and PRAXIS.

## **University Honors Program**

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Gregg Fiegel, Interim Director  
Robert E. Kennedy Library, Bldg. 35, Room 510  
Phone: 805.756.7029  
<http://honors.calpoly.edu>

The University Honors Program provides academically motivated students with the opportunity to develop their potential by fully exploring the resources at Cal Poly. Intellectual creativity, civic engagement, and research are the hallmarks of the program. In particular, it builds relationships among all colleges on campus and seeks to educate students in the connections between the disciplines, from engineering to English, agriculture to art, or business to biology. Honors students have the opportunity to enjoy a varied educational experience, including courses in specially designed honors seminars as well as undergraduate research opportunities.

Following Cal Poly's distinctive "hands-on" approach to education, students are encouraged to participate in community projects and international programs to enhance their global awareness. Most Honors courses offer smaller class sizes, where students work closely with faculty in a challenging, stimulating and supportive learning environment. Analytical and interpretive study is encouraged and communication skills, written and oral, are developed. Most courses fulfill graduation requirements.

## **University Studies**

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Academic Programs and Planning  
Administration Bldg (01), Room 315  
Phone: 805.756.2246  
[www.academicprograms.calpoly.edu/academicpolicies/univ-policies.html](http://www.academicprograms.calpoly.edu/academicpolicies/univ-policies.html)

University Studies (UNIV) courses provide an opportunity for interdisciplinary study, addressing university-wide learning objectives (such as diversity, environmental literacy, sustainability, etc.). UNIV courses are offered across college boundaries, typically team-taught by two or more faculty and carrying GE and/or USCP credit. The offerings are subject to available funding.

## **University Writing & Rhetoric Center**

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Dawn Janke, Director

Bldg 10, Room 130  
Phone: 805.756.2067  
[www.writingcenter.calpoly.edu](http://www.writingcenter.calpoly.edu)

The University Writing & Rhetoric Center is a free service for Cal Poly students, faculty, and staff designed to support writing and writing education across campus. The University Writing & Rhetoric Center offers one-to-one consultations to all Cal Poly students on any writing task. The CSU system-wide Graduation Writing Requirement (GWR) is administered through this office, including the upper-division Writing Proficiency Examination (WPE). The Writing & Rhetoric Center Office also oversees the placement of students into the appropriate first-year writing courses based on their English Placement Test (EPT) scores.

## Career Services

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Student Services (124), Room 114  
Phone: 805.756.2501  
<http://www.careerservices.calpoly.edu>

The mission of Career Services is to empower Cal Poly students to achieve a lifetime of meaningful career success. Career Services is available to work with students the first day they arrive on-campus and to help them every step of the way throughout their academic careers at Cal Poly.

### Career Counseling

Career Counselors help students discover their strengths, interests and personality characteristics to help them develop a dynamic career plan and begin building a professional network. Students considering a change of major are encouraged to utilize Career Services so that they become better informed about career options. Career Counselors can help students explore the link between academic majors, their areas of interest and employment options. This includes helping them develop the skills and strategies needed to get there.

### Job Search Exploration

Students are guided through the job search process, which includes identifying and researching employers, developing resume/cover letters, preparing for the interview, and connecting with employers through career fairs, networking sessions and other career-related events.

Student employment opportunities are available and easily accessible through MustangJOBS, On-Campus Interview Program and Job Listing Service. This includes local part-time jobs (on-campus and off-campus), co-ops, internships, summer jobs and career positions.

### Graduate School Exploration

Career Counselors can assist students with the graduate school admission process, which includes identifying and researching potential graduate programs. They help students learn about the process of applying to graduate school, prepare personal statements and complete the necessary requirements for admissions.

## Computing at Cal Poly

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Michael D. Miller, Vice Provost and CIO Information Services  
Frank E. Pilling Bldg. (14)  
Phone: 805.756.7000  
<http://servicedesk.calpoly.edu>

To enhance Cal Poly's learn-by-doing environment, the university provides access to a wide range of technology resources. All students have free Wi-Fi access to internet services across

campus. PolyLearn, the campus's online learning management system, is used in most courses to provide access to online course materials and learning resources. (For more information, visit <http://polylearnsupport.calpoly.edu>). Technology checkout services by Classroom Technologies and Kennedy Library offer laptops, tablets, projectors, cameras, etc., for temporary student use. Multiple open access student computing labs are available, including several in Kennedy Library. Technology support is available through the Service Desk (phone: 756-7000; email: [servicedesk@calpoly.edu](mailto:servicedesk@calpoly.edu) ; and website: <http://servicedesk.calpoly.edu> ).

All who access Cal Poly's information technology resources must agree to abide by the Responsible Use Policy and other policies at <http://security.calpoly.edu/policies> . Users are also expected to comply with campus security standards, which includes ensuring that networked devices are protected against viruses, spyware, and other threats. Standard tools are available for students to use for this purpose.

## Dean of Students

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Health Services Bldg. (27), Room 188  
Phone: 805.756.0327  
[www.deanofstudents.calpoly.edu](http://www.deanofstudents.calpoly.edu)

The Dean of Students Office provides leadership to support student success, strengthen campus community relations, and provide the initiatives for future student-centered programs that foster the development of the student academically, socially and ethically. The Dean of Students serves as the campus Title IX Coordinator receiving and investigating reports of sexual violence/harassment.

The Dean of Students supports student learning and service through:

- helping students manage academic and nonacademic situations;
- consulting extensively with faculty and staff on behalf of student concerns;
- interpreting and assisting with understanding campus policies and procedures;
- consulting with student clubs and organizations to foster a healthy student life;
- cultivating a caring, supportive campus and community environment; and
- assisting with parent concerns regarding campus life and policies.

The Dean of Students Office oversees the Office of Student Rights and Responsibilities, and Student Life and Leadership. A variety of services and programs are provided to support, encourage and develop leadership skills, personal development, volunteerism, responsible citizenship, and academic success. The mission of the Dean of Students is to prepare students for participation in a global society.

Students with questions or concerns are encouraged to stop by or contact the office. The staff answers questions, advocates when appropriate, investigates student complaints, supports students, and directs students to the appropriate campus or community resource as needed.

## Disability Resource Center

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Student Services Building (124), Room 119  
Phone: 805.756.1395  
[www.drc.calpoly.edu](http://www.drc.calpoly.edu)

The Disability Resource Center's mission is to assist in creating an accessible university community where students with disabilities have an equal opportunity to fully participate in all aspects of the educational environment. The Center cooperates through partnerships with students, faculty, and staff to cultivate student learning and success.

Students wishing to use disability-related services and accommodations complete a Request for Services form, submit disability documentation, and then meet with an access specialist who determines eligibility and accommodations. Advance planning is strongly encouraged.

## Health and Counseling Services

Student Health Center (Bldg. 27)

The goal of Health and Counseling Services is to support the physical and psychological well-being of all students attending Cal Poly. A variety of services are offered for students including ambulatory care, laboratory testing, onsite x-rays, prescription medications, dental consultations, individual and group counseling, and health education programs. Health and Counseling Services assists students by minimizing class time lost due to illness, injury, or personal problems. An After-Hours Nurse Advice Line and a Psychological Crisis Line are available at no cost for care when the Health Center is closed. You may reach the After-Hours Nurse Advice Line by calling the regular Health Center's phone number (805.756.1211). The Psychological Crisis Line may be accessed by calling the regular Counseling Services phone number (805.756.2511).

### Health Services

Student Health Center (Bldg. 27)  
Phone: 805.756.1211  
[www.hcs.calpoly.edu/](http://www.hcs.calpoly.edu/)

The following services are available to all students as part of the health services fee:

- **Outpatient medical services** are available, year-round, Monday through Friday, 8:00 a.m. to 4:30 p.m. except Wednesday, 9:00 a.m. to 4:30 p.m., and include primary care and nursing services, men's/women's health care, laboratory testing and routine x-ray procedures.
- **Health education** offers four programs: Educational Resources On Sexuality (EROS), Thoughtful Lifestyle Choices (TLC), Health Enrichment Action Team (HEAT), and Reach-Out, Empower, Accept, Listen (REAL). These are provided by staff professionals and students trained and certified as peer health educators. Programs include nutrition counseling, alcohol and drug awareness, sexuality and lifestyle wellness, and emotional and mental health issues.
- **Additional medical services** are available at a low cost: prescriptions, over-the-counter items, outside lab tests, immunizations, orthopedic supplies, and optometry consultations.

**Major medical insurance** coverage for off-campus services is strongly recommended. Students are encouraged to have their own coverage for major medical, surgical and emergency expenses. **Due to a shortage of doctors in the community in certain specialty areas, students requiring specialty medical care are encouraged to call for appointments with local specialists well in advance.**

### Counseling Services

Student Health Center (Bldg. 27)

Last updated: 04/22/15

Phone: 805.756.2511

[www.hcs.calpoly.edu/content/counseling/counseling-home](http://www.hcs.calpoly.edu/content/counseling/counseling-home)

Counseling Services offers individual and group counseling, psychiatry, crisis intervention, education and outreach, and internship training. Counselors are available to assist with the normal adjustments of academic and social life; personal issues such as confidence and self-esteem, stress management, body image and sexuality; as well as more serious personal concerns such as depression, anxiety, alcohol and drug abuse.

## Inclusive Excellence

Bldg. 01, Room 412

Phone: 805.756.6655

<http://inclusiveexcellence.calpoly.edu>

Developed by the Association of American Colleges & Universities, "Making Excellence Inclusive" is a unifying vision designed to help institutions fully integrate their diversity, equity, and educational quality efforts and embed them into the core of academic mission and institutional operations. Cal Poly's adoption of Inclusive Excellence (IE) in 2009 was supported by resolutions of the Academic Senate and the ASI Board. Activities and programs are described on the IE website.

## Louis Stokes Alliance for Minority Participation (LSAMP)

Center for Excellence in Science and Mathematics Education (CESaME), Bldg. 25  
Phone: 805.756.2859  
<http://lsamp.calpoly.edu>

Faculty Directors at Cal Poly:  
Dr. Jane Lehr and Dr. John Keller

The CSU Louis Stokes Alliance for Minority Participation (CSU-LSAMP) Program is dedicated to increasing the persistence and graduation rates of students from underrepresented groups who major in science, technology, engineering, and mathematics (STEM) disciplines. The LSAMP program emphasizes activities designed to enhance graduate school and career preparedness, including undergraduate research experiences, support for community college transfer students in STEM, and opportunities for student participation in academic conferences and international activities. The CSU-LSAMP Program is supported by the National Science Foundation and the Chancellor's Office.

The LSAMP Program is for undergraduate students who face or have faced social, educational or economic barriers to careers in STEM; are U.S. citizens or permanent residents; and are enrolled at Cal Poly in any major in the College of Engineering and College of Science and Mathematics (excluding Liberal Studies). Students enrolled in the following majors are also eligible: Agricultural and Environmental Plant Sciences, Agricultural Science, Animal Science, Agriculture Systems Management, Architecture, Architectural Engineering, BioResource and Agricultural Engineering, Dairy Science, Environmental Earth Sciences, Environmental Management and Protection, Environmental Soil Sciences, Food Science, Forestry and Natural Resources, Industrial Technology, Landscape Architecture, and Nutrition.



## Office of Student Rights and Responsibilities

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Student Services Bldg (124)  
Phone: 805.756.2794  
[www.osrr.calpoly.edu](http://www.osrr.calpoly.edu)

The Office of Student Rights and Responsibilities administers the California State University Standards for Student Conduct. This office ensures a fair and impartial administration of the disciplinary process while educating students about their responsibilities and protecting the rights of all members of the University community. The Office addresses student behavioral problems in a developmental and educational manner with the goal of fostering the ethical development and personal integrity of students. The Standards for Student Conduct and disciplinary process are available at [www.osrr.calpoly.edu](http://www.osrr.calpoly.edu).

## Student Ombuds Services

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Patricia Ponce, Student Ombuds  
Robert E. Kennedy Library (35), Room 113  
Phone: 805.756.1380  
<http://ombuds.calpoly.edu>

The Office of Student Ombuds Services provides students with a safe place to seek confidential guidance on university related concerns and complaints. All communications are confidential, informal, impartial, and independent. The Ombuds is committed to hearing about students' experiences, assisting them in understanding applicable university policies and procedures, and - as appropriate - helping them to resolve informally any university-related issue. The Ombuds adheres to the Code of Ethics and Standards of Practice of the International Ombudsman Association.

## Student Affairs

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Office of the Vice President for Student Affairs  
Administration Building (01) Room 209  
Phone: 805.756.1521

The Office of the Vice President for Student Affairs oversees departments that provide services, leadership training, and learning experiences to enhance the Cal Poly out-of-classroom experience. Through advocacy, program development, and serving as a liaison to student organizations on behalf of the University, Student Affairs is the key link to student life on campus. Dedicated to student learning, Student Affairs staff mentor students, encourage personal development, and support important initiatives to enhance retention and matriculation of students.

### Mission Statement

The mission of the Student Affairs Division is to cultivate student learning and success. Together with others in the University, Student Affairs is committed to the principle of integrating its programs and services into the student's total learning environment, and fostering within each student respect and responsibility for self and members of the greater community.

Delivery of programs and services is influenced by an ongoing assessment of student needs, the campus climate and established outcomes. It is guided by:

- The learn-by-doing focus of Cal Poly's curricular and co-curricular activities;
- The scholastic achievements of students;
- The residential nature of the campus;
- The high staff/faculty-to-student ratio of Cal Poly's departments;
- The selective standards of Cal Poly admissions, which draw students throughout the state and beyond; and
- The appreciation for diversity in the student community.

The mission is carried out through teaching and personal instruction, advisement and counseling, community service learning, internships and experiential education, organized programming, and services. The departments that create the Division of Student Affairs are:

- Associated Students, Inc.
- Career Services
- Campus Diversity and Inclusivity
- Dean of Students
- Disability Resource Center
- Health and Counseling Services
- Office of Student Rights and Responsibilities
- Parent Program
- Student Academic Services
- Student Life and Leadership
- Testing Services
- University Housing

## Associated Students, Inc.

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University Union (65), Room 212  
Phone: 805.756.1281  
[www.asi.calpoly.edu](http://www.asi.calpoly.edu)

### Mission Statement

The mission of Associated Students, Inc. is to enrich the quality of student life and to complement the educational mission of Cal Poly through shared governance, student employment, student advocacy and a broad spectrum of programming, services and opportunities for leadership and social interaction.

### Vision Statement

Associated Students, Inc. will be every student's connection to the ultimate college experience.

### ASI Student Government

University Union (65), Room 202  
Phone: 805.756.1291

Leadership opportunities are open to all interested students. This includes the elected College Council representatives who form the Board of Directors, appointed positions on the University Union Advisory Board and the ASI Executive Cabinet. ASI student leaders represent the student body on campus, community and regional committees.

Three student officers guide the organization: the ASI President, Chair of the Board, and Chair of the University Union Advisory Board. These officers and the Board of Directors are elected in spring quarter and are the recognized representatives of Cal Poly students. The ASI Chief



of Staff is an appointed leader who guides the ASI Executive Cabinet in supporting the goals of the ASI President.

The Board of Directors oversees the policy development of ASI, a \$12 million nonprofit corporation. ASI collects quarterly fees, commercial revenue and grants, which support a wide range of campus clubs as well as student programs and services.

## Programs and Services of ASI

The University establishes an operating agreement with ASI to run many University facilities, including the Julian A. McPhee University Union, Orfalea Family and ASI Children's Center, Cal Poly Recreation Center and Cal Poly Sports Complex.

### ASI Business Office

University Union (65), Room 212  
Phone: 805.756.1281

The ASI Business Office provides internal business services to all ASI programs and services including administrative support, fiscal services, human resources, project management and information technology.

### Julian A. McPhee University Union (UU)

The Julian A. McPhee University Union is a central place for students, faculty, staff, alumni and guests to meet, relax and exchange ideas. Facilities include the UU Plaza, UU Epicenter, two student lounges: Chandler Lounge and San Luis Lounge, ASI Events, ASI Craft Center, Mustang Lanes, Ciao!, Starbucks, Student Life & Leadership, Student Community Services, Multicultural Center, Women's Center, Gender Equity Center, ASI Student Government and Chumash Auditorium.

### UU Epicenter

University Union (65), Room 203  
Phone: 805.756.5807

The UU Epicenter is a one-stop shop for "Events, Programs and Ideas." Students can obtain information, materials and resources on the following ASI programs and services: ASI Events, ASI Craft Center, Facility Reservations, Event Management and UU Building Services.

The UU Epicenter also provides services to Cal Poly clubs and independent student organizations.

### ASI Events

University Union (65), Room 203  
Phone: 805.756.1112

ASI Events provides on-campus entertainment programming in a variety of areas including live entertainment, concerts, films, comedians, guest speakers, multicultural activities and special events. ASI Events also offers alternative late night programming such as poker and bingo that are geared to on-campus residents.

### ASI Craft Center

University Union (65), Room 111  
Phone: 805.756.1266

The ASI Craft Center offers a wide variety of fun, non-academic craft classes and workshops such as ceramics, surfboard-shaping, skateboard deck-building, stained glass and bat-making, a bike repair room, woodworking power tools, glass bead-making lab, poster-making tables with pens and paper, and a retail store.

## Poly Escapes

Cal Poly Recreation Center (43)  
Phone: 805.756.1287

For more than 30 years ASI's Poly Escapes has been sponsoring outdoor trips and programs with students at the core of its leadership program. With a zest for spontaneous adventure and the desire to explore the unknown, Cal Poly students have looked to Poly Escapes to take them on "once in a lifetime adventures." Poly Escapes provides trip coordination, educational experiences, a climbing park, resource library and roughly 20 trips each fall, winter and spring. Students may also rent outdoor equipment such as tents, sleeping bags, backpacks, standup paddle boards, surfboards and ice cream makers at reasonable prices.

## Cal Poly Rose Float

University Union (65), Room 111F  
Phone: 805.756.1268

One of the most exciting activities on the Cal Poly campus is building the annual Rose Parade float. Since 1949, teams of students from the San Luis Obispo and Pomona campuses have produced floats annually. For more than 65 consecutive years, students from all academic majors have enjoyed the thrill of watching a float they designed, built and decorated make its way down Colorado Boulevard on New Year's Day in the Tournament of Roses Parade.

Not only is the Cal Poly float a one-of-a-kind venture for student volunteers, it is also an opportunity for participants to develop new innovations such as computer-controlled animation, hydraulics systems for movement and more.

## ASI Children's Programs

Orfalea Family and ASI Children's Center (133)  
Phone: 805.756.1267

The Orfalea Family and ASI Children's Center is a nationally accredited program providing quality early care and education services to children from 4 months to 6 years old. Student parents are given first priority for enrollment. Subsidized childcare is available for low-income student parents.

The ASI Children's Programs' philosophy is based on the belief that young children thrive in an environment that promotes understanding of themselves, others and the world around them. Teachers focus on facilitating children's development in the social-emotional, cognitive and physical domains. Activities are designed to meet the children's individual and age-appropriate needs. With the understanding that children learn through play, caregivers encourage them to explore, discover and have fun. Emphasis is placed on teaching children how to problem-solve and make appropriate choices, while learning to interact within a group setting.

## ASI Recreational Sports

Cal Poly Recreation Center (43)  
Phone: 805.756.1366 (Main); 805.756.PLAY (Hotline)

ASI Recreational Sports provides opportunities for the campus community to participate in a variety of fitness and recreation activities. Registered Cal Poly students and eligible faculty and staff members and his/her spouse/domestic partner can access the Recreation Center, which is open seven days a week. ASI's Recreational Sports Program employs more than 200 students each year.

## Cal Poly Recreation Center

The Cal Poly Recreation Center is 165,000 square feet of recreational space with state-of-the-art weight and cardiovascular equipment, three fitness studios for group exercise classes, an indoor track, a lounge area, an Olympic-sized lap pool and a leisure pool, sand volleyball courts, racquetball courts, basketball courts, personal training, intramural sports, informal recreation and special events.

### Recreational Sports Programs

**Aquatics** classes are for all levels of swimmers, from beginning to masters. Scuba courses and stroke and techniques clinics are just a few of the classes offered.

**Personal Training** provides the opportunity to get fit with nationally certified personal trainers in a fun, safe environment. Individuals learn how to work out and use equipment properly from personal trainers who provide focused attention on each client.

**Group Exercise** offers up to 80 classes per week including breakaway, Zumba, yoga, pilates, BodyCombat and more.

**Fitness and Instructional** programs are designed for individuals to acquire new skills in a relaxed and enjoyable setting. Programs offered include martial arts, circuit training, basic self-defense and more.

**Informal Recreation** provides non-structured opportunities to participate in a variety of activities such as swimming, cardiovascular exercise, free weight and weight machines, basketball, volleyball and racquetball.

**Intramural Sports** provides a variety of structured sports leagues and tournaments in a safe, recreationally competitive environment. The program is open to all Cal Poly students, faculty, staff and alumni who are current members of the Recreation Center. Popular sports include: basketball, flag football, soccer, softball and volleyball.

**Intramural Tournaments** are available year-round for participants to engage in non-traditional sports and activities such as table tennis, badminton, dodgeball and squash.

## Cal Poly Corporation

Corporation Administration Bldg. (15)  
Phone: 805.756.1131

The Cal Poly Corporation is a separate non-profit §501(c)(3) organization serving the university across several key support functions:

- Commercial Operations – Campus Dining, University Store, Cal Poly Downtown, Cal Poly Print & Copy, Commercial Licensure, and Alcohol Licensure
- Fiscal Services – Aid-to-Instruction Programs, Conference and Event Planning, ASI, PAC, Cal Poly Arts, and Technology Park
- Fiscal & Support Services – Swanton Pacific Ranch; Post-award of sponsored projects & centers and institutes; administration of gifts, holding, usage and liquidation of real property & gifts-in-kind; administration of special activity accounts; and funding advances or guarantees for projects

A Board of Directors comprising of students, faculty, community leaders and university administrators oversees Cal Poly Corporation operations.

## Parent Program

Student Services Bldg (124), Room 210  
Parent Helpline: 805.756.6700  
www.parent.calpoly.edu  
Email: calpolyparent@calpoly.edu

The Parent Program is a resource for parents and supports Cal Poly students. Services are designed to enhance student learning by facilitating communication between and among parents and the University; support students' ability to solve problems by increasing their parents' awareness of University resources; and enhance student success by helping parents develop strategies to meet the unique challenges of parenting students throughout their college years.

Staff can be reached via the program's helpline and e-mail address. Parent information and resources are provided through a website, a quarterly e-newsletter, and a Cal Poly Parents Facebook page.

The Parent Program oversees the Parent Program Advisory Council, welcomes parents and supporters at orientation events, and hosts an annual Parent and Family Weekend.

## Student Life and Leadership

University Union (65), Room 217  
Phone: 805.756.2476  
www.studentlife.calpoly.edu

Student Life and Leadership offers opportunities to develop leadership skills, contribute to the community, experience diversity, participate in group dynamics, and mentor new students. Its mission is to advance and encourage the learning and personal development of students, and its programs are integrated into the student's total learning environment.

The department is responsible for the oversight of student clubs and organizations on campus including chartering, membership roster certification and judicial review and sanctioning.

### Cal Poly Clubs

There are close to 300 active clubs and organizations affording students the opportunity to become active in campus life. Clubs include academic and professional organizations, hobby-interest clubs, honor societies, service clubs, residential groups, multicultural organizations and spiritually based groups.

The **Sport Club Program** offers the campus community a wide variety of competition, instruction, and development in the form of 24 sport clubs and related activities. The program currently has over 900 students who participate in various sports clubs and features a competitive level above the traditional intramural program. The members compete against clubs from other universities, improve their skills through instruction, and develop leadership skills through the management of their organizations. Students of all skill levels are encouraged to participate.

### The Center For Community Engagement

The Center For Community Engagement at Cal Poly represents the University's commitment to community involvement and civic engagement. It is dedicated to helping each individual, as well as student clubs, find meaningful and satisfying service experiences

through both volunteer service and service related to academic learning.

**Student Community Services** provides volunteer service programs that address a variety of social issues, concerning children, homeless individuals, mentally disabled adults, seniors, animals, and the environment. Each year, thousands of students participate in service activities. Annual events include Make a Difference Day, WOW Day of Service, Hunger Awareness Week, Homeless Awareness Week, Change the Status Quo Conference, Martin Luther King, Jr. Day of Service, and César Chávez Day of Service.

**Service learning courses** integrate community service with course curriculum to enhance learning outcomes. Each quarter, hundreds of students are involved in community service as part of their academic coursework. The Center For Community Engagement provides support for faculty and students in developing and implementing service learning.

The Center For Community Engagement assists the University in recognizing students for outstanding service in a variety of ways. Each year, the University President awards the President's Community Service Award to outstanding students, clubs, and faculty. Students can have their service hours noted on their official University transcripts.

## Gender Equity Center

The Gender Equity Center is a campus resource where the Cal Poly community can connect for information, educational events, and leadership programs related to gender equality and identity. The Center is a place for all individuals interested in working towards social justice and is committed to fostering a comfortable and all-encompassing Cal Poly experience for everyone, regardless of gender, sexual orientation, or race.

**Women's Programs** is dedicated to educating the Cal Poly community on local, national and global women's issues including gender equality, body image, the wage gap, feminism, women's history, and violence against women. Women's Programs' mission is to create and sustain a university environment that promotes the personal, educational and professional growth of women.

**Men and Masculinity Programs'** mission is to educate the Cal Poly community concerning local, national and global men's issues including masculinity, influences of the media and sexual assault. The intent of Men and Masculinity Programs is to cultivate a community for men that positively affects their campus and surrounding areas through service and personal example.

## Safer

The Safer Program aims to promote, empower and educate students on essential information regarding sexual assault. The purpose of this program is to create a community which fights to end sexual assault and relationship violence by raising awareness, providing resources and offering presentations, events and workshops.

## Fraternity And Sorority Life

There are more than 30 fraternities, sororities, and cultural Greek organizations affiliated with Cal Poly. Many of the social sororities and fraternities own or lease housing near the campus. Some organizations provide lodging and meals for their members.

## Multicultural Center

The mission of the Multicultural Center (MCC) is to promote an environment where diversity is respected and celebrated, and alliances are built regardless of ethnic/racial membership or sexual orientation. The mission serves to complement the University's philosophy that affirms all students' identities and which enhances the quality of university life for all students. The Center's mission strives to prepare all students to become culturally competent citizens in a global society.

## Orientation Programs

**Open House** encompasses many activities showcasing the excellence of Cal Poly and the surrounding community. Open House is held every April. An event preview is hosted on Thursday night at the popular Farmers' Market, and on Friday, conditionally admitted students and their supporters are invited to campus. On Saturday, campus is open to the public with many events, including the Poly Royal parade, open ceremonies, kids' fair, and an exciting club booth and activity area with more than 200 student clubs participating.

**Student Orientation, Advising and Resources (SOAR)** is an academic advising session that helps new students and their families learn how to navigate the Cal Poly environment. The University invites new students to participate in SOAR to get connected to information specific to the students' majors. Families and students learn about available resources and what to expect during their time at Cal Poly.

The **Week of Welcome (WOW)** orientation program is coordinated by staff and operated by students, for students, with a peer-helping method that creates a combination of excitement, learning, and new experiences for new students and their families in a fun, comfortable atmosphere. First-year and transfer students are placed in small groups that participate in activities introducing them to the campus and community for the week prior to fall classes.

The WOW experience is designed to assist new students with a successful academic, social and emotional transition to university life. Parent orientation programs provide parents with an opportunity to celebrate their student's transition as well as have their own questions and concerns addressed during Family Orientation Weekend. During this weekend, programs are also provided for first-year students, transfer students, non-traditional students, and parents and younger siblings of new students.

## Pride Alliance: LGBT (Lesbian, Gay, Bisexual, Transgender) Center

The LGBT Center is a resource center for the entire campus community. Its mission is to provide programming, networking and resources that raise awareness and educate students of diverse backgrounds about LGBT and related issues. The Center's Ally Training program prepares members of the campus community to support, and be sensitive to, the needs of LGBT people.

## University Housing

Building 31  
Phone: 805.756.1226

Living on campus can be a unique and rewarding experience. For the majority of first-year students, it is the first experience in a shared community living environment. Learning in the classroom is extended into on-campus residence halls and apartments through the Living/Learning, Connections, and Transitions Programs.

Returning students and new transfers have an opportunity to live in on-campus apartments in an environment which provides programmatic support with the goal of retention and academic success.

All students participate in a variety of social interactions and share the same community with diverse groups of individuals. Residents are provided with an environment that educates, challenges and supports their development. Activities are coordinated by hall staff and residents. Most students make lifelong friends while residing on campus.

## Staff

Community programs and activities are administered by full-time live-in professionals (Coordinators of Student Development), who are available to assist residents with counseling, crisis intervention, general referrals, and judicial actions. The Coordinators of Student Development also supervise front desk services and the Resident Advisors/Community Advisors.

Resident Advisors and Community Advisors, known as RAs and CAs, are typically upper-division students who understand the challenges faced by new students and try to make living on campus a positive and memorable experience for all residents. The RAs and CAs are trained in advising, event planning, and crisis intervention to assist students through their first year.

## Residential Life Programs

### Living/Learning Halls

The Living/Learning Residence Halls are for freshmen and are centered around Cal Poly's academic colleges. Faculty, administrators, and alumni meet with the students in an informal setting. The programming focuses on four fundamental areas: academic development and support, personal development, professional affiliation, and leadership development. This provides many advantages for residents including direct faculty contact, study groups, and events relating to the student's major and career planning.

### The Connections Program

The Connections Halls offer freshmen programs that support student transition into the residence hall community and University. This program is designed to provide incoming freshmen with the information, resources and support needed to be personally and academically successful at Cal Poly. Participating students have the opportunity to get involved with leadership, community service and social activities in the halls.

### The Transitions Program

Transitions offers programs and activities in the on-campus Cerro Vista Apartments for first-year, transfer and returning students who are comfortable and experienced with a more independent lifestyle. Students living here are expected to be independent and have abilities and experience to live and cook on their own. The Honors Community is located within the Cerro Vista Apartments.

### The Sophomore Success Program

The Poly Canyon Village Apartments and the Sophomore Success Program are offered to returning students. Student programming and activities support retention and overall academic success.

### Community Involvement

Student representatives are elected in fall term to serve on governing boards in each of the halls and apartments. Participants contribute to their hall's community by planning social, recreational, and

educational events, and by voicing student-related concerns. Networks in community services, recreational sports and multicultural issues provide additional opportunities for student involvement.

## ResNet

All on-campus rooms have access to the Cal Poly Network and the Internet. Cal Poly ResNet is the on-campus housing network that provides dedicated high-speed connections 24 hours a day. The ResNet Office provides this and other computing support programs for on-campus residents.

## Applying for On-Campus Housing

[www.housing.calpoly.edu](http://www.housing.calpoly.edu)

Information about the on-campus housing program and timeline to apply can be found at the Housing website. Housing is offered to University-admitted students. On-campus housing is secured on a first-come/first-served payment basis due to the variance of new students admitted each year. Conditionally admitted students who have accepted their offer of admission are able to submit housing applications via an online process through the [my.calpoly.edu](http://my.calpoly.edu) portal. To secure an on-campus housing space, students must print, sign and return the Housing License Agreement and housing payment to Cal Poly.

## Living Expenses for Students in Campus Residence Halls and Apartments (Subject to Change)

All Housing fees are payable in advance. Installment plans are available. All fees listed below reflect 2013-2014 prices and are subject to change:

Location	Price
Residence Hall Rooms – Double Occupancy (academic year license)	\$6,430
Residence Hall Meal Plan (mandatory)	\$4,693
Apartments – Private Rooms (academic year license)	\$830/month (approx.)

## Off-Campus Housing Resources

[www.housing.calpoly.edu](http://www.housing.calpoly.edu)

University Housing maintains information regarding the rental of off-campus houses and apartments, and an extensive list of private and shared rooms. Off-campus housing information is available at the Housing website. The University does not inspect, approve or disapprove of any housing offered through these rental resources.

## University Police

Building 36

Administration: 805.756.6652

Dispatch: 805.756.2281

[www.Police.calpoly.edu](http://www.Police.calpoly.edu)

Cal Poly's Police Department is a full service police agency certified by the California Department of Justice. It has the same responsibilities and authorities as any other law enforcement agency in the State of California and has state-wide authority. It includes a 9-1-1 emergency dispatch center. **Parking**, a major function of the University Police, includes the management of 8,866 parking spaces, three parking

structures, parking and event planning and traffic flow. Special Events management staff is responsible for the traffic and parking coordination of over 500 campus events a year which brings approximately 700,000 visitors to campus.

**Commuter and Access Services** provide resources for alternative transportation in partnership with local transit, regional RideShare, and bicycle organizations. The Escort Van Service provides free transportation for students, faculty and staff on campus and close vicinity of Cal Poly during evening hours.



# Course Descriptions

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## IME 471 Introduction to Senior Project (1) **Effective Fall 2013**

An introduction to requirements of senior project including project definition, methodology and estimate of work. Projects are done in teams and are preferably multi-disciplinary in nature. Course is offered in Fall and students in this course will be required to take IME 481 in Winter and IME 482 in Spring. 1 lab.

Prerequisite: Senior standing in major and consent of instructor.

## IT 470 Packaging in India: Technology, Trends and Practices (4) **Effective Summer 2014**

Packaging related logistics, supply chain, machinery and branding. International perspective on cultural and business practices, based on differences in packaging as well as an understanding of India - a subcontinent of nationalities.

## JOUR 470/471 Data Journalism and Lab (4) **Effective Spring 2014**

Finding compelling stories in data sets and presenting them visually via interactive online displays. Emphasis on adapting emerging tools for digital storytelling.

## KINE 290 Assessment Team (1) **Effective Winter 2014**

Development of knowledge, skills and experience in health and fitness assessments, protocols, and promotion through service learning opportunities in various community and school settings.

## KINE 290 Health Ambassadors (1) **Effective Winter 2014**

Introduction to health education and promotion. Study of the design, presentation, and implementation of community health promotion. Delivery of fitness and nutrition outreach through service learning opportunities in community and school settings.

## MATE 470 Industrial Processing in Materials Engineering (3) **Effective Winter 2014**

Manufacturing practices to solve problems encountered in manufacturing as related to heat treatment, fatigue, creep, and electronic failures. Methodologies used to investigate failures from the material science point of view and being able to trace these failures in manufacturing processes.

Prerequisite: Consent of instructor. Concurrent: Enrollment in MATE 471 Industrial Processing in Materials Engineering Laboratory.

## MATE 471 Industrial Processing in Materials Engineering Lab (1) **Effective Winter 2014**

Practical approaches and methodologies to manufacturing processes in industry. Materials approach to preventing failures in manufacturing processes. Guest speakers, company visits, and case studies.

Prerequisite: Consent of instructor. Concurrent: Enrollment in MATE 470, Industrial Processing in Materials Engineering.

## ME 271 Intermediate Solid Modeling (1) **Effective Fall 2013**

Continuation of solid modeling introduced in ME 152, using current software and hardware. Creation of more involved part models with varied configurations and dynamic assembly models. Working drawings produced from the models. Introduction to mass and inertia using the chosen software.

## ME 470/471 Design of Machinery and Lab (4) **Effective Fall 2014**

Graphical synthesis (design) and analysis of mechanisms and machines. Analytical Fundamentals for study of displacements, velocities, accelerations, and static and dynamic forces necessitated for proper design of planar linkages and gearing systems. Creative design projects are required using ADAMS.

Prerequisite: ME 212 and consent of instructor.

## ME 470 Design of Machinery (4) **Effective Fall 2013**

Graphical synthesis (design) and analysis of mechanisms and machines. Analytical fundamentals for study of displacements, velocities, accelerations, and static and dynamic forces necessitated for proper design of planar linkages and gearing systems. Creative design projects using ADAMS.

Prerequisite: or consent of instructor.

## ME 470 Intelligent Vehicles (3) **Effective Winter 2015**

Intelligent engineering in vehicles, including positioning and navigation systems, surrounding sensing and map building, multi-sensor data fusion techniques, and safety applications.

Prerequisite: Consent of instructor.

## NR/AGB 470 Sustainability and Certification Systems (4) **Effective Summer 2014**

Introduction to ideas underlying the concept of sustainability and how they get incorporated into certification systems. Exposure to how sustainability concepts are applied in agricultural and resource management, particularly organic agriculture, sustainable forestry, and grass-fed cattle operations.

Prerequisite: Consent of instructor.

## PHIL 270 Ethics Bowl (4) **Effective Fall 2014**

Preparation for competition in the Intercollegiate Ethics Bowl. Coverage of ethical theory and cases specific to the current year's competition.

## STAT 470 SAS Advanced Certification Preparation (2) **Effective Spring 2014**

Preparation and discussion of programming topics related to the Certified Advanced Programmer Exam offered by the SAS Institute.

Prerequisite: or STAT 530

## TH 275 Introduction to Dialects and International Phonetic Alphabet (IPA) (4) **Effective Spring 2015**

Introduction of basic speech skills for actors at any level to develop ear training, apply the International Phonetic Alphabet (IPA) for phonetic analysis, and execute a foreign dialect in performance.

## TH 470 Contemporary Playwriting (4) **Effective Spring 2015**

Focus on contemporary forms of playwriting, specifically, ten-minutes plays. Writing within the guidelines that make for a successful and theatrical short-form. Investigation of production opportunities, competitions, and publication options.

Prerequisite: Consent of instructor.

## WGS 470 Crossing Borders: Women Writing Their Lives (4) **Effective Fall 2013**

In this advanced creative nonfiction workshop, students will read prize-winning essays and memoirs by prominent women worldwide and use these texts to develop craft to write their own essays and explore the struggles and achievements in women's lives.

## A

Aerospace Engineering (AERO) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/aero>)

Agribusiness (AGB) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/agb>)

Agricultural Communication (AGC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/agc>)

Agricultural Education (AGED) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/aged>)

Agriculture (AG) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ag>)

Animal Science (ASCI) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/asci>)

Anthropology (ANT) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ant>)

Architectural Engineering (ARCE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/arce>)

Architecture (ARCH) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/arch>)

Art (ART) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/art>)

Astronomy and Astrophysics (ASTR) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/astr>)

## **B**

Biology (BIO) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/bio>)

Biomedical Engineering (BMED) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/bmed>)

BioResource and Agricultural Engineering (BRAE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/brae>)

Botany (BOT) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/bot>)

Business (BUS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/bus>)

## **C**

Chemistry (CHEM) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/chem>)

Child Development (CD) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/cd>)

Chinese (CHIN) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/chin>)

City and Regional Planning (CRP) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/crp>)

Civil Engineering (CE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ce>)

Communication Studies (COMS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/coms>)

Computer Engineering (CPE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/cpe>)

Computer Science (CSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/csc>)

Construction Management (CM) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/cm>)

Crop Science (CRSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/crsc>)

## **D**

Dairy Science (DSCI) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/dsci>)

Dance (DANC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/danc>)

Disaster Management and Homeland Security (DMHS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/dmhs>)

## **E**

Early Start English (ESE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ese>)

Early Start Math (ESM) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/esm>)

Earth Science (ERSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ersc>)

Economics (ECON) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/econ>)

Education (EDUC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/educ>)

Electrical Engineering (EE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ee>)

Engineering (ENGR) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/engr>)

English (ENGL) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/engl>)

Environmental Design (EDES) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/edes>)

Environmental Engineering (ENVE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/enve>)

Environmental Horticultural Science (EHS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ehs>)

Ethnic Studies (ES) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/es>)

## **F**

Fire Protection Engineering (FPE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/fpe>)

Food Science and Nutrition (FSN) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/fsn>)

French (FR) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/fr>)

Fruit Science (FRSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/frsc>)

## **G**

Geography (GEOG) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/geog>)

Geology (GEOL) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/geol>)

German (GER) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ger>)

Graduate Studies (GS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/gs>)

Graduate Studies-Accounting (GSA) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/gsa>)

Graduate Studies-Business (GSB) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/gsb>)

Graphic Communication (GRC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/grc>)

## **H**

History (HIST) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/hist>)

Honors Contract (HNRC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/hnrc>)

Honors (HNRS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/hnrs>)

Horticulture and Crop Science (HCS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/hcs>)

Humanities (HUM) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/hum>)

## I

Industrial and Manufacturing Engineering (IME) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ime>)

Industrial Technology (IT) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/it>)

Interdisciplinary Studies (IS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/is>)

Italian (ITAL) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ital>)

## J

Japanese (JPNS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/jpns>)

Journalism (JOUR) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/jour>)

## K

Kinesiology (KINE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/kine>)

## L

Landscape Architecture (LA) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/la>)

Liberal Arts and Engineering Studies (LAES) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/laes>)

Liberal Studies (LS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ls>)

## M

Materials Engineering (MATE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/mate>)

Mathematics (MATH) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/math>)

Mechanical Engineering (ME) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/me>)

Microbiology (MCRO) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/mcro>)

Military Science Leadership (MSL) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/msl>)

Modern Languages and Literatures (MLL) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ml>)

Music (MU) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/mu>)

## N

Natural Resources (NR) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/nr>)

## P

Philosophy (PHIL) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/phil>)

Physical Education: Men (PEM) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/pem>)

Physical Education: Women (PEW) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/pew>)

Physical Science (PSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/psc>)

Physics (PHYS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/phys>)

Plant Protection Science (PPSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ppsc>)

Political Science (POLS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/pols>)

Psychology (PSY) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/psy>)

## R

Recreation, Parks and Tourism Administration (RPTA) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/rpta>)

Religious Studies (RELS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/rels>)

## S

Science and Mathematics (SCM) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/scm>)

Social Sciences (SOCS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/socs>)

Sociology (SOC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/soc>)

Soil Science (SS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/ss>)

Spanish (SPAN) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/span>)

Statistics (STAT) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/stat>)

Systems Integration Engineering (SIE) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/sie>)

## T

Theatre (TH) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/th>)

## U

University Studies (UNIV) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/univ>)

## V

Vegetable Science (VGSC) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/vgsc>)

## W

Wine and Viticulture (WVIT) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/wvit>)

Women's and Gender Studies (WGS) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/wgs>)

## Z

Zoology (ZOO) (<http://catalog.calpoly.edu/previouscatalogs/2013-15/coursesaz/zoo>)

# Aerospace Engineering (AERO)

## Aerospace Engineering Courses

### AERO 102. General Aviation. 4 units.

Fundamentals of flight aerodynamics and principles. Introduction to power systems, instrumentation, flight planning, modern air navigation, weather data interpretation, flight computer uses, meteorology. Hands-on cockpit/taxi familiarization. Private pilot's examination preparation. Not a technical elective for engineering students. Field trip may be required. 4 lectures.

**AERO 121. Aerospace Fundamentals. 2 units.**

Introduction to the engineering profession including the aeronautical and aerospace fields. Engineering approach to problem-solving and analysis of data obtained from experiments. Basic nomenclature and design criteria used in the aerospace industry. Applications to basic problems in the field. 1 lecture, 1 laboratory.

**AERO 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**AERO 215. Introduction to Aerospace Design. 2 units.**

Prerequisite: AERO 121, MATH 143, and IME 144. Recommended: CSC 111.

Introduction to problem solving techniques and team-centered design projects in aerospace engineering. Primary emphasis on the solutions of design problems in aerospace engineering using computers. 2 laboratories.

**AERO 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**AERO 300. Aerospace Engineering Analysis. 5 units.**

Prerequisite: PHYS 133, ME 211 and MATH 244.

Analytical methods for aerospace engineering problems. Topics include vector calculus, linear algebra, differential equations, Laplace transforms and Fourier series. Computer tools and numerical methods as applied to problems in aerodynamics, structures, stability and control and astronautics. 4 lectures, 1 laboratory.

**AERO 301. Aerothermodynamics I. 4 units.**

Prerequisite: ME 211. Corequisite: AERO 300.

Properties and characteristics of fluids, fluid statics and dynamics, the thermodynamic relations, laminar and turbulent flows, subsonic and supersonic flows as applied to flight vehicles. Introduction to heat transfer. 4 lectures.

**AERO 302. Aerothermodynamics II. 4 units.**

Prerequisite: AERO 301.

Properties and characteristics of fluids, fluid statics and dynamics, the thermodynamic relations, laminar and turbulent flows, subsonic and supersonic flows as applied to flight vehicles. Introduction to heat transfer. 4 lectures.

**AERO 303. Aerothermodynamics III. 4 units.**

Prerequisite: AERO 302.

Properties and characteristics of fluids, fluid statics and dynamics, the thermodynamic relations, laminar and turbulent flows, subsonic and supersonic flows as applied to flight vehicles. Introduction to heat transfer. 4 lectures.

**AERO 304. Experimental Aerothermodynamics. 2 units.**

Prerequisite: ENGL 149 and AERO 301.

Laboratory experiments verify the momentum and energy equations. Mass flow rate, fan performance, boundary layer measurements, diffuser performance, and induction pump performance experiments are evaluated. Introduction to electronic sensors, signals and data acquisition. 1 lecture, 1 laboratory.

**AERO 306. Aerodynamics and Flight Performance. 4 units.**

Prerequisite: AERO 215, AERO 301. Concurrent: AERO 302.

Introduction to theoretical aerodynamics. Primary emphasis in the subsonic region, including compressibility effects. Basic aerodynamic theory: Airfoil theory, wing theory, lift and drag. Team-centered aerodynamic design. Flight performance. 4 lectures.

**AERO 307. Experimental Aerodynamics. 2 units.**

Prerequisite: AERO 302, AERO 306, ENGL 149.

Wind tunnel testing of basic aerodynamic properties of airfoils, finite wings, aircraft or spacecraft models, and vehicle flight performance. Emphasis on both static and dynamic responses of aircraft. Various measurement techniques, data reduction schemes, and analysis methods. 2 laboratories.

**AERO 310. Air and Space. 4 units.**

GE Area F

Prerequisite: Junior standing and Completion of GE Area B.

Technological innovations that have led to modern aircraft and spacecraft as viewed from an historical perspective. Development of aerodynamics, propulsion systems, light-weight structures, and control systems. How aviation has affected, and been affected by, history. Impact of aviation on society, including civil and military aircraft/spacecraft. Federal regulation of aviation, including air traffic control and airlines. Future developments in air and space technology. 4 lectures. Crosslisted as AERO/HNRS 310. Fulfills GE Area F.

**AERO 320. Fundamentals of Dynamics and Control. 4 units.**

Prerequisite: AERO 300 and ME 212.

Introduction to six degree of freedom rigid body dynamic and kinematic equations of motion, including coordinate transformations, Euler angles and quaternions for aerospace vehicles. Linearization and dynamic system theory and stability. Introduction to linear control theory, controller design and analysis. 4 lectures.

**AERO 331. Aerospace Structural Analysis I. 4 units.**

Prerequisite: AERO 300, CE 207, and ME 212.

Deflection analysis. Principles of fictitious displacement, virtual work, and unit load method. Energy methods: Castigliano's theorem, Maxwell-Betti reciprocal theorem, minimum principles, Rayleigh-Ritz's method and Galerkin's method. Stress analysis of aircraft and spacecraft components. 4 lectures.

**AERO 351. Introduction to Orbital Mechanics. 4 units.**

Prerequisite: AERO 300 and ME 212.

Motion of a body in a central field. Keplerian Orbits. Orbital maneuvers. Interplanetary trajectories. 4 lectures. Formerly AERO 451.

**AERO 353. Spacecraft Environment. 4 units.**

Prerequisite: AERO 300 and AERO 301.

Effects of the space environment on a spacecraft and design considerations. Topics include the launch, vacuum, particulate, plasma, and radiation environments 4 lectures.

**AERO 354. Space Environment Laboratory. 2 units.**

Prerequisite: ENGL 149 and AERO 353.

Laboratory examples of the effects of the space environment on a spacecraft and design considerations. Topics include the launch, vacuum, particulate, plasma, and radiation environments. All topics are applied to how the environment affects spacecraft design considerations. 2 laboratories.



**AERO 360. Creative Problem Solving in Engineering Design. 2 units.**

Prerequisite: PSY 350.

The creative problem solving process for an engineering design team. How to explore context and causes as part of defining a design problem; the principles of brainstorming, synthesis, and judgment. Role of iteration, implementation, and communication. Importance of a diverse view, including: customers, products, processes, systems, ethics, and professional responsibility. Team-based applications to case studies and real-world engineering design problems. 2 laboratories.

**AERO 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units.

**AERO 401. Propulsion Systems. 5 units.**

Prerequisite: AERO 303, CHEM 124.

Power plant types, components, characteristics, and requirements. Principles of thrust and energy utilization. Thermodynamic processes and performance of turboprop, turboshaft, turbofan, turbojet, ramjet, and rocket engines. 4 lectures, 1 laboratory.

**AERO 402. Spacecraft Propulsion Systems. 5 units.**

Prerequisite: AERO 303, AERO 353 and CHEM 124.

Effects of the propulsion subsystem on spacecraft design. Introduction to air breathing propulsion systems. Topics include basic rocket performance, monopropellant thrusters, bipropellant thrusters, electric thrusters, thruster placement, plumbing, tank sizing and design, system layout, component design, and systems integration. 4 lectures, 1 laboratory.

**AERO 405. Supersonic and Hypersonic Aerodynamics. 4 units.**

Prerequisite: AERO 303; and AERO 306 or AERO 353.

Review of gas dynamics, shock-wave and boundary-layer interaction, aerodynamic design. 2-dimensional supersonic flows around thin airfoil; finite wing in supersonic flow. Local surface inclination methods for high-speed flight, boundary-layer and aerodynamic heating, viscous interactions. 4 lectures.

**AERO 406. Applied Computational Fluid Dynamics. 4 units.**

Prerequisite: AERO 303 and AERO 306.

Application of Computational Fluid Dynamics to study wide range of fluid dynamics problems as they relate to the application of aerospace engineering. Topics include grid generation, sources of errors in CFD studies, boundary conditions, 2D and 3D external flows, and other related subjects. 3 lectures, 1 laboratory.

**AERO 407. Reentry Aerodynamics. 4 units.**

Prerequisite: AERO 303.

Near planet environments. Transition from orbital to aero-dynamic motion. Aerodynamic heating and effects on design. 4 lectures.

**AERO 409. Flight Test. 4 units.**

Prerequisite: AERO 306. Concurrent: AERO 320.

Overview of flight tests, test equations, and supporting facilities. Principles of team-centered flight testing with applications to performance, stability and control, and avionics systems testing. Test planning, instrumentation, data analysis and reports. 2 lectures, 2 laboratories.

**AERO 416. Principles of Rotary Wing Flight. 4 units.**

Prerequisite: AERO 306, AERO 300.

Introduction to analysis of rotary wing aircraft. Overview of avionics systems. Performance figures of merit. Stability and control of helicopters. Equations of motion for forward flight. 4 lectures.

**AERO 419. Simulation of Aerospace Vehicles and Systems. 4 units.**

Prerequisite: AERO 420.

Overview of flight simulators, aerospace avionics systems, and supporting facilities including simulation equations for flight mechanics and land navigation. Team-centered projects, reports, and presentations are emphasized with a strong focus on computer simulation of piloted flight. 2 lectures, 2 laboratories.

**AERO 420. Aircraft Dynamics and Control. 4 units.**

Prerequisite: AERO 300; AERO 306; and AERO 320.

Newton's 6-degree-of-freedom equations of motion applied to aerospace vehicles. Stability and control derivatives, reference frames, steady-state and perturbed dynamic analyses applied to aerospace vehicles. Stability and control design principles applied to transfer functions, state-space, and modal system dynamics. 4 lectures.

**AERO 421. Spacecraft Attitude Dynamics and Control. 4 units.**

Prerequisite: AERO 300; AERO 351; and AERO 320.

Introduction to spacecraft attitude dynamics and control. Momentum exchange devices and bang-bang thruster control. Orbit determination (GPS), maneuvers and station keeping. Fundamentals of guidance and navigation systems. Analysis and design of control systems for aerospace vehicles. 4 lectures.

**AERO 425. Aircraft Performance. 4 units.**

Prerequisite: ME 212, AERO 306, AERO 300.

Fundamentals of propeller and jet aircraft performance. Steady and accelerated flight. Equations of motion. Level flight, gliding, climbing, driftdown. Takeoff and landing. Federal Aviation Regulations (FARs). Range and endurance. Payload-range diagram. Maneuvering. V-n diagram. Turning and pull-ups. Stall and spin behavior. Energy methods. 4 lectures.

**AERO 431. Aerospace Structural Analysis II. 4 units.**

Prerequisite: AERO 331.

Basic equations of elasticity with applications to typical aerospace structures. Concepts studied include analysis of aircraft and aerospace structures; airworthiness and airframe loads; structural constraints; elementary aeroelasticity; structural instability; introduction to modern fatigue; fracture mechanics; and composite structures analysis. 4 lectures.



**AERO 432. Advanced Composite Structures Analysis. 4 units.**

Prerequisite: AERO 331.

Review of isotropic material behavior. Behavior of unidirectional fiber composites. Properties of short-fiber composites and orthotropic lamina. Analysis of laminated composites. Stresses and strains of composites. Strength and hygrothermal behavior of composite materials. 3 lectures, 1 laboratory.

**AERO 433. Experimental Stress Analysis. 1 unit.**

Prerequisite: AERO 331, AERO 431.

Employing the knowledge of stress analysis and aerospace structural analysis in an individual and group design project dealing with aerospace structures. 1 laboratory.

**AERO 435. Aerospace Numerical Analysis. 4 units.**

Prerequisite: AERO 300, AERO 331.

Taylor series. Finite difference calculus. Interpolation and extrapolation. Finite difference method. Basic equations of elasticity. Global stiffness matrix. Rayleigh-Ritz method. Galerkin method. Bernoulli-Euler beam element. Finite element formulation. Dynamic analysis. 3 lectures, 1 laboratory.

**AERO 443. Aircraft Design I. 4 units.**

Prerequisite: Senior standing, IME 144, AERO 215, AERO 303, AERO 306, AERO 331, AERO 405, AERO 420, AERO 431. Concurrent: AERO 401.

Preliminary layout of a typical aircraft vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of a flight vehicle, including its structures and systems. Preparation of necessary drawings and a report. 2 lectures, 2 laboratories. Open to students enrolled in the multidisciplinary design minor.

**AERO 444. Aircraft Design II. 3 units.**

Prerequisite: Senior standing, IME 144, AERO 215, AERO 303, AERO 306, AERO 331, AERO 405, AERO 420, AERO 431. Concurrent: AERO 401.

Preliminary layout of a typical aircraft vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of a flight vehicle, including its structures and systems. Preparation of necessary drawings and a report. 3 laboratories. Open to students enrolled in the multidisciplinary design minor.

**AERO 445. Aircraft Design III. 3 units.**

Prerequisite: Senior standing, IME 144, AERO 215, AERO 303, AERO 306, AERO 331, AERO 405, AERO 420, AERO 431. Concurrent: AERO 401.

Preliminary layout of a typical aircraft vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of a flight vehicle, including its structures and systems. Preparation of necessary drawings and a report. 3 laboratories. Open to students enrolled in the multidisciplinary design minor.

**AERO 446. Introduction to Space Systems. 4 units.**

Prerequisite: ME 212; EE 201 and EE 251; and AERO 353.

Basic satellite types and their applications. Major subsystems of a satellite system including ground support and launch systems. Interactions between subsystems and their effects on the overall system design. Detailed analysis of key subsystems on a spacecraft with special emphasis on power and communications subsystems. 4 lectures.

**AERO 447. Spacecraft Design I. 4 units.**

Prerequisite: IME 144; AERO 215; AERO 303; AERO 331; AERO 351 (formerly AERO 451); AERO 420 or AERO 421; AERO 431; AERO 446; and senior standing. Concurrent: AERO 402. Recommended: AERO 353.

Preliminary layout of typical space vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of selected components and preparation of necessary drawings. 2 lectures, 2 laboratories. Open to students enrolled in the multidisciplinary design minor.

**AERO 448. Spacecraft Design II. 3 units.**

Prerequisite: AERO 447.

Preliminary layout of typical space vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of selected components and preparation of necessary drawings. 3 laboratories. Open to students enrolled in the multidisciplinary design minor.

**AERO 449. Spacecraft Design III. 3 units.**

Prerequisite: AERO 448.

Preliminary layout of typical space vehicle using design and calculation techniques developed in previous aerospace engineering courses. Design of selected components and preparation of necessary drawings. 3 laboratories. Open to students enrolled in the multidisciplinary design minor.

**AERO 450. Introduction to Aerospace Systems Engineering. 4 units.**

Prerequisite: Senior standing or consent of instructor.

Aerospace systems and subsystems. Systems integration. Development of system requirements. Analysis, modeling and simulation of complex systems. Project management. Cost analysis. Optimization and trade studies. 4 lectures.

**AERO 452. Spaceflight Dynamics II. 4 units.**

Prerequisite: AERO 451.

Orbital motion, perturbing forces. Asphericity of the earth, aerodynamic drag, third-body tidal forces, etc. Encke and Cowell solution techniques. Restricted 3-body problem. Satellite attitude dynamics, rigid body-symmetric and asymmetric semirigid bodies. Attitude control, spinning/fixed gravity gradient. 4 lectures.

**AERO 460. Aerospace Engineering Senior Seminar. 1 unit.**

Prerequisite: Senior standing.

Final formal advising for student success. Topics include resume building and career prospecting, current events in the aerospace industry, graduate studies, engineering ethics, intellectual property, non-disclosure agreements, teamwork, and innovation and entrepreneurship. 1 seminar.

**AERO 461. Senior Project I. 2 units.**

Prerequisite: Senior standing.

Selection and completion of a project which is typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time.

**AERO 462. Senior Project II. 3 units.**

Prerequisite: Senior standing.

Selection and completion of a project which is typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time.

**AERO 463. Senior Project Laboratory I. 2 units.**

Prerequisite: Senior standing.

Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project involves, but is not limited to, physical modeling and testing of integrated design and may include students from other disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories. Note: although AERO 463, 464 substitute for AERO 461, 462, students may not use repeat credit for the purpose of increasing GPA.

**AERO 464. Senior Project Laboratory II. 3 units.**

Prerequisite: Senior standing.

Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project involves, but is not limited to, physical modeling and testing of integrated design and may include students from other disciplines. Formulation of outline, literature review, and project schedule. 3 laboratories. Note: although AERO 463, 464 substitute for AERO 461, 462, students may not use repeat credit for the purpose of increasing GPA.

**AERO 465. Aerospace Systems Senior Laboratory. 1 unit.**

Prerequisite: AERO 303, AERO 304, AERO 320, AERO 431 and Senior standing.

Culminating laboratory based experience. Experiments require the integration of the many disciplines in Aerospace Engineering. The successful completion of each experiment requires synthesis and integration of the fundamental concepts of the engineering sciences. Experimentation in the areas of aeroelasticity, active vibration control, inertial navigation, thermal control, hardware-in-the-loop simulation, and momentum exchange. 1 laboratory.

**AERO 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**AERO 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**AERO 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**AERO 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**AERO 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**AERO 500. Individual Study. 1-4 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 12 units.

**AERO 510. Systems Engineering I. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Project management. Scheduling and budgeting. Queuing theory. Process control and life-cycle cost analysis. Contracts and negotiation. 4 lectures. Crosslisted as AERO/IME 510.

**AERO 511. Systems Engineering II. 4 units.**

Prerequisite: AERO 510 or IME 510, graduate standing or consent of instructor.

Risk management. Design strategies to meet system/mission requirements. Design for supportability, manufacturability, reliability, etc. Quality function development and quality control concepts. 4 lectures. Crosslisted as AERO/IME 511.

**AERO 512. Aerospace Vehicle Software Application. 4 units.**

Prerequisite: AERO 510, AERO 546 and graduate standing.

Computer system requirements for aerospace vehicles. Typical aerospace vehicle computer architectures. Software testing, verification and validation. Vehicle automatic systems. Risks and benefits of vehicle autonomous operations. Integration of software with vehicle subsystems. Software development cost/schedule estimation. 4 lectures.

**AERO 515. Continuum Mechanics. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Vectors and tensors stress analysis. Analysis of deformation. Velocity fields and compatibility conditions. Constitutive equations. Isotropy. Mechanical properties of real fluids and solids. Field equations and boundary conditions in fluid mechanics problems and applications in elasticity. Active remodeling of structures. 4 seminars.

**AERO 517. Multidisciplinary Design and Optimization. 4 units.**

Prerequisite: Familiarity with programming in Matlab and graduate standing or consent of instructor.

Numerical optimization applied to the design of complex systems. Multi-criteria decision making, unconstrained and constrained optimization methods, system sensitivity analysis, system decomposition techniques, and multidisciplinary design optimization. 4 lectures.

**AERO 519. Fundamentals of Vehicle Dynamics and Control. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Fundamentals of particle and rigid body dynamics as they apply to aerospace vehicles. Kinematic variables and coordinate transformations. Attitude dynamics. Fundamentals of feedback control and its application to aerospace systems. Stability analysis. Numerical simulation. Not open to students with credit in AERO 451 and AERO 452. 4 lectures.

**AERO 522. Boundary-Layer Theory. 4 units.**

Prerequisite: AERO 302, graduate standing or consent of instructor.

Concept of boundary-layer. Boundary-layer equations, similarity transformation, integral and differential methods for steady, two-dimensional laminar and turbulent boundary layers. 4 lectures.

**AERO 523. Turbulence. 4 units.**

Prerequisite: AERO 302, graduate standing or consent of instructor.

Flow physics of turbulence. Turbulence scales and structures. Reynolds equations. Vorticity dynamics. Energy production, convection, and dissipation. Similarity rules and turbulence modeling for jets, wakes, mixing and boundary layers. Effect of turbulence on noise, combustion, heat transfer, and flow control. 4 lectures.

**AERO 524. Low Gravity Fluid Dynamics and Heat Transfer. 4 units.**

Prerequisite: AERO 301, AERO 302, and AERO 303, graduate standing or consent of instructor.

Low gravity environment. Mass, momentum and energy transport equations. Free and forced convections. Materials processing. Two-phase flows. Combustion and flame propagation. Turbulence. Fluid management in space. Students are expected to do self-study and make a presentation for the seminar. 3 lectures, 1 seminar.

**AERO 525. Computational Fluid Dynamics. 4 units.**

Prerequisite: AERO 303, graduate standing or consent of instructor.

Classification of partial differential equations. Numerical methods applicable to the solution of elliptic, parabolic, and hyperbolic partial differential equations. Consideration of accuracy and stability of numerical methods. Application to the fundamental equations of fluid dynamics, grid generation, turbulence modeling. 4 lectures.

**AERO 526. Spacecraft Thermal/Fluid Control. 4 units.**

Prerequisite: AERO 301, AERO 302, and AERO 303, or graduate standing.

Satellite thermal/fluid control hardware. Governing equations for flow and heat transfer. Surface tension and liquid/vapor interface. Heat transfer by free convection, forced convection and radiation in low-gravity environment. Heat pipes. Capillary-pumped loops. Cryogenic systems. Fluid management in space. 4 lectures.

**AERO 530. Inelastic Structural Analysis. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Inelastic stress analysis. Yield criteria. Strain hardening. Plastic straining and bending. Elastic-plastic problems. Plastic instability. Slip-line fields for plains. Plastic strain problems and analysis and introduction to viscoplasticity. 3 lectures, 1 laboratory.

**AERO 532. Advanced Aerospace Composite Design. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Behavior of composite materials. Bending, buckling, and vibration of laminated plates. Fatigue and fracture mechanics analysis of composite structures. Optimum design of composite pressure vessels. 2 seminars, 2 laboratories.

**AERO 533. Finite Elements for Aerospace Structural Analysis. 4 units.**

Prerequisite: AERO 431.

Overview of theoretical and applied methods of finite element analysis for aerospace structures including composite and light weight structures. Topics include basic equations of elasticity, solutions of linear systems of equations transformation, global stiffness matrix, Bernoulli-Euler element, plane stress triangles, finite element formulation, isoparametric elements, alternative formulation, eigenvalue problems and dynamic analysis. 3 lectures, 1 laboratory.

**AERO 534. Aerospace Structural Dynamics Analysis. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Fundamentals of structural dynamics and aeroelasticity of flight vehicles. Undamped and damped, free and forced vibration of a single and multi degree-of-freedom linear systems. Finite elements and vibrational analysis. 3 lectures, 1 laboratory.

**AERO 535. Advanced Aerospace Structural Analysis. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Types of failure. Theories of failure. Stability of structures. Advanced flight vehicle and fracture mechanics analysis and design. Fundamentals and applications of modern fatigue analysis in the aerospace industry. 3 lectures, 1 laboratory.

**AERO 540. Elements of Rocket Propulsion. 4 units.**

Prerequisite: AERO 303, AERO 401, graduate standing or consent of instructor.

Thrust and impulse equations, propellant composition and mixture ratios, nozzle expansion ratios, solid and liquid propellant combustion, internal ballistics, thermo-chemical computations, chemical kinetics, and combustion instability, nozzle design and exhaust plumes. 4 seminars.

**AERO 541. Air Breathing Propulsion. 4 units.**

Prerequisite: AERO 401, graduate standing or consent of instructor.

Aerothermodynamics of propulsion systems, power plant selection and design, on-off design performance, component characterization, component design, component matching, optimization, and introduction to power plant and airframe integration systems for aircraft. 4 seminars.

**AERO 546. Spacecraft Systems Design. 4 units.**

Prerequisite: Graduate standing.

Spacecraft missions, vehicle types, and applications. Introduction and preliminary sizing of major subsystems of a space system. Introduction to and design drivers for space environments, propulsion system, power system, structural design, spacecraft dynamics and attitude control, orbit mechanics, thermal control, communications, and ground segments. 4 lectures.

**AERO 550. Analysis and Design of Flight Control Systems. 4 units.**

Prerequisite: AERO 420, graduate standing or consent of instructor.

Fundamental principles of flight control design and the application of the Cooper-Harper test and evaluation tool to modern aerospace vehicles. Human factors, issues, and automation, case study of the space shuttle. 3 lectures, 1 laboratory.

**AERO 551. Global Positioning Satellite Navigation Systems. 4 units.**

Prerequisite: AERO 420, graduate standing or consent of instructor.

Principles of Global Positioning Satellite navigation systems. Kalman filter design and application to integrated navigation and guidance systems. Statistical evaluation and test methods in aerospace. Interactive computer simulations. 3 lectures, 1 laboratory.

**AERO 552. Advanced Control of Spacecraft and Aircraft. 4 units.**

Prerequisite: AERO 420, graduate standing or consent of instructor.

Model following and digital control of aerospace craft, including dynamic estimation of vehicle states using Kalman filters and adaptive compensation. Team-centered projects involving optimal attitude control in deep space, hovering vehicles, and aeroelastic systems. Survey of non-linear, fuzzy, and neural net controllers for aerospace applications. 2 lectures, 2 laboratories.

**AERO 553. Advanced Linear Control Theory. 4 units.**

Prerequisite: AERO 320, graduate standing or consent of instructor.

Advanced linear control theory techniques and analytic and computational analysis. State space system representation, solutions to linear dynamic systems, stability analysis, full-state and output feedback, controllability and observability and advanced control topics. Computational methods applied to problems in stability and control of dynamic systems. 4 lectures.

**AERO 557. Advanced Orbital Mechanics. 4 units.**

Prerequisite: AERO 451, graduate standing, or consent of instructor.

N-body orbit interactions, computer simulations, orbit determination, orbit and transfer optimization, libration points, halo orbits, and orbit perturbations. 4 lectures.

**AERO 560. Spacecraft Dynamics and Control. 4 units.**

Prerequisite: AERO 420, AERO 452, AERO 553, graduate standing or consent of instructor.

Orbit determination and control. Orbit maneuvering and rendezvous. Attitude control of rigid spacecraft via reaction wheels, control moment gyros and thrusters. Modeling, analysis and control of flexible spacecraft. 4 lectures.

**AERO 561. Vehicle Integration and Testing. 2 units.**

Prerequisite: AERO 446 and graduate standing or consent of instructor. Recommended: AERO 450.

Space vehicle integration requirements and procedures. Clean room requirements and operations. Quality control and inspection. Qualification and acceptance testing requirements. Test equipment. Vibration and shock testing. Space environment and thermal-vac testing. Development of test procedures. 1 lecture, 1 laboratory.

**AERO 562. Space Operations. 2 units.**

Prerequisite: AERO 446 and graduate standing or consent of instructor. Recommended: AERO 450.

Launch operations and vehicle integration with launch vehicle. In-orbit operations and maneuvers. Spacecraft tracking. Telemetry and command. Ground systems. Failure detection and identification. Emergency operations. 1 lecture, 1 laboratory.

**AERO 565. Advanced Topics in Aircraft Design. 4 units.**

Prerequisite: AERO 522, AERO 530 and AERO 550, graduate standing or consent of instructor.

Application of advanced analytic engineering methods to aircraft design problems. Analysis and synthesis of advanced topics related to design of aircraft. 4 lectures.

**AERO 566. Advanced Topics in Spacecraft Design. 4 units.**

Prerequisite: AERO 510, AERO 546, and graduate standing.

Application of advanced engineering tools to the design of space vehicles. System architecture and mission design. Concept of operations. Requirements development and flow down. System and subsystems trade studies and preliminary design. 4 lectures.

**AERO 567. Launch Vehicle and Missile Design. 4 units.**

Prerequisite: AERO 401, AERO 450, AERO 446, graduate standing or consent of instructor.

Basic launch vehicle/missile types. Launch vehicle subsystems and their interactions. Vehicle requirements development and flow down. Payload accommodations. System and subsystems trade studies and preliminary design. 4 lectures.

**AERO 570. Selected Advanced Topics. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**AERO 571. Selected Advanced Topics Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.



**AERO 572. Topics in Aircraft Manufacturing and Fabrication. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Selected topics for assembling aircraft and aircraft components, including empennage, wing fuselage, engine, flight controls, avionics, finishing work, and flight testing. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 laboratory.

**AERO 593. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**AERO 594. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**AERO 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only.

**AERO 596. Culminating Experience in Space Systems Engineering. 5 units.**

Prerequisite: Graduate standing.

Performance of comprehensive systems analysis of a space system. Communication of the results and findings of such evaluations in written report and by oral presentation. Conducted under supervision of faculty.

**AERO 599. Thesis (Design Project). 1-9 units.**

Prerequisite: Graduate standing.

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis.

## **Agribusiness (AGB)**

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### **Agribusiness Courses**

**AGB 101. Introduction to Agribusiness. 4 units.**

Prerequisite: AGB major and freshman standing.

Orientation to the agribusiness sector of agriculture. An overview of the breadth, size, scope and management aspects of the agricultural business complex. Agribusiness students are required to complete this within the first year of the major. 4 lectures.

**AGB 200. Special Problems for Undergraduates. 1-2 units.**

CR/NC

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit can only be used to satisfy free electives. Credit/No Credit grading only.

**AGB 202. Sales, Communication and Leadership in Agribusiness. 4 units.**

Self management, communication, and interpersonal skills necessary in developing managerial abilities, leadership qualities, and facilitating teamwork within the agribusiness sector. Industry opportunities ranging from input and output products and services along with government and special interest groups will be surveyed. 4 lectures.

**AGB 212. Agricultural Economics. 4 units.**

Theoretical development of factors affecting demand and supply for food and fiber and for agricultural inputs. Methods of selecting optimal levels of agricultural production and consumption variables. Evaluation of market structure and price formulation for agricultural products and resources. 4 lectures.

**AGB 214. Agribusiness Financial Accounting. 4 units.**

Principles of financial accounting in agribusiness. Preparation for understanding and interpreting financial statements. Exploration of financial reporting standards to provide an understanding of how financial events are reflected in financial statements. The importance of social responsibility in accounting. The accounting cycle, from transactions posting to financial statements through spreadsheet applications. 3 lectures, 1 activity.

**AGB 260. Agribusiness Information Technology. 4 units.**

Prerequisite: AGB 101 or junior standing.

Using data and analysis in making decisions related to agribusiness. Developing basic and intermediate spreadsheet skills necessary to organize, analyze, and summarize information. Development of data management and analysis as tools to assist in agribusiness problem-solving. 4 lectures.

**AGB 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**AGB 301. Food and Fiber Marketing. 4 units.**

Prerequisite: AGB 212, ECON 201, or ECON 221.

Food and fiber marketing, examining commodity, industrial, and consumer product marketing from a managerial viewpoint. A global perspective in understanding consumer needs and developing the knowledge of economic, political, social and environmental factors that affect food and fiber marketing systems. 4 lectures.



**AGB 303. Introduction to the Horse Racing Industry. 4 units.**

Prerequisite: Junior standing.

Descriptive analysis of horse racing industry: breeding farms, race tracks, trade associations, training issues, and auction sales. Industry structure, economic flows, contributions to state and local taxes, and racing law. Cultural influences of racing in Europe, Australasia, and Latin America. 4 lectures.

**AGB 310. Agribusiness Credit and Finance. 4 units.**

Prerequisite: AGB 214 for AGB majors; AGB 214 or BUS 212 or BUS 214 for non-AGB majors.

Financing California's agricultural industry. Sources of credit and types of loans used by agribusinesses. Costs of credit. Financial analysis of agricultural borrowers. Future and present value techniques used in evaluating agricultural investments. Agricultural financial management. Financial capital markets and leasing. 4 lectures.

**AGB 311. Intermediate Agribusiness Finance. 4 units.**

Prerequisite: AGB 260 and AGB 310.

Financial tools applied to the agribusiness industry, focusing on unique risks in agriculture. Risk and return in the production and processing sectors, working capital management, cash flows and financial statement forecasting for agribusiness firms, using spreadsheet analysis. 4 lectures.

**AGB 312. Agricultural Policy. 4 units.**

Prerequisite: AGB 212 and ECON 222.

Agricultural policy objectives and formulation, resource allocation and production adjustments. Survey of State and Federal agricultural policies as they influence the planning and practices of agribusiness. 4 lectures.

**AGB 313. Agriculture Economic Analysis. 4 units.**

Prerequisite: AGB 212 and MATH 221.

Advanced agricultural microeconomics with emphasis on mathematical problem solving; production and cost functions, single and multiple input allocation, agricultural output combinations, agricultural market structures, and economies of size. 4 lectures.

**AGB 314. Fair and Fair Facility Management. 4 units.**

Prerequisite: Upper division standing.

Fundamentals of the year round operation of a fair facility to include rental opportunities, master planning, and maintenance. Principles and procedures in planning, organizing, operating, and evaluating a fair. One day field trip required. 4 lectures.

**AGB 315. Land Economics. 4 units.**

Prerequisite: AGB 312 and AGB 313.

Economics of agricultural and rural land use. Incorporates production economics with welfare theory to explore society's implicit and explicit land use decisions and problems in California, the West and nationwide. Incorporates land use planning and its implicit economic content. 4 lectures.

**AGB 318. Global Agricultural Marketing and Trade. 4 units.**

Prerequisite: AGB 301 and 312.

Analysis of international marketing opportunities for agricultural products. Strategies for enhancing the performance of U.S. agricultural exports/ imports. Impact of government trade policies and regulations, distribution systems, and the changing consumer. 4 lectures.

**AGB 321. Farm Records. 4 units.**

Prerequisite: AGB 212 or ECON 201.

Fundamentals of record keeping, kinds of records, inventory, depreciation, payrolls, cash and accrual basis of income tax reporting, financial statements and analysis. 3 lectures, 1 activity.

**AGB 322. Principles of Agribusiness Management. 4 units.**

Prerequisite: AGB 212; and AGB 214 or AGB 321.

Organization and operation of agribusinesses. Identification of factors affecting profitability. Evaluation of the business for increased efficiency and profit. Application of budgeting to representative firms and independent analysis of an agribusiness. 3 lectures, 1 activity.

**AGB 323. Agribusiness Managerial Accounting. 4 units.**

Prerequisite: AGB 214.

Agribusiness management with an emphasis on using accounting procedures that will provide useful information in making management decisions, setting objectives, and controlling operations. 3 lectures, 1 activity.

**AGB 324. Agricultural Property Management and Sales. 4 units.**

Prerequisite: AGB 310 or consent of instructor.

Economic, legal and real estate principles in the investment, development, mortgaging and transferring of agricultural real estate. 3 lectures, 1 activity.

**AGB 326. Rural Property Appraisal. 4 units.**

Prerequisite: AGB 310.

Methods of rural appraisal, including farms, ranches and other rural properties, use of county records, appraisal practice on different types of rural properties, discussions with professional appraisers. 3 lectures, 1 activity.

**AGB 327. Agribusiness Data Analysis. 4 units.**

Prerequisite: STAT 251 and AGB 260.

Methods in agricultural business data analysis, including multiple regression analysis, analysis of variance, and time series analysis. Applications include agricultural price forecasting and estimation of the determinants of food and fiber demand. 3 lectures, 1 activity.

**AGB 328. Decision Tools for Agribusiness. 4 units.**

Prerequisite: STAT 251 and AGB 260.

Development of agribusiness modeling techniques that are applied to solving a diverse and unique set of resource allocation issues encountered throughout the agricultural and food retail sectors. Techniques include linear programming, decision analysis, and computer simulations. 3 lectures, 1 activity.

**AGB 331. Farm Accounting. 4 units.**

Prerequisite: AGB 214.

Application of commercial accounting process to farm and ranch accounting problems. Emphasis on accounting systems that facilitate financial statement presentation, tax preparation and ADP enterprise analysis. Income tax laws pertaining to agriculture. 3 lectures, 1 activity.

**AGB 339. Internship in Agribusiness. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected students will spend up to 12 weeks with an approved agricultural firm engaged in production or related agribusiness. Time will be spent applying and developing agribusiness functional and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 6 units. Credit/No Credit grading only.

**AGB 370. World Food Economy. 4 units.**

Prerequisite: AGB 312 and AGB 313.

International agricultural production, economics, and distribution. Comparative and competitive advantage in world agriculture. Food security issues and regional analysis of agriculture policies. The future of agriculture from a global perspective. 4 lectures.

**AGB 400. Special Problems. 1-2 units.**

Prerequisite: Consent of department head or instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**AGB 401. Managing Cultural Diversity in Agricultural Labor Relations. 4 units.**

USCP

Prerequisite: Senior standing.

Agricultural labor trends and problems as determined by changes occurring in farming and farm related industries. Labor-management relations in agriculture; principles and procedures in organizing and managing the agricultural business personnel program. 4 lectures. Fulfills USCP.

**AGB 404. Food Retail Management. 4 units.**

Prerequisite: AGB 301.

Uses and techniques in management of perishable and non-perishable food commodities at the retail level. Issues in traditional versus new models of retail with emphasis on the marketing mix. Introduction to vendor, category and shelf management. 4 lectures.

**AGB 405. Agribusiness Marketing Research Methods. 4 units.**

Prerequisite: STAT 251 and AGB 301.

Agricultural marketing research data collection and analysis. Emphasis on food sector market segmentation, product positioning, new product testing, sales forecasting, and marketing plan development through secondary and primary data sources. Experimental research design and implementation. 4 lectures.

**AGB 406. Agribusiness Marketing Planning. 4 units.**

Prerequisite: AGB 301, AGB 310, AGB 312, AGB 313, AGB 323 and AGB 405.

Client centered course where self-managed teams develop agribusiness marketing plan. Emphasis on developing presentation skills. Integration of marketing mix, particularly promotional elements in developing agribusiness marketing strategy emphasized. 4 lectures.

**AGB 407. Agribusiness Marketing Plan Internship. 4 units.**

Prerequisite: AGB 405. Corequisite: AGB 339.

A minimum of 120 hours spent with an approved agricultural marketing firm. Development of an agribusiness marketing plan. Integration of marketing mix, particularly promotional elements in developing agribusiness marketing strategy emphasized. Presentation of the marketing plan to corporate management and instructor.

**AGB 409. California Agricultural Law. 4 units.**

Prerequisite: BUS 207, senior standing or consent of instructor.

Historical and current sources of law, examination of judicial systems, application of contracts, agency, labor law, torts, property, air, and water law, business organizations, agricultural cooperatives, debtor and creditor rights and regulations that impact agricultural enterprises. 4 lectures.

**AGB 410. Agricultural Lending. 4 units.**

Prerequisite: AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Structure and performance of the agricultural lending industry. Advanced agricultural loan analysis and risk assessment. Agricultural loan documentation, securitization of farm loans, and farm bankruptcy. Exploration of interest rate impacts on agricultural lending. 4 lectures.

**AGB 411. Agribusiness Risk Management. 4 units.**

Prerequisite: AGB 301, AGB 311, and AGB 328 or graduate standing.

Risk management strategies and tools applied to the agribusiness industry, focusing on risks in agriculture. Forward contracting, futures and options, swaps, crop insurance, trading and hedging strategies, and their applications to agribusiness problems. 4 lectures.

**AGB 412. Advanced Agricultural Policy. 4 units.**

Prerequisite: AGB 312; AGB 315; AGB 370; and one of the following AGB 327, AGB 328, AGB 421 or AGB 433.

Agricultural resource allocation issues with emphasis on policies that impact the production of food and fiber and inputs used in their production. Special topics in agricultural resource allocation stressing issues and policies emphasizing economic externalities. 4 lectures.

**AGB 422. Logistics in Global Agribusiness. 4 units.**

Prerequisite: Junior standing; AGB majors: STAT 251; non-AGB majors: STAT 218 or STAT 251.

Scope and elements of the agribusiness logistics system including supply and distribution channels, transportation, inventory, warehousing, packaging, and order processing. 4 lectures.

**AGB 426. Advanced Rural Appraisal. 4 units.**

Prerequisite: AGB 326.

Case studies in agricultural and rural property appraisal. Practice in income, cost and direct sales comparison approaches, and advanced appraisal topics such as conservation easements. 3 lectures, 1 activity.

**AGB 427. Advanced Agribusiness Data Analysis. 4 units.**

Prerequisite: AGB 327 or AGB 328 or graduate standing and consent of instructor.

Advanced topics in agricultural business data analysis. Topics include advanced agricultural price analysis, advanced linear programming in agribusiness, and advanced agricultural business operations analysis. The Schedule of Classes will list the topic selected. 4 lectures.

**AGB 440. Field Studies in Agribusiness. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Visitation to selected agribusinesses. Organization, operation, services and problems considered. Can only be taken once for credit in the major.

**AGB 444. Wine Compliance and Market Analysis. 4 units.**

Prerequisite: STAT 251.

Legal aspects of wine marketing with emphasis on Federal (BATF) requirements. Application of statistical theory to the collection, interpretation, and forecasting of wine and grape industry data with emphasis on production and sales. Introduction to standard accounting ratios. 4 lectures.

**AGB 445. Produce Marketing. 2 units.**

Prerequisite: Senior standing and AGB 301.

Directed group study of fresh fruit and vegetable marketing. Includes analysis of terminal markets, retail marketing (supermarkets, farmer's markets, roadside stands), limited preserving and ripening, grading and inspection, economics of transportation, international marketing. 2 seminars.

**AGB 450. Agribusiness Strategy Formulation. 4 units.**

Prerequisite: AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Development of strategy for agribusinesses where an uncontrollable environment makes output and results highly unpredictable; emphasis on the total enterprise. Case analysis. 4 lectures.

**AGB 452. Agricultural Market Structure and Strategy. 4 units.**

Prerequisite: AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Development of skills for quantity and price determination in a noncompetitive setting. Emphasis on examining the agribusiness industry structures that exist and their effects on decision-making. The use of game theory demonstrated as a strategy formulation tool. 4 lectures.

**AGB 455. Advanced Fair Management Seminar. 2 units.**

Prerequisite: AGB 314.

Advanced studies in fair management with emphasis on budgets, contracts, entertainment, carnivals, exhibit programs, crowd control, master planning maintenance. 2 seminars.

**AGB 456. Agricultural Management Problems. 4 units.**

Prerequisite: AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Management problems in agricultural production. Enterprise costing procedures, equipment costing and replacement, scheduling of operations to obtain efficiencies. Determination of most profitable production mix. Includes whole farm budget development and analysis. 4 lectures.

**AGB 460. Research Methodology in Agribusiness. 2 units.**

Prerequisite: Senior standing and AGB major; AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Empirical application of the scientific method as it relates to the design and development of Senior Project. Research plan is developed. First quarter of Senior Project. 2 seminars.

**AGB 461. Senior Project. 2 units.**

Prerequisite: Senior standing and AGB 460.

Completion of a project under faculty supervision. Research topics or projects typical of problems which graduates must solve in the agricultural, food and fiber industries. Project results are presented in a formal report. Minimum 60 hours total time.

**AGB 462. Senior Project - Applied Agribusiness Problems. 4 units.**

Prerequisite: Senior standing and AGB major; AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Selection and analysis of agribusiness problems and opportunities in directed group-based projects. Exploration of problems which agribusiness graduate students may encounter in marketing, finance, management and production in the food and fiber industry. Formal report and presentation required. 4 lectures.

**AGB 463. Senior Project - Agribusiness Consulting. 4 units.**

Prerequisite: Senior standing and AGB major; AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and one of the following AGB 327, AGB 328, AGB 405, AGB 421, AGB 422, AGB 433, AGB 435.

Client-centered course where self-managed teams develop solutions to agribusiness problems. Exploration of problems typical to those which agribusiness graduates may encounter in marketing, finance, management and production in the food and fiber industry. Formal report and presentation to client required. 4 lectures.

**AGB 464. Senior Project - Advanced Internship Experience in Agribusiness. 4 units.**

Prerequisite: Senior standing and Agribusiness major; AGB 301; AGB 310; AGB 312; AGB 313; AGB 323; and AGB 327 or AGB 328.

A minimum of 120 hours spent with an approved agribusiness firm. Independent internship experience conducted under faculty supervision focusing on a discipline area of agribusiness. Completion of a project as a component of the internship. Formal report and presentation required.

**AGB 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**AGB 500. Individual Study in Agribusiness. 1-6 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced independent study planned and completed under the direction of a member of the Agribusiness faculty. Total credit limited to 6 units.

**AGB 514. Agribusiness Managerial Leadership and Communication. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Current issues in agriculture addressed through the case analysis method. Emphasis on communication skills and leadership qualities, identifying key success requirements. 4 seminars.

**AGB 539. Graduate Internship in Agribusiness. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of agricultural production or related business in the field of Agribusiness. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**AGB 543. Agribusiness Policy and Program Analysis. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Economic, political, and social objectives of domestic agricultural policies and programs. Consequences of government's policies and programs to control production, allocate resources, support market prices, and provide benefits to food and fiber producers, marketers, and consumers. Topical analysis of current effort of government to direct agriculture. 4 seminars.

**AGB 554. Food System Marketing. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Major issues facing the food system marketer. Vertical and horizontal linkages, pricing in agricultural markets, management of price risk through futures markets and hedging, and public policy and consumer impacts on the system. Student involvement through case studies simulations, and presentations. 4 seminars.

**AGB 555. Technological and Economic Change in Agribusiness. 4 units.**

Prerequisite: Graduate standing, or consent of instructor.

Ramifications and impacts in agribusiness firms from technological and economic changes. Emphasis on specific agribusiness firms and their managerial process of dealing with problems and opportunities in the operational environments of economic, technology, political, global, domestic and marketing. 4 seminars.

**AGB 563. International Agribusiness Trade and Development. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Agricultural trade dynamics in a world economy. Evaluation of multinational firms and unilateral and multinational government policy strategies in interacting with and expanding markets for agricultural trade. Agribusiness opportunities with social and institutional limitations; emphasis on environmental and sustainable trade issues. 4 seminars.

**AGB 570. Selected Topics in Agribusiness. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**AGB 571. Selected Advanced Laboratory in Agribusiness. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**AGB 599. Thesis in Agribusiness. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem in Agribusiness. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Agricultural Communication (AGC)

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### Agricultural Communication Courses

**AGC 102. Orientation to Agricultural Communication. 2 units.**

Orientation to the communication sector of agriculture. Overview of professional opportunities and skills needed for success in agricultural communications. Preparation of press releases and short articles, and development of a planned program of study. 2 lectures.

**AGC 200. Special Problems in Agricultural Communication. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems in Agricultural Communication/Agricultural Education. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**AGC 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**AGC 339. Internship in Agricultural Communications. 1-12 units. CR/NC**

Prerequisite: Consent of internship instructor.

Selected Agricultural Communication students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 6 units. Credit/No Credit grading only.

**AGC 400. Advanced Special Problems in Agricultural Communication. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems in Agricultural Communication/Agricultural Education. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**AGC 407. Agricultural Publications. 4 units.**

Prerequisite: JOUR 205. Recommended: CSC 113.

Integration of writing, editing, and layout skills in producing agricultural publications. Emphasis on using computer applications in desktop publishing. Total credit limited to 9 units; may be in same term. 2 lectures, 2 activities.

**AGC 426. Presentation Methods in Agricultural Communication. 4 units.**

Prerequisite: Completion of GE A2, junior standing.

Development, delivery and evaluation of effective means of communication by use of a variety of presentation methods and the use of technology for effective communication. 2 lectures, 2 activities.

**AGC 461. Senior Project I. 1 unit.**

Prerequisite: AGED 460.

Empirical application of the scientific method as it relates to the selection of a project under faculty supervision. Projects typical of problems that graduates must solve in their field of employment. Minimum 30 hours total time.

**AGC 462. Senior Project II. 1 unit.**

Prerequisite: AGC 461.

Completion of a project begun in AGC 461 under faculty supervision. Projects typical of problems that graduates must solve in their field of employment. Project results are presented in a formal report. Minimum 30 hours total time.

**AGC 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**AGC 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**AGC 500. Individual Study In Agricultural Communication. 1-3 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced independent study planned and completed under the direction of a member of the Agricultural Education and Communication faculty. Total credit limited to 6 units.

**AGC 539. Graduate Internship in Agricultural Communication. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of agricultural production or related business in the field of Agricultural Communication. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**AGC 570. Selected Topics in Agricultural Communication. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**AGC 571. Selected Advanced Laboratory in Agricultural Communication. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**AGC 580. Special Problems in Agricultural Communication. 1-3 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Individual study of modern issues and problems conducted through research, planning and development. Field problems and in-service study in agricultural industry encouraged. Final written report required. Total credit limited to 9 units with not more than 3 units in any one quarter.

**AGC 581. Graduate Seminar in Agricultural Communication. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Group study of selected developments, trends and issues in the field of Agricultural Communication. 3 seminars.

## **Agricultural Education (AGED)**

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### **Agricultural Education Courses**

**AGED 102. Introduction to Agricultural Education. 2 units.**

Overview of agricultural education career pathways including goals and purposes. Kinds of classes and types of programs. Qualifications essential to success in teaching agriculture. Planned program of studies to meet requirement for teaching agricultural science and related disciplines. 2 lectures.

**AGED 200. Special Problems in Agricultural Education. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems in Agricultural Communication/Agricultural Education. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**AGED 220. Agricultural Youth Conferences. 2 units.**

CR/NC

Prerequisite: Consent of instructor.

Problems encountered and practices applied during the conduct of the annual FFA State Convention. Methods, procedures and materials adapted for use by the student in developing the committee system to produce conferences, conventions and workshops of all kinds and sizes. Total credit limited to 6 units. Credit/No Credit grading only. 2 activities.



**AGED 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**AGED 303. FFA and Supervised Agricultural Experience. 4 units.**

Prerequisite: AGED 102.

Emphasis on historical, philosophical and social foundation of high school agricultural education as it relates to the classroom/laboratory instruction, leadership (FFA) and supervised agricultural experiences (SAEs). Application of integral components in developing a total program of agricultural education. Two day field study tour required. 2 lectures, 2 activities.

**AGED 330. FFA and Supervised Agriculture Programs. 6 units.**

Prerequisite: AGED 102.

Implementation processes and operational procedures for initiating, conducting and integrating FFA activities and SOE Programs appropriate to community, school and student needs. Demonstration, application and observation of practices and techniques utilized by agriculture instructors in conducting organized classroom, shop, school farm, laboratory and home visit instruction in agriculture, FFA and SOE activities. 3 activities, and supervised work.

**AGED 339. Internship in Agricultural Education. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected Agricultural Education students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 6 units. Credit/No Credit grading only.

**AGED 350. Early Field Experience in Agriculture Education. 2 units.**

CR/NC

Prerequisite: AGED 303; and junior standing.

Observation of the practices and techniques utilized by agriculture teachers in conducting organized instruction in high school classrooms, shops, school farms, and laboratories. Discussion of activities and programs unique to teaching agriculture in California secondary schools. Participation in public schools requires mandated fingerprint clearance. 2 seminars.

**AGED 400. Advanced Special Problems in Agricultural Education. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems in Agricultural Communication/Agricultural Education. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**AGED 404. Agricultural Leadership. 3 units.**

Prerequisite: Completion of GE D4, junior standing.

Emphasis upon equipping current and prospective leaders in agriculture with the background and skills to achieve their potential. Class members will assess their status as leaders and identify means to improve their effectiveness. Focus on the theoretical underpinnings of human motivation, personal leadership, and organizational development. 2 lectures, 1 activity.

**AGED 410. Computer Applications in Agricultural Education. 2 units.**

Prerequisite: AGED 102. Recommended: AGED 303.

Development of computer literacy for teaching agriculture. Analysis and specialization of hardware. Instruction in digital technology, network systems and software applicable to teaching agriculture at the secondary level.

**AGED 422. Organizing and Teaching K-6 Standards. 4 units.**

Prerequisite: LS 230, LS 250.

Objectives, content, techniques, materials, and recent trends of successful application of agricultural literacy and awareness to K-6 grade level standards. Ongoing projects, individual and group, allow for exploration and understanding of agriculture as a theme to teach all of the content areas, as well as assist in understanding the educational standards accompanying each lesson. 4 lectures.

**AGED 424. Organizing and Teaching Agriculture. 3 units.**

Prerequisite: AGED 438 and consent of instructor.

Determining course objectives, content, and calendar for use by the teacher in classroom, shop and field instruction while assigned to community schools. Concurrent with student teaching. 3 activities.

**AGED 438. Instructional Processes in Agricultural Education. 4 units.**

Prerequisite: AGED 330, EDUC 410, EDUC 412 and EDUC 414 or consent of instructor.

Principles of specific agricultural teaching methods and developmentally appropriate pedagogy. Daily and unit lesson plans that adopt content, teaching methods, and assessment for English Learners and students with special needs. Class demonstrations in teaching procedures, analysis, assessment and reflection. 2 lectures, 2 activities.

**AGED 440. Student Teaching in Agricultural Education. 6-12 units.**

CR/NC

Off-campus assignment to a selected cooperating public school. Participation in all phases of agriculture teacher duties and activities including departmental organization and administration. Prior approval and appointment necessary. Total credit limited to 18 units. Credit/No Credit grading only.

**AGED 441. Student Teaching Practicum. 2 units.**

Prerequisite: Consent of instructor.

Problems encountered and practices applied during student teaching. Methods, procedures and materials adapted for use by the teacher concurrent with student teaching. 2 activities.

**AGED 460. Research Methodology in Agricultural Education and Communication. 1 unit.**

Prerequisite: Junior standing.

Introduction of the research process and topic selection as it relates to the design and development of the senior project within the Agricultural Sciences major. 1 lecture.

**AGED 461. Senior Project I. 1 unit.**

Prerequisite: AGED 460.

Empirical application of the scientific method as it relates to the selection of a project under faculty supervision. Projects typical of problems that graduates must solve in their field of employment. Minimum 30 hours total time.

**AGED 462. Senior Project II. 1 unit.**

Prerequisite: AGED 461 or consent of instructor.

Completion of a project begun in AGED 461 under faculty supervision. Projects typical of problems that graduates must solve in their field of employment. Project results are presented in a formal report. Minimum 30 hours total time.

**AGED 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**AGED 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**AGED 481. Developing Digital Presentations for Instruction in Agricultural Education. 1 unit.**

Prerequisite: Senior standing.

Directed group study and individualized projects in the design and development of digital presentations in technical agriculture for use in teaching and program public relations. Total credit limited to 3 units. 1 laboratory.

**AGED 482. Teaching Resources and Curriculum Design. 1 unit.**

Prerequisite: Senior standing.

Traditional academic and student-centered approaches to gaining resources and curriculum design. Methods of using, and the development of the knowledge and skills related to planning, implementation and assessing the high school agriculture curriculum. Organization and management and their relationship to education effectiveness and productivity. 1 lecture.

**AGED 500. Individual Study in Agricultural Education. 1-3 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced independent study planned and completed under the direction of a member of the Agricultural Education and Communication faculty. Total credit limited to 6 units.

**AGED 513. Field Experience - Vocational Agriculture. 1-3 units.**

Prerequisite: Prior approval and appointment.

Practice and techniques in management and supervision of vocational agriculture programs. Relationships among students, staff, community and school groups. Budgeting, staffing, records, reporting. Student activities and Future Farmers of America programs. Total credit limited to 6 units.

**AGED 520. Program Development in Agricultural Education. 3 units.**

Prerequisite: Senior standing.

Development of up-to-date approaches to a total integrated program based on occupational opportunities and community needs. Philosophy, organization and administration of agricultural education programs. Development in such areas as curriculum, supervised occupational experience, Future Farmers of America, and summer programs. 3 seminars.

**AGED 522. Instructional Programs in Agricultural Mechanics. 3 units.**

Prerequisite: Senior standing.

Organizing the vocational agriculture mechanics curriculum and determining course content. Student demonstrations and presentations; evaluation and analysis. 1 seminar, 2 laboratories.

**AGED 525. Organizing Instruction for Growing and Selling Horticulture Products. 3 units.**

Prerequisite: HCS 120 or EHS 230, and senior or graduate standing.

Skills and techniques of propagation and production of horticulture crops. Scheduling, growing media, construction and use of forcing structures, and plant identification. Marketing plans and promotions. Teaching methods, curriculum development, and identification of resources and materials for horticultural instruction. 3 lectures. Open to agricultural educators or credential students only.

**AGED 526. Curriculum Development in Horticulture Science. 3 units.**

Prerequisite: AGED 438 and senior standing. Recommended: EDUC 410, EDUC 412, EDUC 414, EDUC 416 and EDUC 418.

Development of curriculum that meets California high school ornamental horticulture instructional needs and provides foundation for student entry into the horticulture industry. Instructional methods for lecture and laboratory activities. Identification of teaching resources and instructional materials. 3 lectures.

**AGED 530. Developing FFA and Supervised Agricultural Experience Programs in Secondary Education. 3 units.**

Prerequisite: Senior or graduate standing.

Integrating FFA and supervised agricultural experience programs into the curriculum. Career development event implementation; record book usage; officer and committee training; recruitment; retention; retreat and leadership training. Current national and state initiatives and experiential learning opportunities in the workplace and entrepreneurial settings. Not open to students with credit in AGED 330. 3 lectures.

**AGED 536. College Teaching in Agriculture. 3 units.**

Prerequisite: Graduate standing.

Selection and use of various teaching strategies, methods/approaches, and techniques when planning, delivering, and evaluating instruction. For graduate students interested in pursuing a faculty position in agriculture at post-secondary institutions. 3 seminars.

**AGED 537. Enhancing Instruction in Agricultural Biology. 3 units.**

Prerequisite: AGED 438 or consent of instructor, enrollment in agriculture teaching credential program or MS degree in Agricultural Education, or current agriculture teacher; undergraduate biology course (BIO 111 or equivalent).

Teaching methods of important biological concepts using agriculture as the context. Assisting agriculture teachers in identifying proper pedagogical strategies to integrate activities and laboratories into existing agriculture biology courses, including leadership development opportunities and activities. Emphasis on appropriate teaching methods and techniques, curriculum integration and application, and classroom resources. 3 seminars.

**AGED 538. Laboratory Integration in Agricultural Education. 3 units.**

Prerequisite: BIO 112 or BIO 115 or BIO 161; AGED 438; and either enrollment in MS degree in Agricultural Education or currently teaching agriscience.

Teaching important science concepts using agriculture as the context. Assisting current agriculture teachers in identifying proper pedagogical strategies to integrate agriscience activities and laboratories into existing high school agriculture courses. Emphasis on appropriate teaching methods and techniques, curriculum integration and application, and classroom resources. 3 seminars.

**AGED 539. Graduate Internship in Agricultural Education. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of agricultural production or related business in the field of Agricultural Education. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**AGED 570. Selected Topics in Agricultural Education. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**AGED 571. Selected Advanced Laboratory in Agricultural Education. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**AGED 580. Special Problems in Agricultural Education. 1-3 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Individual study of modern issues and problems conducted through research, planning and development. Field problems and in-service study in agricultural industry encouraged. Final written report required. Total credit limited to 9 units with not more than 3 units in any one quarter.

**AGED 581. Grad Seminar in Agricultural Education. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Group study of selected developments, trends and issues in the field of Agricultural Education. 3 seminars.

## **Agriculture (AG)**

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## **Agriculture Courses**

**AG 200. Special Problems for Undergraduates. 1-2 units.**

CR/NC

Prerequisite: Consent of rodeo coach/instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit can only be used to satisfy free electives. Credit/No Credit grading only.

**AG 243. Theory and Practice of Rodeo. 2 units.**

CR/NC

Prerequisite: Consent of rodeo coach/instructor.

Beginning through advanced skills in the event areas of college rodeo. Areas include saddle bronc, bareback, and bull riding; calf, team, and breakaway roping; steer wrestling, goat tying, and barrel racing. Minimum of 10 hours of laboratory per week. Total credit limited to 8 units. Credit/No Credit grading. Enrollment limited to those qualified to compete in intercollegiate rodeo.

**AG 315. Organic Agriculture. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Origins, application, regulation and technology of organic agriculture. Theoretical and practical issues surrounding organic agriculture from a cross-disciplinary perspective. Topics include the history of the organic movement; current regulation and certification; and field management practices and technologies. Features industry guest lecturers. 3 lectures, 1 activity. Fulfills GE Area F.

**AG 330. Cal Poly Land: Nature, Technology, and Society. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Scientific investigation of the natural features of the Cal Poly landscape and their transformations by land management technology. Analysis of the environmental, economic, social, and political effects of agriculture, resource extraction, and construction technology on that landscape. Emphasis on the educational, land-use, and long term planning issues of technology presented by this case study. 4 lectures. Crosslisted as AG/HUM/UNIV 330. Fulfills GE Area F.

**AG 339. Internship in Agriculture. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Credit/No Credit grading.

**AG 350. The Global Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary investigation of how human activities impact the Earth's environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/ historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 4 lectures. Crosslisted as AG/EDES/ENGR/ HUM/SCM/UNIV 350. Fulfills GE Area F.

**AG 360. Holistic Management. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Application of holistic management, a goal-oriented, value-driven framework for making decisions that are ecologically, economically, and socially sound. Impact of technology and other tools on ecosystem processes. Holistic approach to management, especially of land-based resources, aimed toward greater biodiversity and sustainability. Not open to students with credit in AG 450. 3 lectures, 1 laboratory. Fulfills GE Area F.

**AG 400. Special Problems for Advanced Undergraduates. 1-2 units.**

CR/NC

Prerequisite: Consent of rodeo coach/instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit/No Credit grading only.

**AG 439. Internship in Integrated Ranch Operations. 6-12 units.**

CR/NC

Prerequisite: Senior or graduate standing and consent of instructor; for students working and living at Swanton Pacific Ranch.

Work experience in all activities/projects associated with the production of crops, livestock and timber at Swanton Pacific Ranch. Students will be responsible for all activities associated with ranch operation including supervising. Credit/No Credit grading only. Total credit limited to 18 units.

**AG 450. Applied Holistic Management. 4 units.**

Prerequisite: One GE Area B2 course and junior standing.

Application of holistic management, a goal-oriented, value-driven framework for making decisions that are ecologically, economically, and socially sound. Impact of technology and other tools on ecosystem processes. Holistic approach to management, especially of land-based resources, aimed toward greater biodiversity and sustainability. Not open to students with credit in AG 360. 3 lectures, 1 laboratory.

**AG 452. Issues Affecting California Agriculture. 4 units.**

Prerequisite: Junior standing.

Interactive seminars with speakers from government and industry covering policy and regulations affecting California agriculture. Students develop an understanding of agricultural policy and work in teams to develop a public presentation and position paper on a significant issue. Field trip to Sacramento required. 4 seminars.

**AG 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 12 units. Credit/No Credit grading only.

**AG 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 24 units. Credit/No Credit grading only.

**AG 500. Individual Study. 1-6 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced independent study planned and completed under the direction of a member of the college faculty. Total credit limited to 6 units.

**AG 539. Graduate Internship in Agriculture. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of agricultural production or related businesses in the field. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**AG 581. Graduate Seminar. 1 unit.**

CR/NC

Prerequisite: Graduate standing or consent of instructor.

Advanced topics in agriculture and natural resources. Group study of current research and industry trends. Invited speakers covering a variety of topics. Total credit limited to 3 units. 1 hour seminar.

**AG 585. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only.

**AG 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only.

**AG 598. Reading and Conference. 1-12 units.**

CR/NC

Prerequisite: Graduate standing and instructor consent.

Systematic development of an agricultural thesis research project including literature searches, reports and experimental design. Repeatable for up to 12 units. Credit/No Credit grading only.

**AG 599. Thesis. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Animal Science (ASCI)

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### Animal Science Courses

**ASCI 101. Introduction to the Animal Sciences. 2 units.**

CR/NC

Economic, environmental and societal impact of the livestock, poultry and horse industries. Basic terminology, anatomy, and physical requirements of animals. Career and academic planning. Co-curricular, extra-curricular, and post-graduate opportunities. Required of all first-time students in the Animal Science Department. Credit/No Credit grading only. 2 lectures.

**ASCI 112. Principles of Animal Science. 4 units.**

GE Area B2

Economic and environmental roles of animal production and companionship to society. Introductory nutrition, genetics, reproduction, behavior, growth and development, animal products, biosecurity, and food processing and safety of animals. 4 lectures. Fulfills GE B2 except for ASCI majors.

**ASCI 200. Special Problems. 1-4 units.**

CR/NC

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 3 units per quarter. Credit/No Credit grading only.

**ASCI 203. Animal Parasitology. 3 units.**

Prerequisite: BIO 111 or BIO 161.

Identification, life cycles, prevention and control of the common external and internal parasites causing economic loss in livestock. 3 lectures.

**ASCI 211. Meat Science. 4 units.**

Muscle food processing methods and operations. Conversion of muscle to meat. Meat inspection, grading, composition, curing, preservation, food safety and related topics. Carcass beef, pork, and lamb processed into consumer ready products. 3 lectures, 1 laboratory.

**ASCI 212. Livestock Show Management. 3 units.**

Application of the management and operations of Cal Poly's Western Bonanza Livestock Show. Principles and procedures in planning, organizing, financing, promoting and managing a major livestock show and the fair industry. Total credit limited to 6 units. Not open to students with credit for ASCI 412 or ASCI 413. 1 lecture, 2 activities.

**ASCI 214. Equine Management. 2 units.**

Prerequisite: Consent of instructor.

Application of safety, risk reduction, horsemanship skills. Develop a working equine/human relationship. Selection and application of nutrition, equipment, preventive health and farrier program, and equitation skills. 2 laboratories.

**ASCI 216. Meat Grading and Evaluation. 2 units.**

Prerequisite: ASCI 211.

Factors related to carcass quality and yield. USDA meat grading principles and practices. Judging of carcass and wholesale cuts. Field trip to meat packing plants required. 1 lecture, 1 laboratory.

**ASCI 220. Introductory Animal Nutrition and Feeding. 4 units.**

Prerequisite: ASCI 112.

Nutrient digestion and absorption; basic functions of major nutrient classes; NRC feed classification and feedstuff characteristics; Van Soest system of fiber analysis and practical applications; feed processing: effects on feeds and nutrient availability; nutrient requirements of animals; diet formulation techniques. 3 lectures, 1 laboratory.

**ASCI 221. Introduction to Beef Production. 4 units.**

Prerequisite: ASCI 112.

Survey of industry characteristics, breeds, market classes, production systems, and current issues facing the beef industry. 3 lectures, 1 laboratory.

**ASCI 222. Systems of Swine Production. 4 units.**

Prerequisite: ASCI 112.

Structure of the pork industry in the U.S.; production standards and new technologies; breed systems. Market classification, product quality and quality assurance. Swine behavior and husbandry systems; biosecurity, health and feeding systems and management. 3 lectures, 1 laboratory.

**ASCI 223. Systems of Sheep Management. 4 units.**

Prerequisite: ASCI 112.

Sheep industry overview, populations, trends, cultural implications, breed identification, nutritional, reproductive, health, and marketing management of sheep. 3 lectures, 1 laboratory.

**ASCI 224. Equine Science. 4 units.**

Prerequisite: ASCI 112.

History, status of the horse industry, breeds. Application of management skills, safety, conformation evaluation, hoof and leg conformation and care. Understanding equine behavior. Insurance and tax ramifications. Pedigree analysis. Alternate therapies. 3 lectures, 1 laboratory.

**ASCI 225. Introduction to Poultry Management. 4 units.**

Introduction to modern techniques in poultry production, processing, marketing and price discovery. Consumption trends, breeds and consumer grades. Laboratory application of management skills, health care, keeping of production and accounting records and processing techniques. 3 lectures, 1 laboratory.

**ASCI 226. Livestock Evaluation. 3 units.**

Utilization of objective and subjective estimation measures in establishing economic worth of domestic animals of the three meat animal species and horses. 1 lecture, 2 laboratories.



**ASCI 227. Companion Animal Science. 4 units.**

Prerequisite: ASCI 112.

Companion animal anatomy and physiology, reproduction, nutrition, behavior, management, common parasites, and infectious diseases. Scientific method in studying the human-animal bond. Application of biological concepts to problems related to companion animals. Trends in pet industry including animal welfare issues. 3 lectures, 1 laboratory.

**ASCI 228. Equine Evaluation. 2 units.**

Appraisal of equine breeds at halter and in performance classes. Evaluate horse classes, decide their order of placement, and then orally justify these decisions to a judge. The relationship of equine anatomy and physiology on competitive performance. 2 laboratories.

**ASCI 229. Anatomy and Physiology of Farm Animals. 4 units.**

Prerequisite: BIO 111 or BIO 161.

Comprehensive overview of the principal systems of farm animals using an integrative, systemic approach to learning the homeostasis of mammalian organisms so the information can be applied to their daily care and management. 3 lectures, 1 laboratory.

**ASCI 232. General Animal Science Laboratory. 1 unit.**

Basic handling skills of livestock; introductory selection of livestock; basic feedstuff identification and processing; and health care practices. 1 laboratory.

**ASCI 260. Preparation of Livestock for Shows and Sales. 3 units.**

Techniques, equipment and knowledge necessary in order to properly condition, groom, and present beef cattle or horses for evaluation and merchandising. 3 activities.

**ASCI 265. Equine Behavior and Training. 3 units.**

Training of weanling and yearling horses at halter. Selection of proper attire for the handler and equipment for the horse. Application of safe, behavioral training techniques enabling the horse to accept handling, farrier and health care. 3 activities.

**ASCI 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ASCI 290. Animal Production and Management Enterprise. 1-5 units.**

CR/NC

Prerequisite: Consent of instructor.

Beginning field experience in animal production systems. May include health, nutrition, reproduction, management, processing, budgeting, and/or marketing exercises. Total major credit for ASCI 290 limited to 6 units. Total credit for ASCI 290 limited to 10 units. Credit/No Credit grading only. 1-5 lectures.

**ASCI 304. Animal Genomics. 3 units.**

Prerequisite: BIO 302 or BIO 303 or BIO 351.

Application of genetic principles for domestic animal improvement. Improving animal performance and health through use of genetic markers and diagnostics, gene mapping, and related current technologies. 3 lectures.

**ASCI 305. Game Bird Propagation and Management. 3 units.**

Prerequisite: ASCI 225.

Habitat needs, management and propagation of North American game bird species in the wild and in captivity. Reproduction, nutrition and maintenance of flock health as practiced by commercial game bird operations. 3 lectures.

**ASCI 310. Technical Veterinary Skills. 4 units.**

Prerequisite: ASCI 229.

Restraint and handling of animals, physical examination, necropsy procedure, basic wound management, applied pharmacology. Reproduction and herd health programs. 3 lectures, 1 laboratory.

**ASCI 311. Advanced Beef Cattle System Management. 4 units.**

Prerequisite: ASCI 221 or consent of instructor.

Management principles for the sustainability of commercial beef cattle operations. Systems approach for goal setting, financial analysis, range management, breeding systems, nutrition, health programs, marketing, and production practices to enhance profitability of commercial cow-calf operations. 3 lectures, 1 laboratory.

**ASCI 312. Production Medicine. 3 units.**

Prerequisite: ASCI 221 or ASCI 223; ASCI 225 or ASCI 222; ASCI 224 or ASCI 227; and ASCI 229.

Basic disease concepts. Fundamentals of immunology and therapeutics. Disease prevention principles, infectious and non-infectious. Pre-harvest food safety and milk and meat quality assurance. Herd health management programs for production efficiency and product quality. 3 lectures.

**ASCI 315. Equine Biomechanics. 4 units.**

Prerequisite: ASCI 224.

Anatomy and physiology of the equine hoof and limb. An understanding of the art and science of the farrier's work. Evaluation of proper hoof care, trimming, and shoeing. Foot and leg conformation as it relates to sound locomotion. 3 lectures, 1 activity.

**ASCI 320. Physiological Chemistry of Animals. 4 units.**

Prerequisite: CHEM 312 or CHEM 316, ASCI 229.

Interactions between the biological and chemical reactions in livestock. Physiology explained at the organ, tissue and cellular level as it relates to the whole animal system. 4 lectures.

**ASCI 321. Zoonoses and Veterinary Public Health Concerns. 4 units.**

Prerequisite: BIO 111 or BIO 161.

Public health concerns including: animal and bird diseases which may be transmitted to people; pre-harvest food safety and handling concerns; and environmental public health hazards. 3 lectures, 1 activity.

**ASCI 324. Advanced Equine Evaluation. 2 units.**

Prerequisite: ASCI 228 or consent of instructor.

Appraising the relative merit of individual horses in halter and performance through the application, development and refinement of deductive and inductive logical processes. Oral and written expression of the selection rationale. 2 laboratories.

**ASCI 325. Egg Production, Processing and Distribution. 4 units.**

Prerequisite: ASCI 225.

Management of replacement pullets and laying hens including flock scheduling, vaccination and handling procedures, nutrition management, costs of operation and production projections. Quality determination, processing, sales and distribution of shell eggs and egg products. 3 lectures, 1 laboratory.

**ASCI 326. Advanced Livestock Evaluation. 2 units.**

Prerequisite: ASCI 226.

Application of deductive and inductive logical processes in appraising the relative merit of individual animals within a group sample. Oral expression of the selection rationale. 2 laboratories.

**ASCI 329. Principles of Range Management. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Characteristics, history and multiple uses of rangeland. Principles of range plant physiology and ecology in relation to range condition, trend, utilization and improvement practices. Principles of proper grazing practices and nutrition of livestock. 3 lectures, 1 laboratory.

**ASCI 330. Poultry Meat Production and Processing. 4 units.**

Prerequisite: ASCI 225.

Modern production techniques for the poultry meat industry. Management of hatcheries, broiler and/or turkey meat production, processing and further processing. 3 lectures, 1 laboratory.

**ASCI 333. Equine Reproduction. 5 units.**

Prerequisite: ASCI 224.

Management of the breeding farm, breeding problems, diseases, study of estrus cycles, servicing the mare, handling stallions. Breeding systems, teasing, embryo transfer, ultrasound pregnancy diagnosis, new developments in breeding technology. 4 lectures, 1 laboratory.

**ASCI 339. Internship in Animal Science. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected Animal Science students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Major credit limited to 6 units. Total credit limited to 12 units. Credit/No Credit grading only.

**ASCI 342. Poultry Business Management. 4 units.**

Prerequisite: ASCI 225 or consent of instructor.

Organization and management of vertically integrated poultry operations. Personnel management, cash flow analysis, cash vs. accrual accounting, structuring of financial statements, projecting product outputs and cash flow needs, employee benefit programs and insurance needs for poultry companies. 4 lectures.

**ASCI 344. Equine and Human Communication. 3 units.**

Prerequisites: ASCI 214, or consent of instructor.

Behavior of the horse and its relationship with people. Learning, motivation, social behavior and communication with techniques to improve the safety and understanding between people and horses. 3 activities.

**ASCI 345. Equine Behavior Modification. 5 units.**

Prerequisite: ASCI 344 and consent of instructor.

Advanced principles of equine behavior modification for training young horses under saddle. Identifying differences in individual horse's attitudes, techniques to teach horses to respond to different stimuli, management of young equine athlete. 5 activities.

**ASCI 346. Equine Nutrition. 4 units.**

Prerequisite: ASCI 224 and ASCI 220.

Equine digestion, diet development considerations and evaluations, nutritional management, and the relationship of respective topics to recommended feeding practices, research data, and nutritional portfolios. Information is based on recent advances in horse nutrition and the National Research Council's Nutrient Requirements for Horses. 3 lectures, 1 laboratory.

**ASCI 347. Equine Exercise Physiology. 3 units.**

Prerequisite: ASCI 224.

Applied physiology of the exercising horse. Examine different physiological systems: muscular, cardiovascular, respiratory, and nutritional. Gait analysis, lameness, and treatment. The athletic horse: sports medicine, conditioning, drugs, and necropsy evaluation. A distance learning course. 3 lectures.

**ASCI 350. Applied Nonruminant Nutrition. 4 units.**

Prerequisite: ASCI 220.

Comparison of nonruminant and ruminant digestive systems, nutrient requirements, risk management for ingredients, formulation and nutritional management. Influence of growth and production curves, consumption patterns, and feeding management in commercial poultry and swine industries. Feed manufacturing and governmental regulations. 3 lectures, 1 laboratory.

**ASCI 351. Reproductive Physiology. 4 units.**

Prerequisite: ASCI 229.

Reproductive anatomy of male and female farm animals. General endocrinology and systemic physiology. Endocrine system effects on the various aspects of reproduction, such as: gametogenesis, estrus, gestation, parturition, mothering and seasonality. Introduction to reproductive biotechnology and embryo manipulation. 3 lectures, 1 laboratory.

**ASCI 355. Ruminant Nutrition. 4 units.**

Prerequisite: ASCI 220; ASCI 320 or CHEM 313 or CHEM 371.

Digestive physiology and nutrition of ruminants. Anatomy and physiology of the digestive tract. Rumen microbial fermentation. Nitrogen utilization and metabolism. Energy partitioning. Net energy system. Range livestock and feedlot nutrition. Supplementation. Common metabolic and nutritional dysfunctions. Diet formulation. 3 lectures, 1 laboratory.

**ASCI 363. Undergraduate Seminar. 2 units.**

Prerequisite: Junior standing.

Major developments in the chosen field of the student. Discussion of new developments, policies, practices, and procedures. Each individual is responsible for the development and presentation of a topic in the chosen field, resume, and cover letter. 2 seminars.

**ASCI 366. Veterinary Pharmacology. 4 units.**

Prerequisite: CHEM 111 or CHEM 127, and ASCI 229.

Investigation of pharmacological principles applied to animal systems. Overview of drugs acting on the nervous, endocrine, circulatory, urinary systems, and reproductive systems, specialty areas of pharmacology, and pharmacogenomics of livestock and companion animals. 3 lectures, 1 activity.

**ASCI 370. Rangeland Improvements. 3 units.**

Prerequisite: ASCI 329.

Review of practices used for improving the productivity or ecological functions of rangeland landscapes managed for grazing livestock, wildlife, or for ecological and/or aesthetic values. 3 lectures.

**ASCI 384. Processed Meat Products. 4 units.**

Prerequisite: ASCI 211 and junior standing.

Physical, chemical and functional characteristics of meat food raw materials. Science and technology of value-added processing including curing, sausage manufacture, low moisture products, and restructuring. Quality assurance and related current industry topics. 3 lectures, 1 laboratory.

**ASCI 400. Special Problems for Advanced Undergraduates. 1-4 units.**

CR/NC

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 4 units per quarter. Credit/No Credit grading only.

**ASCI 403. Applied Biotechnology in Animal Science. 5 units.**

Prerequisite: BIO 161, BIO 162, upper division genetics course (BIO 302 or BIO 303 or BIO 351 or ASCI 304) or consent of instructor.

Coverage of current resources, techniques and methodologies used in animal research and biotechnology as well as experimental design, model assessment, and data interpretation with application to an experimental setting in the laboratory. 3 lectures, 2 laboratories.

**ASCI 405. Domestic Livestock Endocrinology. 4 units.**

Prerequisite: ASCI 229.

Endocrine system and its role in the homeostasis of the animal. Use of hormones in increasing productivity of domestic animals. Endocrinology of reproduction, growth, metabolism and immunology. Discussions of cost-benefit relationships in the use of hormones. 4 lectures.

**ASCI 406. Applied Animal Embryology and Assisted Reproduction. 5 units.**

Prerequisite: ASCI 229 and ASCI 351.

Comparative physiology and molecular understanding of oocyte development, fertilization, culturing, cryopreservation and micromanipulation of gametes and embryos. 3 lectures, 2 activities.

**ASCI 407. Assisted Reproduction Technologies of Gametes and Embryos Laboratory. 3 units.**

Prerequisite: ASCI 229; ASCI 351; and ASCI 406. Recommended: ASCI 320 or CHEM 371; CHEM 327.

Coverage of current resources, advanced techniques and methodologies of assisted reproduction of gametes and embryos involving in-vivo collection, in-vitro fertilization, cryopreservation and micromanipulation. Mouse, cattle and horse gametes used for learning the techniques involved in embryology and assisted reproduction 1 lecture, 2 laboratories.

**ASCI 410. Applied Animal Behavior Science. 4 units.**

Prerequisite: ASCI 320, or CHEM 313 or CHEM 371, and ASCI 221, or ASCI 222, or ASCI 223, or ASCI 224, or ASCI 225, or ASCI 227.

Principles of behavior applied to animals in managed environments. Observation and measurement of behavior, including sampling and recording methods. Learning, including training and operant conditioning. Discussion of issues related to behavioral welfare. Etiology and management of maladaptive behavior. 3 lectures, 1 laboratory.

**ASCI 412. Advanced Livestock Event Planning. 3 units.**

Prerequisite: ASCI 212, AGB 314 and consent of instructor.

Organization and planning for the Western Bonanza Junior Livestock Show. Establishment of committee assignments and show manager responsibilities. Corporate partnerships established and fund raising begun. Planning for activities and guest speakers and new student recruitment. Total credit limited to 6 units. 1 lecture, 2 activities.

**ASCI 413. Advanced Livestock Event Management. 1 unit.**

Prerequisite: ASCI 412 and consent of instructor.

Student management of the Western Bonanza Junior Livestock Show. Leadership skills, team building, media relations, use of computer applications, livestock and fair industry contacts and mentoring to new students. Application of knowledge learned in ASCI 412. Total credit limited to 2 units. 1 activity.

**ASCI 415. HACCP for Meat and Poultry Operations. 3 units.**

Prerequisite: ASCI 211 or consent of instructor.

Using Hazard Analysis and Critical Control Point (HACCP) principles to develop regulatory inspection plans for meat and poultry operations; development and use of prerequisite programs; microbiological and process overviews. 3 lectures.

**ASCI 420. Animal Metabolism and Nutrition. 3 units.**

Prerequisite: ASCI 220; ASCI 320 or CHEM 313 or CHEM 371.

Metabolism of proteins, carbohydrates, lipids, minerals, vitamins and water, and the relationship of nutrient utilization to animal production. 3 lectures.

**ASCI 425. Meat Industry Study Tour. 2 units.**

Prerequisite: ASCI 211 or consent of instructor.

Study tour of commercial meat businesses. Livestock harvest and carcass fabrication, further meat processing, retail and food service operations. Personnel, processing procedures, regulatory standards, industry specifications and current issues. Travel for 4 days. 2 activities.

**ASCI 430. Animal Feed Processing. 4 units.**

Prerequisite: ASCI 112 or consent of instructor.

Management of feed manufacturing for poultry/swine, dairy/beef, and companion animals. General operation of a processing facility including process flow, raw materials receiving, particle reduction, mixing, pelleting, packaging and delivery. State and federal regulations. 3 lectures, 1 laboratory.

**ASCI 438. Systemic Animal Physiology. 4 units.**

Prerequisite: ASCI 229; CHEM 313 or CHEM 371, or ASCI 320.

Homeostatic relationships of organ systems. Cardiovascular, respiratory, urogenital and neuro-endocrinological functions. 3 lectures, 1 laboratory.

**ASCI 440. Immunology and Diseases of Animals. 4 units.**

Prerequisite: ASCI 229. Recommended: ASCI 320, CHEM 371 or equivalent.

Introduction to immune system, including innate and acquired immunity of domesticated animals. Application of immunological analyses and examination of current disease issues in domesticated animals. 3 lectures, 1 laboratory.

**ASCI 450. Computer Applications in Animal Science: Spreadsheet Analysis. 4 units.**

Prerequisite: Junior standing.

Development of spreadsheets relating to livestock production. Integration of database and analytical techniques. Cost-benefit analyses of livestock production systems. 2 lectures, 2 activities.

**ASCI 455. Advanced Equine Reproductive Technologies. 4 units.**

Prerequisite: ASCI 333 and ASCI 351. Recommended: ASCI 405 and ASCI 406.

Assisted reproductive technologies in horses; use of gametes from normal and sub-fertile horses; manipulation of sub-fertile horses, donor and recipient mares; manipulation of endocrine system; embryo utilization; cryobiology of gametes and embryos; assessment of high-risk mare, fetus, and neonate. 3 lectures, 1 laboratory.

**ASCI 460. Rangeland Assessment and Planning. 4 units.**

Prerequisite: ASCI 329.

Examination of methods used for determining the healthy and function of rangeland ecosystems, and the application of planning processes used in the management of rangelands and associated ecosystems. Field trip required. 3 lectures, 1 laboratory.

**ASCI 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**ASCI 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**ASCI 476. Issues in Animal Agriculture. 3 units.**

Prerequisite: Upper division standing.

Exploration of social, political and environmental forces which will affect livestock production in the future. Roles played by advocacy groups and the media in influencing consumer demands and management practices. 3 seminars.

**ASCI 477. Senior Project - Research Experience in Animal Science. 3 units.**

Prerequisite: Senior standing, ASCI 363 and consent of instructor.

Recommended: one course in statistics.

Independent research experience in a specific area of animal science conducted under faculty supervision. Satisfies senior project requirement. Minimum 90 hours required.

**ASCI 478. Senior Project - Advanced Internship Experience in Animal Science. 3 units.**

Prerequisite: ASCI 363 and senior standing.

Independent internship experience conducted under faculty supervision focusing on a discipline area of animal science. Completion of a project as a component of the internship. Satisfies senior project requirement. Minimum 90 hours required.

**ASCI 479. Senior Project - Current Topics in Animal Science. 3 units.**

Prerequisite: Senior standing and ASCI 363 or consent of instructor.

Critical evaluation and formal presentation of current issues facing animal agriculture. Evaluation of current topics, analysis of supporting evidence and logic, and synthesis and formal presentation of the resulting perspectives on different approaches to current challenges. 3 lectures.

**ASCI 480. Advanced Integration of Livestock and Meat Production. 4 units.**

Prerequisite: ASCI 211 and ASCI 221; or equivalent course.

Integration of domestic livestock systems and meat production. Advanced concepts in science and technology of animal management, growth enhancement, harvest and processing related to product safety and quality. 3 lectures, 1 laboratory.

**ASCI 490. Advanced Animal Production and Management Enterprise. 1-5 units.**

CR/NC

Prerequisite: Consent of instructor.

Advanced field experience in animal production systems. May include health, nutrition, reproduction, management, processing, budgeting, and/or marketing exercises as well as management decision-making opportunities. Total major credit for ASCI 490 limited to 6 units. Total credit for ASCI 490 limited to 10 units. Credit/No Credit grading only. 1-5 lectures.

**ASCI 500. Individual Study in Animal Science. 1-6 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced independent study planned and completed under the direction of a member of the Animal Science faculty. Total credit limited to 6 units.

**ASCI 503. Advanced Molecular Techniques in Animal Science. 4 units.**

Prerequisite: ASCI 403 or equivalent course.

Advanced molecular laboratory techniques in animal science. Topics include analyses of cellular and metabolic regulation, gene expression, gene activation and regulation, gene construct design, transgenesis, knockout animal models. 2 lectures, 2 laboratories.

**ASCI 520. Comparative Animal Nutrition. 4 units.**

Prerequisite: ASCI 320, or CHEM 313 or CHEM 371, and one of the following: ASCI 346, or ASCI 350, or ASCI 355, or DSCI 301, or consent of instructor.

Advanced problem-based presentation of animal nutrition case studies. Emphasis on nutrients, clinical nutrition disorders and species not commonly considered in production animal nutrition. Analytical and problem-solving skills will be utilized to develop solutions to complex animal nutrition management issues. 3 lectures, 1 activity.

**ASCI 530. Advanced Molecular Nutrition. 3 units.**

Prerequisite: ASCI 320 or ASCI 420 or CHEM 372 or graduate standing and consent of instructor.

In-depth analysis of molecular signaling mechanisms and events related to nutrient metabolism using examples from the current literature in animal science and nutrition. 3 lectures.

**ASCI 540. Advanced Immunology and Diseases of Animals. 4 units.**

Prerequisite: ASCI 229; ASCI 320 or CHEM 371 or equivalent; STAT 218 or equivalent; or consent of instructor. Corequisite: ASCI 541.

In-depth analysis of the immune system, including molecular basis for immunity of domesticated animals. Application of immunological assays, and application of scientific method to examine immunity and disease in domesticated animals. Not open to students with credit in ASCI 440. 3 lectures, 1 laboratory.

**ASCI 541. Advanced Animal Immunology Laboratory. 1 unit.**

Corequisite: ASCI 540.

Laboratory complement to ASCI 540. Independent research projects, including hypothesis development, experimental design, data collection and analyses, and written and oral presentations. 1 laboratory.

**ASCI 555. Advanced Equine Reproductive Technologies. 4 units.**

Prerequisite: Graduate standing.

Assisted reproductive technologies in horses; use of gametes from normal and sub-fertile horses; manipulation of sub-fertile horses, donor and recipient mares; manipulation of endocrine system; embryo utilization; cryobiology of gametes and embryos; assessment of high-risk mare, fetus, and neonate. 3 lectures, 1 laboratory.

**ASCI 570. Selected Topics in Animal Science. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**ASCI 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**ASCI 581. Graduate Seminar in Animal Science. 1-4 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Current findings and research problems in the field and their application to the industry. Credit/No Credit grading only. Total credit limited to 12 units. 1-4 seminars.

**ASCI 593. Stem Cell Research Internship. 5 units.**

Prerequisite: Graduate standing in the Specialization in Stem Cell Research for the MS in Biological Sciences or for the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture, and BMED 510, BMED 545, BMED 515, and BIO 534.

Supervised graduate research in stem cell science and engineering. Provides students with an off-campus industrial or university research internship. Total credit limited to 10 units. Crosslisted as ASCI/BIO/BMED 593.

**ASCI 594. Applications in Stem Cell Research. 2 units.**

Prerequisite: ASCI/BIO/BMED 593.

Transfer of skills and knowledge gained through ASCI/BIO/BMED 593, in an applied setting at Cal Poly. Demonstration of technical, problem solving, and presentation skills, and familiarity with current research. Part of the culminating experience for the Specialization in Stem Cell Research for the MS in Biological Sciences or for the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture. 1 seminar and supervised work. Crosslisted as ASCI/BIO/BMED 594.

## Anthropology (ANT)

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### Anthropology Courses

**ANT 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**ANT 201. Cultural Anthropology. 4 units.**

GE Area D3

Contemporary human cultures throughout the world. General patterns sought within the diversity of individual cultures. Includes such topics as: family organization; gender roles; adaptation to the environment; systems of economic exchange; political organization and leadership; religious beliefs and values; ethnicity and cultural pluralism; impact of Western culture on the developing world. 4 lectures. Fulfills GE D3.

**ANT 202. World Prehistory. 4 units.**

GE Area D3

Development of the diverse human cultures of both the Old and New Worlds from the emergence of the first human ancestors (hominins) to the dawn of history; biological evolution, global cultural development, and adaptation before the advent of writing. 4 lectures. Fulfills GE D3.



**ANT 250. Biological Anthropology. 4 units.**

GE Area B2

Biological aspects of human unity and diversity. Primate and human evolution, including anatomical, physiological and behavioral adaptations. Origin and diversity of modern races. 4 lectures. Fulfills GE B2.

**ANT 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ANT 309. Elements of Archaeology. 4 units.**

Prerequisite: ANT 202 or consent of instructor.

Archaeological method and theory covering the history and development of archaeological thought, approaches to data recovery, dating and analysis of artifacts and ecofacts, the construction of models of prehistoric human behavior through application of archaeological and anthropological theories. 4 lectures.

**ANT 310. Archeological Field Methods. 4 units.**

Prerequisite: ANT 202 or ANT 309, or consent of instructor.

Hands-on introduction to the methods and techniques of archaeology with an emphasis on excavation. Training in artifact and ecofact identification with a focus on lithic technology. Practical field experience with hand tools, and stratigraphic interpretation. Methodological approaches to both academic research questions and compliance with environmental planning mandates. 3 lectures, 1 laboratory.

**ANT 311. Archaeological Laboratory Methods. 4 units.**

Prerequisite: ANT 309 or ANT 310.

Hands-on introduction to the methods employed in post-field processing, classification, analysis, and preservation of archaeological materials. Compilation of quantitative and qualitative information in data base format to assist in the classification and interpretation of faunal remains and artifacts. 3 lectures, 1 laboratory.

**ANT 312. Introduction to Cultural Resources Management. 4 units.**

Prerequisite: ANT 201, ANT 202 or ANT 309, or consent of instructor.

Introduction to federal, state, and local legislation pertinent to the identification, evaluation, and treatment of cultural resources. A history of preservation legislation, culminating with detailed discussion of Section 106 of the National Historic Preservation Act and the California Environmental Quality Act. Practical experience in orienteering, map-reading, and simple cartography. 4 lectures.

**ANT 320. California's Native Past. 4 units.**

Prerequisite: ANT 202 or consent of instructor.

Overview of the paleoenvironment, prehistory, archaeology, and ethnography of Native California. The last 12,000 years of California's past from the arrival of the first human beings to the establishment of Spanish settlements in 1769, and the demise of native societies. 4 lectures.

**ANT 325. Pre-Columbian Mesoamerica. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, one course in D2 and one course in D3. Recommended: Junior standing.

Cultures of Mesoamerica (Mexico and Central America) from earliest times to the Spanish Conquest. Olmec, Teotihuacano, Zapotec, Maya and Aztec civilizations. Major topics include religion, politics, warfare, art, writing, calendrics, ecology and trade. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

**ANT 330. Indigenous South Americans. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two lower-division Area D courses. Recommended: Junior standing.

Indigenous peoples of South America from the past to the present. Cross-cultural study of small band societies, tribes and large civilization states located from the Amazon basin to the Altiplano. Comparison of current state of indigenous rights and place in modern society. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

**ANT 344. Sex, Death, and Human Nature. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A, D3, and B2. Recommended: Junior standing.

How Darwinian processes of differential reproduction and mortality influence human interests, passions and behaviors. Theories of inclusive fitness, parental investment and senescence. Sex differences, sexual attraction, life histories, violence and aggression, including rape, homicide and infanticide. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

**ANT 345. Human Behavioral Ecology. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Area A, one course in B2 and one lower-division Area D course.

Biological and cultural influences of natural and sexual selection on individual behavior. Ecological effects on human behavior to reproduce and acquire resources. Scientific method for understanding foraging behavior, group living, social skills, kinship, parenting, religion, and mating. Cross-cultural, cross-sex, and cross-species comparisons. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

**ANT 360. Human Cultural Adaptations. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, one course in D2 and one course in D3. Recommended: Junior standing.

Social and cultural evolution from Paleolithic times to the present. Interactions of demographic, economic and ecological factors are emphasized. Main topics include human nature/culture, sex and gender, cooperation and conflict, the 'agricultural revolution', state formation, social inequality and globalization. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

**ANT 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**ANT 401. Culture and Health. 4 units.**

Prerequisite: Junior standing; completion of ANT 201 and ANT 250; or graduate standing.

Global perspective on the relationship between culture and health. Ecological factors influencing health and illness. Origins of disease and impact of diseases on society. Diet and nutrition. Classifications of illness causation. Kinds of curers. Relationship of gender and reproduction to illness. Pharmacology. Mental illness. Global health problems. Alternative health care modalities. Health-care needs of U.S. ethnic groups. 4 lectures.

**ANT 402. Nutritional Anthropology. 4 units.**

Prerequisite: Junior standing; completion of GE Area A and ANT 201, or consent of instructor. Recommended: ANT 250.

Interrelationships of sociocultural and ecological factors and their influence on nutrition and human health in developing and developed country contexts. Topics include human adaptation, nutritional assessment, food production and allocation, the effect of development on diet and health. 4 lectures.

**ANT 415. Native American Cultures. 4 units.**

USCP

Prerequisite: One upper division ANT course or consent of instructor.

Survey of Native American cultures from earliest times to present, emphasizing regional diversity in traditional lifeways. Origins of New World peoples, domestication, war, social organization, trade and gender roles. 4 lectures. Fulfills USCP.

**ANT 425. Meaning, Gender, and Identity in Anthropological Theory. 4 units.**

Prerequisite: Completion of GE Area A, D3 and junior standing. Recommended: ANT 201.

Exploration of the intersection of anthropological theory with meaning, gender/sexuality, and identity formations within and between cultural contexts. Situate and analyze anthropological discourses regarding social meanings and cultural identities as defined by oppositions of us and other, male and female, normal and abnormal, natural and unnatural. Provide a potential source of comparative cultural reflection and critique. 4 lectures.

**ANT 455. Anthropology-Geography Research Design and Methods. 4 units.**

Prerequisite: Completion of one GE B2 and two upper division ANT or GEOG classes.

Development of knowledge and skills needed to conduct original scientific anthropology-geography research and prepares students for senior projects. Various empirical methodologies highlighted, with a focus on quantitative design and measurement of human culture, biology, behavior, environment and ecology. 3 lectures, 1 laboratory. Crosslisted as ANT/GEOG 455.

**ANT 461. Senior Project I. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**ANT 462. Senior Project II. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**ANT 464. Professional Preparation for Anthropologists/Geographers. 1 unit.**

CR/NC

Prerequisite: Junior standing, ANT 201, GEOG 150.

Preparation for professional advancement in the fields of anthropology and geography. Supervised career planning emphasizing resume development, selection of an internship or international experience, exploration of career options and graduate programs. Lectures from outside, practicing professionals. Credit/No Credit grading only. 1 seminar.

**ANT 465. Internship. 3-8 units.**

CR/NC

Prerequisite: ANT 464, senior standing and/or consent of instructor.

Supervised training, research, and work in public and private organizations. Credit/No Credit grading only. Total credit limited to 18 units.

**ANT 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

## Architectural Engineering (ARCE)

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### Architectural Engineering Courses

**ARCE 106. Introduction to Building Systems. 2 units.**

Introduction to building systems and materials. Use and application of structural, foundation, envelope, mechanical and electrical systems in the field of Architectural Engineering. 1 lecture, 1 activity.

**ARCE 211. Structures I. 3 units.**

Prerequisite: For ARCE majors: PHYS 141, MATH 142; for ARCH and CM majors: PHYS 121 or PHYS 141, MATH 142 or MATH 182.

Introduction to the role of structures in the making of buildings. Introduction to statics and creation of simple three-dimensional structures. Development of skills to analyze structures composed of axial force (truss) members. 2 lectures, 1 activity.

**ARCE 212. Structures II. 3 units.**

Prerequisite: ARCE 211 (C- or better required for ARCE Majors).

Introduction to the role of structures in the making of buildings. Introduction to shear and moment diagrams using the principles of statics and the application of the diagrams to simple three-dimensional structures. Development of skills, particularly free body diagrams, to analyze structures composed of bending (beams) members. 2 lectures, 1 activity.

**ARCE 221. Elementary Structures. 3 units.**

Prerequisite: PHYS 141, MATH 142.

Forces on building structures. Static equilibrium and stability of structural systems. Shear and bending moment diagrams. 3 lectures.

**ARCE 222. Introduction to Mechanics of Structural Members. 3 units.**

Prerequisite: ARCE 221 (C- or better required for ARCE Majors).

Stress-strain relationships. Stresses and deformations in structural members due to axial force, shear, torsion, and moment. 3 lectures.

**ARCE 223. Mechanics of Structural Members. 3 units.**

Prerequisite: ARCE 212 or ARCE 222 (C- or better required for ARCE Majors). Concurrent for ARCE majors: ARCE 224.

Advanced topics of stresses in beams. Plastic bending, unsymmetrical bending. Combined stresses. Stress transformation. Buckling. Deflection of beams. 3 lectures.

**ARCE 224. Mechanics of Structural Members Laboratory. 1 unit.**

Concurrent: ARCE 223.

Experimental investigations of material properties. Experimental studies of stresses and deflections in beams, including plastic bending, and unsymmetrical bending. Stress transformations via strain gages for combined loading cases. Culminating lab experience: A student run, self-designed experiment. 1 laboratory.

**ARCE 225. Dynamics. 3 units.**

Prerequisite: ARCE 211 or ARCE 221 (C- or better required for ARCE Majors) and MATH 241.

Dynamics of particles and rigid bodies. Introduction to vibrations of spring/mass/damper systems. 3 lectures.

**ARCE 226. Structural Systems. 3 units.**

Prerequisite: ARCE 212 or ARCE 222.

Description, behavior and comparison of structural building systems. Concepts of structural stability, load flow, framing schemes and building configuration related to vertical and lateral loads. For architecture and construction management students. 3 lectures.

**ARCE 227. Structures III. 2 units.**

Prerequisite: ARCE 212 or ARCE 222 (C- or better required for ARCE Majors).

Continuation of selected concepts covered in ARCE 211 and ARCE 212. Advanced topics in two-dimensional and three-dimensional equilibrium of structural building systems. 2 lectures.

**ARCE 240. Additional Engineering Laboratory. 1-2 units.**

Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 or 2 laboratories.

**ARCE 257. Structural CAD for Building Design. 2 units.**

Prerequisite: ARCH 133, CM 115.

Emphasis on the use of computer graphics software to represent a building's structural system and its individual elements. 1 lecture, 1 laboratory.

**ARCE 260. History of Structures. 4 units.**

GE Area C3

Social, symbolic, and technical importance of landmark structures. Analysis of breakthrough ideas that led to major advances in building design. Contextualization of these advances. Tools by which to assess and critique structural art as a separate and distinct art form. 4 lectures. Fulfills GE C3.

**ARCE 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ARCE 302. Structural Analysis. 4 units.**

Prerequisite: ARCE 223 and ARCE 227 (C- or better required for ARCE Majors). Concurrent for ARCE majors: ARCE 352.

Analysis of statically indeterminate structures using virtual work, slope deflection, the force method and moment distribution. Analysis of structural systems using approximate methods and influence lines. 4 lectures.

**ARCE 303. Steel Design I. 3 units.**

Prerequisite: ARCE 223 (C- or better required for ARCE Majors). Corequisite for ARCE majors: ARCE 371. Corequisite for ARCE minors: ARCE 226.

Analysis and design of steel structural members subjected to bending, shear and axial forces. 3 lectures.

**ARCE 304. Timber Design. 3 units.**

Prerequisite: ARCE 371 for ARCE majors (with C- or better); ARCE 223 and ARCE 226 for ARCE minors.

Analysis and design of timber structural members subjected to bending, shear, and axial forces. Wood diaphragms, shear walls and their connections. 3 lectures.

**ARCE 305. Masonry Design. 2 units.**

Prerequisite: ARCE 371 for ARCE majors (with C- or better); ARCE 223 and ARCE 226 for ARCE minors.

Design of load-bearing walls, shear walls, columns and beams in masonry. 2 lectures.

**ARCE 306. Matrix Analysis of Structures. 3 units.**

Prerequisite: ARCE 302 (C- or better required for ARCE Majors). Concurrent: ARCE 353.

Analysis of statically indeterminate structures by direct stiffness method including continuous beams, plane trusses, and frames. Introduction to finite-element methods. 3 lectures.

**ARCE 315. Small Scale Structures. 4 units.**

Prerequisite: ARCE 226.

Introduction to structures that use timber and steel as the primary construction material. Introduction to gravity load carrying systems and lateral load resisting systems using steel and timber elements. Development of skills to analyze structures using free body diagrams and the concept of load flow. 4 lectures.

**ARCE 316. Large Scale Structures. 4 units.**

Prerequisite: ARCE 315.

Introduction to structures that use steel and concrete as the primary construction material. Introduction to gravity load carrying systems and lateral load resisting systems using steel and concrete elements. Development of skills to analyze structures using free body diagrams and the concept of load flow. 4 lectures.

**ARCE 351. Structural Computing Analysis I. 1 unit.**

Prerequisite: ARCE 212 or ARCE 222 (C- or better required for ARCE Majors). Concurrent: ARCE 223.

Computer calculations, programming basics and technical reporting. Emphasis on use of spreadsheets as a tool to analyze structural elements. 1 laboratory.

**ARCE 352. Structural Computing Analysis II. 1 unit.**

Concurrent: ARCE 302.

Computer calculations, programming and technical reporting. Emphasis on use of two-dimensional structural analysis software to analyze a building's structural system and its individual elements. 1 laboratory.

**ARCE 353. Structural Computing Analysis III. 1 unit.**

Prerequisite: ARCE 352 (C- or better required for ARCE Majors). Concurrent: ARCE 306.

Emphasis on the use of nonplanar structural analysis software to analyze a building's structural system and its individual elements. 1 laboratory.

**ARCE 354. Numerical Analysis Laboratory. 1 unit.**

Prerequisite: MATH 244 and ARCE 353 (C- or better required for ARCE Majors). Concurrent: ARCE 412.

An intensive survey of numerical analysis techniques used for solving engineering problems. Topics include integration, ordinary differential equations, and the eigenproblem. 1 laboratory.

**ARCE 371. Structural Systems Laboratory. 3 units.**

Prerequisite: ARCE 223, ARCE 227 (C- or better required for ARCE Majors), and third year standing in Architectural Engineering. Corequisite: ARCE 302.

Studies in the relationship of structural framing to overall building geometry. Emphasis on the stability of structural configurations, calculation of building loads and development of a complete gravity and lateral load path. 3 laboratories.

**ARCE 372. Steel Structures Design Laboratory. 3 units.**

Prerequisite: ARCE 257, ARCE 302, ARCE 303, ARCE 352 and ARCE 371 (C- or better required for ARCE Majors).

Steel framed project incorporating structural system configuration and selection, structural analysis for gravity and lateral loads, and construction drawings and specifications. Integration of building services and architectural design, constructability issues, and relationships between construction methods and cost. 3 laboratories. Cannot be taken concurrently with ARCE 451 or ARCE 452.

**ARCE 400. Special Problems for Advanced Undergraduates. 1-3 units.**

Prerequisite: Consent of instructor and department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 3 units per quarter.

**ARCE 403. Advanced Steel Structures Laboratory. 3 units.**

Prerequisite: ARCE 372 (C- or better required for ARCE Majors).

Advanced topics in design and construction of steel structures, such as: plate girders, plastic design of beams and frames, and composite beam design, load and resistance factor design, and advanced topics related to moment frames and braced frames. 3 laboratories.

**ARCE 410. Integrated Building Envelopes. 4 units.**

Prerequisite: Fourth year standing or consent of instructor.

Recommended: Third year design and analysis courses; ARCE 302, ARCE 372.

Multidisciplinary exploration of the value and collaboration required of an integrated project team approach to the design and construction of sophisticated building envelopes. Team taught by instructors and practitioners from each of the following disciplines: architecture, architectural engineering and construction management. 4 lectures.

**ARCE 412. Dynamics of Framed Structures. 3 units.**

Prerequisite: ARCE 225 (C- or better required for ARCE Majors) or ME 212, MATH 244, and ARCE 306 (C- or better required for ARCE Majors). Concurrent: ARCE 354.

Analysis of structures subjected to dynamic loads with single- and multi-degrees of freedom. Development of techniques for analysis of structures in response to time varying loads. 3 lectures.

**ARCE 414. Precast Concrete. 3 units.**

Prerequisite: ARCE 444 (C- or better required for ARCE Majors).

Precast and prestressed concrete principles, materials and techniques of construction. Design of basic precast elements and connections and prestressed concrete fundamentals as applied to precast concrete. Design potentials, aesthetics, cost and construction time as related to buildings and other structures. 3 laboratories.

**ARCE 415. Interdisciplinary Capstone Project. 4 units.**

Prerequisite: ARCE 303, ARCE 304, ARCE 305, ARCE 444, ARCE 372 or ARCE 451 (C- or better required for ARCE Majors).

Team based interdisciplinary capstone / senior project course. Analysis and evaluation of interdisciplinary challenges associated with integrating the design and construction processes to deliver a project with respect to the design, budget, schedule, quality, and performance expectations of a client. 4 laboratories.

**ARCE 421. Soil Mechanics. 3 units.**

Prerequisite: ARCE 212 or ARCE 222 (C- or better required for ARCE Majors), GEOL 201.

Principles of soil mechanics, including rudiments of geology, soil classification, gravimetric and volumetric relations, compaction, methods and testing, shear strength of soil and strength theories. 2 lectures, 1 laboratory.

**ARCE 422. Foundation Design. 3 units.**

Prerequisite: ARCE 421 (C- or better required for ARCE Majors).

Soil-bearing capacity; sizing and design of spread footings. Design and analysis of earth-retaining structures. Analysis of the stability of slopes. 3 lectures.



**ARCE 423. Advanced Foundation Design. 3 units.**

Prerequisite: ARCE 422 and ARCE 444 (C- or better required for ARCE Majors).

Design, analysis, and construction issues related to shallow and deep foundation systems, mat foundations, retaining walls, and grade beams. Studies investigation the impact of sub-grade structural systems on building behavior and cost. 3 laboratories.

**ARCE 444. Reinforced Concrete Laboratory. 3 units.**

Prerequisite: ARCE 371 and ARCE 302 (C- or better required for ARCE Majors).

Theory and design of basic reinforced concrete elements: non-slender columns, beams, tee beams and one way slabs. 3 laboratories.

**ARCE 445. Prestressed Concrete Design Laboratory. 3 units.**

Prerequisite: ARCE 444 (C- or better required for ARCE Majors).

Design and analysis of prestressed concrete structures. 3 laboratories.

**ARCE 446. Advanced Structural Systems Laboratory. 3 units.**

Prerequisite: ARCE 226 or ARCE 371 (C- or better required for ARCE Majors).

Concepts and issues involved in the design of complex structures including tall buildings, shells, arches and tension structures. 3 laboratories.

**ARCE 447. Advanced Reinforced Concrete Laboratory. 3 units.**

Prerequisite: ARCE 444 (C- or better required for ARCE Majors).

Advanced topics in the design of reinforced concrete structures with emphasis on isolated and combined foundations, retaining walls, seismic-resistant ductile frames and yield line theory. 3 laboratories.

**ARCE 448. Seismic Rehabilitation Laboratory. 3 units.**

Prerequisite: ARCE 303, ARCE 304, ARCE 305, ARCE 412, ARCE 444 (C- or better required for ARCE Majors).

Overview of the general rehabilitation process and philosophy. Evaluation and analysis of existing structures to determine expected performance due to seismic loads. Development of basic rehabilitation strategies for buildings. 3 laboratories.

**ARCE 449. Cold Formed Steel Design Laboratory. 3 units.**

Prerequisite: ARCE 303 and ARCE 451 (C- or better required for ARCE Majors).

Analysis and design of cold formed steel structural members subjected to bending, shear, and axial forces. Project based design and constructability of cold formed structural systems including gravity framing, diaphragms, shear walls and their connections. 3 laboratories.

**ARCE 451. Timber and Masonry Structures Design and Constructability Laboratory. 3 units.**

Prerequisite: ARCE 257, ARCE 304, ARCE 305, and ARCE 371 (C- or better required for ARCE Majors).

Timber and masonry framed project incorporating structural system configuration and selection, structural analysis for gravity and lateral loads, and construction drawings and specifications. Integration of building services and architectural design, constructability issues, and relationships between construction methods and cost. 3 laboratories. Cannot be taken concurrently with ARCE 372 or ARCE 452.

**ARCE 452. Concrete Structures Design and Constructability Laboratory. 3 units.**

Prerequisite: ARCE 257, ARCE 444, and ARCE 372 or ARCE 451 (C- or better required for ARCE Majors).

Cast in place concrete framed project incorporating structural system configuration and selection, structural analysis for gravity and lateral loads, and construction drawings and specifications. Integration of building services and architectural design, constructability issues, and relationships between construction methods and cost. 3 laboratories. Cannot be taken concurrently with ARCE 372 or ARCE 451.

**ARCE 453. Interdisciplinary Senior Project. 3 units.**

Prerequisite: ARCE 372, ARCE 451, ARCE 452, ARCE 483 (C- or better required for ARCE Majors).

Interdisciplinary projects by interdisciplinary teams under faculty supervision that go beyond topics covered in the ARCE curriculum. Projects must include integration with other disciplines outside of structural or architectural engineering.

**ARCE 460. Collaborative Design Laboratory. 2 units.**

Prerequisite: ARCE 372 or ARCE 451 (C- or better required for ARCE Majors).

Investigation of the collaborative nature of the design process as it relates to the architectural engineer and related disciplines. Development of skills necessary to create a successful design team through the development of specific projects. Total credit limited to 4 units. 2 laboratories.

**ARCE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**ARCE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**ARCE 473. Advanced Timber and Masonry Structures Laboratory. 3 units.**

Prerequisite: ARCE 372, ARCE 422, ARCE 444 and ARCE 451 (C- or better required for ARCE Majors).

Emphasis on long span industrial/warehouse type buildings. Use of steel in timber/masonry construction and constructability. Holes in diaphragms, out-of-plane wall behavior and sub-diaphragms, perforated wood and masonry shear walls, pre-manufactured shear walls, masonry retaining walls, connections including post-installed anchors. 3 laboratories.

**ARCE 475. Civil Infrastructure and Building Systems. 4 units.**

Prerequisite: Senior standing in CE or ARCE.

Principles and practices for the sustainable design, fabrication, and installation of systems for the civil infrastructure and building; including structural, air/gas, water/wastewater, electrical, and control systems. Methods and materials used for fabrication and installation; including cost and schedule considerations. 4 lectures. Crosslisted as ARCE/CE 475.



**ARCE 480. Senior Seminar. 1 unit.**

Prerequisite: Senior standing.

Discussion of selected topics that are of current interest to the structural engineering profession. 1 seminar.

**ARCE 483. Seismic Analysis and Design. 4 units.**

Prerequisite: ARCE 372, ARCE 412 (C- or better required for ARCE Majors).

Introduction to dynamic response analysis of building structures with emphasis on earthquake ground motion. Earthquake resistant design of buildings in accordance with building codes. Application of computer programs and physical models for seismic design. Laboratory studies utilizing physical models for studying the behavior of building structures subjected to simulated ground motions. 3 lectures, 1 activity.

**ARCE 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of department head.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 12 units. Credit/No Credit grading only. Credits to not count toward graduation in the ARCE Degree Program.

**ARCE 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 24 units. Credit/No Credit grading only. Credits to not count toward graduation in the ARCE Degree Program.

**ARCE 501. Advanced Structural Mechanics. 3 units.**

Prerequisite: ARCE 306, ARCE 353.

Principles, concepts, and techniques of advanced structural mechanics. Studies of displacement, strain, stress, strain-displacement relation and constitutive models in three dimensions. Failure criteria. Introduction into energy principles and approximate solutions. 3 lectures.

**ARCE 502. Nonlinear Structural Behavior I. 3 units.**

Prerequisite: ARCE 306 and ARCE 353.

Principles, concepts, and behavior of structures loaded beyond their linear-elastic limit. Elastic-plastic behavior of truss, beam, and frame structures. Buckling and post-buckling behavior of columns. Behavior of beam-columns and the principle of superposition. Second-order elastic behavior of frames. 3 lectures.

**ARCE 503. Nonlinear Structural Behavior II. 3 units.**

Prerequisite: ARCE 502.

Principles, concepts, and techniques of nonlinear structural analysis currently used in practice. Classification of nonlinear problem types. Investigation of typical iterative solution strategies. Studies in material and geometric nonlinearities in spring, truss, and frame elements. Use of current nonlinear analysis software. 3 lectures.

**ARCE 504. Finite Element Method for Building Structures. 3 units.**

Prerequisite: MATH 244, ARCE 306, ARCE 501.

Basic concepts of equilibrium and compatibility. Stiffness and flexibility properties of various types of finite elements. Development and application of displacement and force methods. Elastic stability and dynamic response of buildings to earthquake, wind, and moving loads. Use of finite-element computer programs. 3 seminars.

**ARCE 511. Structural Systems Behavior. 3 units.**

Prerequisite: ARCE 371, ARCE 403, ARCE 452, ARCE 483.

Design, performance, and construction issues related to structural systems. Further development of design and analysis techniques necessary for performance based engineering of structural systems. Assessment of advantages and limitations of different structural forms and systems. 3 laboratories.

**ARCE 521. Architectural Structures. 3 units.**

Prerequisite: Graduate standing in Architecture.

Static and dynamic loads, structural equilibrium and stability, structural configurations and systems, response to dynamic loads, behavior of structures. 2 seminars, 1 activity.

**ARCE 522. Structural Systems. 3 units.**

Prerequisite: Graduate standing in Architecture.

Exploration of the relationship between structural systems and architectural form. Understanding of structural stability and structural order is developed through construction of a series of small scale models. Historical perspectives are presented along with the effects of available materials and technology on structural possibilities. 3 seminars.

**ARCE 523. Seismic Design for Architects. 3 units.**

Prerequisite: Graduate standing in Architecture.

Introduction to the earthquake resistant design of buildings. Observed behavior of buildings during earthquakes. Recent developments of seismic design procedures, provisions, and building codes. Influence of architectural form on seismic response. 3 lectures.

**ARCE 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**ARCE 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**ARCE 598. Structural Engineering Design Project. 3 units.**

Prerequisite: ARCE 371, ARCE 403, ARCE 452, ARCE 483.

Independent development, research, and conclusion of a graduate project by individuals or teams specializing in the area of architectural or structural engineering. Projects may include graduate students from other disciplines. Students shall enroll in 3 quarters. Total credit limited to 9 units. 3 laboratories.

## Architecture (ARCH)

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## Architecture Courses

### **ARCH 101. Survey of Architectural Education and Practice. 1 unit.** CR/NC

Exploration of the major paradigms which have guided the development of architectural education and the profession. Survey of the roles of the architects and an introduction to curricula and programs designed to prepare students for careers in architecture. Credit/No Credit grading only. 1 lecture. Total credit limited to 3 units.

### **ARCH 105. Architectural Practice I. 1 unit.**

Shop safety, machine and tool operation and small-scale design and construction. 1 laboratory.

### **ARCH 106. Materials of Construction. 2 units.**

Use and application of construction processes and materials. 2 lectures.

### **ARCH 131. Design and Visual Communication 1.1. 4 units.** Concurrent: EDES 101.

An introduction to the issues, concepts, processes and skills pertaining to two- and three-dimensional design and the freehand, constructed and digital representation and visual communication of ideas, objects and environments. Purchase of a laptop computer, software and peripherals is highly recommended to participate in this course. 4 laboratories.

### **ARCH 132. Design and Visual Communication 1.2. 4 units.** Prerequisite: ARCH 131.

Continuation of ARCH 131 plus the issues, concepts, processes and skills pertaining to color theory and the design and visual communication of architectural space. Purchase of a laptop computer, software and peripherals is highly recommended to participate in this course. 4 laboratories.

### **ARCH 133. Design and Visual Communication 1.3. 4 units.** Prerequisite: ARCH 132.

Continuation of ARCH 131 and ARCH 132 plus the issues, concepts, processes and skills pertaining to the analysis and design of architectural form, space and organizations. Purchase of a laptop computer, software and peripherals is highly recommended to participate in this course. 4 laboratories.

### **ARCH 160. Digital Tools for Architecture. 4 units.**

Substantive introduction to the use of digital tools in architectural design and visual communication in the areas of 3-D modeling, 2-D drawing, image editing and page layout. 4 seminars.

### **ARCH 202. Creative Problem Solving. 3 units.**

Techniques for stimulating creative behavior applied to general and environmental problems. Development of problem-solving and decision-making skills and knowledge. 3 lectures.

### **ARCH 204. Architectural Theory. 3 units.** Prerequisite: EDES 101.

Theories of architectural design. 3 lectures.

### **ARCH 207. Environmental Control Systems I. 4 units.** Prerequisite: ARCH 242. Concurrent: ARCH 253.

Theory and application of climate, energy use and comfort as determinants of architectural form in small-scale buildings. Emphasis on architectural methods of ventilating, cooling, heating, and lighting for envelope-load dominated buildings. 2 lectures, 2 activities.

### **ARCH 217. History of World Architecture: Prehistory - Middle Ages. 4 units.** GE Area C3

Architecture and urbanism in the ancient world, from prehistory to the Middle Ages. Social, cultural and physical conditions that influenced the built environment to the Mediterranean basis, plus Europe, Asia, Africa and Pre-Columbian America. 4 lectures. Fulfills GE C3.

### **ARCH 218. History of World Architecture: Middle Ages - 18th Century. 4 units.** GE Area C3

World architecture and urbanism from the Middle Ages until the end of the 18th century Baroque. Social, cultural and physical conditions which influenced the built environment of Europe, Asia, and the Pre-Columbian and Colonial Americas. 4 lectures. Fulfills GE C3.

### **ARCH 219. History of World Architecture: 18th Century - Present. 4 units.** GE Area C3

Architecture and urbanism of the modern world, from the 18th century to the present. Social, cultural and physical conditions influencing the built environment of Europe, Asia, Africa and the Americas. 4 lectures. Fulfills GE C3.

### **ARCH 221. Architectural Design Fundamentals 2.1. 3 units.** Prerequisite: ARCH 133.

Continuation of ARCH 133 in terms of materiality, structure and function and the theories, concepts, processes and skills pertaining to the design of architectural form, space and organizations. 3 laboratories.

### **ARCH 241. Architectural Practice 2.1. 4 units.** Prerequisite: ARCH 133. Corequisite: ARCH 251.

The language, principles and materials of construction with an emphasis on the origin, history, and application of traditional and emergent materials. 2 lectures, 2 activities.

### **ARCH 242. Architectural Practice 2.2. 4 units.** Prerequisite: ARCH 241. Corequisite: ARCH 252.

A continuation of ARCH 241 with an emphasis on the fundamental aspects of construction systems and the basics of construction documentation. 2 lectures, 2 activities.

### **ARCH 250. Computer Applications. 3 units.**

Introduction to the application of computers in architecture. History of computing and its use in architectural practice, hardware options, operating systems, electronic mail, databases, programming languages, graphics systems, survey and use of selected applications in architecture. 2 lectures, 1 laboratory.

**ARCH 251. Architectural Design 2.1. 5 units.**

Prerequisite: ARCH 133. Corequisite: ARCH 241.

Continuation of ARCH 133 in terms of materiality and the theories, concepts, processes and skills pertaining to the analysis and design of architectural form, space and organizations to communicate intended concepts and meanings. 5 laboratories.

**ARCH 252. Architectural Design 2.2. 5 units.**

Prerequisite: ARCH 251, ARCH 241. Corequisite: ARCH 242.

Continuation of ARCH 251 plus the theories, concepts, processes and skills pertaining to light, construction and function as determinants that shape the built environment and support the communication of intended concepts and meanings. 5 laboratories.

**ARCH 253. Architectural Design 2.3. 5 units.**

Prerequisite: ARCH 252 and ARCH 242. Corequisite: ARCH 207.

Continuation of ARCH 251 and ARCH 252 plus the theories, concepts, processes and skills pertaining to context, structure and climate as determinants that shape the built environment and support the communication of intended concepts and meanings. 5 laboratories.

**ARCH 270. Selected Topics. 1-4 units.**

Directed group study of selected topics. The Schedule of Classes will list title selected. Open to first-, second-, third-year students. Total credit limited to 8 units. 1 to 4 lectures.

**ARCH 302. Theories of Architectural Design. 3 units.**

Prerequisite: ARCH 253.

Theories of architecture and their application in architectural design. 3 lectures.

**ARCH 307. Environmental Control Systems 2. 4 units.**

Prerequisite: ARCH 207. Concurrent: ARCH 352.

Continuation of ARCH 207 plus theory and application of climate, energy use and comfort as determinants of architectural form in large-scale buildings. Emphasis on architectural and mechanical methods of ventilating, cooling, heating, lighting, acoustics, and water and waste systems for internal-load dominated buildings. 2 lectures, 2 discussions.

**ARCH 310. Architectural Design Methods and Theories. 4 units.**

Prerequisite: ARCH 253.

Analysis of design process, methods of analysis, synthesis, and evaluation in design. Relation between methods used and theories of design. 4 lectures.

**ARCH 313. Advanced Delineation. 2 units.**

Prerequisite: ARCH 253.

Development of proficiency in architectural presentation. Projects and critiques. 2 laboratories.

**ARCH 316. California Architecture and the California Dream. 3 units.**

Prerequisite: ENGL 134.

Development of California Architecture as the symbolic expression of the myth of the California Dream. Focus on tracing California's unique contribution to architecture and urban patterns in the United States. 3 lectures.

**ARCH 320. Topics in Architectural History. 4 units.**

GE Area C4

Prerequisite: GE Area A1 and one of the following Area C3 courses: ARCH 217, 218, 219, or ART 112.

In-depth examination of a significant region, movement or period in architectural history, theory and criticism. The material covered will vary depending upon the topic. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for Architecture majors.

**ARCH 326. Native American Architecture and Place. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The role of culture and setting in the construction of spatial, material and landscape concepts and artifacts, through the introduction of selected North American cultures, with focus from 1300 AD through contemporary time. 4 lectures. Crosslisted as ARCH/ES 326. Fulfills GE C4 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ARCH 337. Photographic Presentation. 2 units.**

Prerequisite: ARCH 133.

Media presentations in architecture with emphasis on black and white and color print photographic presentations, formats, and techniques applicable to architecture subjects and to design communication. 1 lecture, 1 laboratory.

**ARCH 340. Architectural Photography. 4 units.**

Prerequisite: ARCH 337.

Photography specifically related to architecture and design. Advancement of students technical skills in communicating design through the medium of photography. 2 lectures, 2 laboratories.

**ARCH 341. Architectural Practice 3.1. 4 units.**

Prerequisite: ARCH 242 and ARCH 253. Corequisite: ARCH 351.

Continuation of ARCH 242 plus the concepts, methods and processes and building systems that pertain to the detailing and construction of large-scale masonry, steel, concrete and combination structures. 2 lectures, 2 discussions.

**ARCH 342. Architectural Practice 3.2. 4 units.**

Prerequisite: ARCH 341. Corequisite: ARCH 353.

Continuation of ARCH 341 plus the concepts, methods, and processes pertaining to the preparation of outline specifications, production of design development drawings, life safety, building systems integration and building envelope and fabrication systems that inform the design and development of large scale buildings. 2 lectures, 2 discussions.

**ARCH 351. Architectural Design 3.1. 5 units.**

Prerequisite: ARCE 212, ARCH 253, ARCH 207 and PHYS 122 or PHYS 132, or consent of department head. Corequisite: ARCH 341.

Continuation of ARCH 253 plus the development and exploration of architectural theories, building systems, and design concepts and processes involved in creating architecture with an emphasis on implications of the program and space planning issues as building form generator. 1 lecture, 4 laboratories.

**ARCH 352. Architectural Design 3.2. 5 units.**

Prerequisite: ARCH 351, ARCH 341. Corequisite: ARCH 307.

Continuation of ARCH 351 plus the development and exploration of architectural theories, building systems, and design concepts and processes involved in creating sustainable architecture with an emphasis on implications of ecological, environmental and site issues as building form generator. 1 lecture, 4 laboratories.

**ARCH 353. Architectural Design 3.3. 5 units.**

Prerequisite: ARCH 352, ARCH 307. Corequisite: ARCH 342.

Continuation of ARCH 352 plus the development and exploration of architectural theories, building systems, and design concepts and processes involved in creating large-scale architecture with an emphasis on implications of socio-cultural and comprehensive/life safety systems integration issues as building form generator. 1 lecture, 4 laboratories.

**ARCH 363. Off-Campus Orientation Seminar. 2 units.**

CR/NC

Prerequisite: Consent of instructor.

Preparation for off-campus architectural study programs includes cultural orientation, an introduction to basic language skills, travel and housing protocols as well as academic and financial advising. Credit/No Credit grading only. Total credit limited to 4 units, with a maximum of 2 units per quarter. 2 seminars.

**ARCH 400. Special Problems for Advanced Undergraduates. 1-2 units.**

CR/NC

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit/No Credit grading only.

**ARCH 401. Toward a Barrier-Free Environment. 3 units.**

Prerequisite: Junior standing or consent of instructor.

Exploring the interface between the built environment and human behavior. Physical and psychological design determinants. Attitudes towards deviancy, accessible environments and persons with disabilities. Legal, ethical, human factors. 3 lectures.

**ARCH 407. Environmental Control Systems 3. 4 units.**

Prerequisite: ARCH 307.

Theory and application of mechanical and electrical systems for comfort. Emphasis on internal-load dominated buildings. Consideration of artificial lighting, H.V.A.C. systems, acoustics, water and waste systems. 4 lectures.

**ARCH 420. Seminar in Architectural History, Theory and Criticism. 4 units.**

Prerequisite: ARCH 217, ARCH 218, and ARCH 219.

Special topics based on the exploration of specific approaches, periods of time, and cultural or geographic areas. The Schedule of Classes will list topic selected. Total credit limited to 12 units; repeatable in same term. 4 seminars.

**ARCH 443. Issues in Contemporary Professional Practice. 4 units.**

Prerequisite: ARCH 342, ARCH 353.

An exploration of topics related to the practice of architecture, including financial considerations, client obligations, project and practice management, leadership, legal responsibilities, ethics and professional judgment, and community and social responsibility, as well as the process and requirements for internship and licensure. 2 lectures, 2 discussions.

**ARCH 445. Urban Design in Architecture. 3 units.**

Prerequisite: ENGL 134.

Design role of the urban architect. Economic, environmental and technological forces impacting on architectural practice in urban areas. 3 lectures.

**ARCH 450. Digital Design and Visualization. 5 units.**

Prerequisite: For architecture majors, all prerequisites required by the year and course level for which the student is seeking credit; for non-architecture majors, junior standing or permission of instructor; for local professionals not seeking academic credit, permission of instructor.

Theory, principles and techniques of computer aided architectural or product design, visualization, and digital animation. Utilization of desk-top computers and 2-D and 3-D software as integrated tools for development of a comprehensive computer enhanced design process. 5 laboratories.

**ARCH 451. Architectural Design 4.1. 5 units.**

Prerequisite: ARCE 316, ARCH 353, ARCH 342.

Problems of increasing architectural complexity involving the comprehensive integration of architectural theory, design processes, and building systems with emphasis placed on multifunction singular buildings. 5 laboratories.

**ARCH 452. Architectural Design 4.2. 5 units.**

Prerequisite: ARCE 316, ARCH 353, ARCH 342.

Problems of increasing architectural complexity involving the comprehensive integration of architectural theory, design processes, and building systems with emphasis placed on multibuilding, multifunctional projects. 5 laboratories.

**ARCH 453. Architectural Design 4.3. 5 units.**

Prerequisite: ARCE 316, ARCH 353, ARCH 342.

Problems of increasing architectural complexity involving the comprehensive integration of architectural theory, design processes, and building systems with emphasis placed on multifunctional projects in an urban context. Total credit limited to 10 units and may substitute for ARCH 451 or ARCH 452. 5 laboratories.

**ARCH 457. Computer Graphics in Architecture. 4 units.**

Prerequisite: Fourth year standing.

Two-dimensional drawing systems in architectural practice with particular emphasis on office productivity in the production side of the design process; includes drawing database administration, local area networks, management and cost issues. 2 lectures, 2 laboratories.

**ARCH 460. Computer Graphics Applications III. 3 units.**

Prerequisite: ARCH 133 or ARCH 160 or consent of instructor.

Advanced methods in the application of computer graphics and multi-media techniques in architectural design. 2 lectures, 1 activity.

**ARCH 461. Advanced Computer-Aided Fabrication in Architecture. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Applications of computer-aided manufacturing in architectural design with emphasis on subtractive and additive fabrication methods, material assemblies, and advanced techniques in digital design software. 2 lectures, 2 activities.

**ARCH 462. Topics in Architectural Practice. 3-4 units.**

Prerequisite: ARCH 342 or consent of instructor.

Selected topics addressing various aspects of Architectural Practice for advanced students in CAED. Topics may include strategic planning, managing quality, ethics, and legal considerations. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units; repeatable in same term. 3-4 lectures.

**ARCH 463. Undergraduate Seminar. 2 units.**

CR/NC

Prerequisite: Fourth-year standing in architecture.

Discussion and lectures on problems of practice in architecture. Total credit limited to 6 units. 2 seminars. Credit/No Credit grading only.

**ARCH 464. Computer Applications in Design. 3 units.**

Prerequisite: Junior standing and current participation in Washington Alexandria Architectural Consortium off-campus program.

Exposure to all aspects of two-dimensional computer-aided design. Introduction to three-dimensional CAD through the use of AUTOCAD 12 software. Class Schedule will list topic selected. Total credit limited to 12 units. 3 lectures.

**ARCH 465. Design Related Media. 3 units.**

Prerequisite: Junior standing and current participation in Washington Alexandria Architectural Consortium off-campus program.

The role of various media of visual communication as tools of documentation, analysis and creation in the design visual environment. Skills in graphics, photography, product design, film, video techniques, and printmaking graphics will be developed in specific relation to environmental design study and presentation. Class Schedule will list topic selected. Total credit limited to 12 units. 3 lectures.

**ARCH 466. Topics in Architectural History and Theory. 3 units.**

Prerequisite: Junior standing and current participation in Washington Alexandria Architectural Consortium off-campus program.

Design from its beginning with the crafts design period to its expression of industrial design in its present form. Various stages in the evolution of design explored through analyzing the influences and contributions of leading artists. Class Schedule will list topic selected. Total credit limited to 12 units. 3 lectures.

**ARCH 467. Undergraduate Research. 3 units.**

Prerequisite: Junior standing and current participation in Washington Alexandria Architectural Consortium off-campus program.

Architecture and urban theoretical intentions and results in the context of the Capitol of the United States - Washington, DC. This theoretical and historical study will not occur within the confines of the classroom, but directly within the 'laboratory' of the city. Class Schedule will list topic selected. Total credit limited to 12 units. 3 lectures.

**ARCH 468. Advanced Environmental Building Systems. 3 units.**

Prerequisite: Junior standing and current participation in Washington Alexandria Consortium off-campus program.

Technologies which provide a 'well building' environment by engaging in: weather protection; thermal/moisture control; natural and artificial lighting; and electrical and other 'energy source' utility service. 3 lectures.

**ARCH 469. Topics in Design Methods. 3 units.**

Prerequisite: Junior standing and current participation in the Washington Alexandria Architectural Consortium off-campus program.

Relationship of art and architecture addressed to encourage critical debate. Historically, the 'art' and the 'architecture' were not as polarized as today. Both historical perspective and practical issues concerning collaboration. Class Schedule will list topic selected. Total credit limited to 12 units. 3 lectures.

**ARCH 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 16 units. 1 to 4 lectures.

**ARCH 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**ARCH 472. Housing Design Concepts. 3-4 units.**

Prerequisite: Third-year standing or consent of instructor.

For students preparing for further study or practice relating to housing, urban design and new communities. This course will address design objectives, concepts, and current theories and forms in housing and mixed-use projects. 3-4 lectures.

**ARCH 477. Advanced Topics in Environmental Architecture. 4 units.**

Prerequisite: ARCH 307.

Theory and application of methods used to address energy and ecological issues of integrated building and site design. Class Schedule will list topic selected. Total credit limited to 12 units, repeatable in same term. 4 seminars.

**ARCH 480. Special Studies in Architecture. 1-12 units.**

Prerequisite: Junior standing.

Special issues and problems through research, field trips, design projects, and other forms of investigation and involvement. Course requirements are determined prior to each individual project through a contractual agreement between students and department. The departmental Off Campus Study Guidelines apply except when superseded by guidelines and practices of the London Study Program of the College of Liberal Arts. Total credit limited to 36 units.



**ARCH 481. Senior Architectural Design Project. 5 units.**

Prerequisite: ARCH 451, ARCH 452 and ARCH 453.

Comprehensive building design and research project in an architectural concentration area. Demonstration of professional competency in integration of architectural theory, principles and practice with creative, organizational and technical abilities in architectural programming, design and design research. Total credit limited to 15 units. 5 laboratories.

**ARCH 485. Cooperative Education Experience. 4-8 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid. Formal report and evaluation by work supervisor required. Major credit limited to 20 units; total credit limited to 24 units. Credit/No Credit grading only.

**ARCH 486. Internship Education Experience. 4-8 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are unpaid and usually require relocation. Formal report and evaluation by work supervisor required. Major credit limited to 20 units; total credit limited to 24 units. Credit/No Credit grading only.

**ARCH 492. Senior Design Thesis. 3 units.**

Prerequisite: ARCH 451, ARCH 452 and ARCH 453. Concurrent: First quarter of ARCH 481.

Development of the framework and format of a thesis project proposal related to the specific design option. Work to include: research topic, intent, scope, methodology, assumptions, outline of work program and documentation. 3 seminars.

**ARCH 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid. Formal report and evaluation by work supervisor required. Major credit limited to 20 units; total credit limited to 24 units. Credit/No Credit grading only.

**ARCH 496. Internship Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are unpaid and usually require relocation. Formal report and evaluation by work supervisor required. Major credit limited to 20 units; total credit limited to 24 units. Credit/No Credit grading only.

**ARCH 510. Environmental Design Methods 1. 3 units.**

Prerequisite: Graduate standing.

Application of systematic, step-by-step procedures to rational and intuitive judgmental tasks. Methods for formulation, idea production, evaluation, and testing applied to planning, testing, design information systems, communication between designer and client, user participation in design, and other current topics. 511 focuses on specific problem area among topics and may be repeated up to 9 units. 3 lectures.

**ARCH 511. Environmental Design Methods 2. 3 units.**

Prerequisite: Graduate standing.

Application of systematic, step-by-step procedures to rational and intuitive judgmental tasks. Methods for formulation, idea production, evaluation, and testing applied to planning, testing, design information systems, communication between designer and client, user participation in design, and other current topics. 511 focuses on specific problem area among topics and may be repeated up to 9 units. 3 lectures.

**ARCH 519. Theory of Architecture. 3 units.**

Prerequisite: Graduate standing.

Comparative analysis of the major historic influences which have contributed to the development of architectural design theories. Class Schedule will list topic selected. Total credit limited to 9 units. 1 lecture, 2 seminars.

**ARCH 521. Graduate Architectural Design Project. 5 units.**

Prerequisite: ARCH 407, ARCH 451, ARCH 452, ARCH 453 and 5th-year standing.

Comprehensive building design and research project in an architectural concentration area. Demonstration of professional competency in integration of architectural theory, principles and practice with creative, organizational and technical abilities in architectural programming, design and design research. Total credit limited to 15 units. 5 laboratories.

**ARCH 532. Research Methods in Architecture. 3 units.**

Prerequisite: Graduate standing.

Roles of research and analysis in architecture. Approaches to research, hypothesis testing, design process, and systems for design. Use of research findings in various decision-making systems. 3 seminars.

**ARCH 533. Architectural Programming. 3 units.**

Prerequisite: ARCH 453.

Information management in the design process. Techniques for gathering, analyzing, and transforming data for use as design information. Variety of approaches to pre-design planning. 3 seminars.

**ARCH 551. Architectural Design. 5 units.**

Prerequisite: Graduate standing.

Professional initiative and responsibility in integrating architectural design theory and practice with fields influencing the total environment. Building types considered as the coordinating factor. Total credit limited to 15 units with no more than 5 units in any one quarter. 5 laboratories.

**ARCH 561. Advanced Design. 3 units.**

Prerequisite: Graduate standing.

Continuation of ARCH 551. Advanced studies integrating architectural design theory and practice with fields influencing the shaping of the total environment. Total credit limited to 9 units. 3 laboratories.

**ARCH 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**ARCH 580. Seminar in Theory of Architecture. 3 units.**

Prerequisite: Graduate standing.

Directed group study of selected topics in the theory of architecture for graduate students. The Schedule of Classes will list topic selected. Total credit limited to 9 units. 3 seminars.

**ARCH 592. Graduate Design Thesis. 3 units.**

Prerequisite: 5th year standing or consent of instructor. Concurrent: First quarter of ARCH 521.

Development of the framework and format of a thesis project proposal related to the specific design option. Work to include: research topic, intent, scope, methodology, assumptions, outline of work program and documentation. 3 seminars.

**ARCH 598. Master's Design Project. 3-6 units.**

Prerequisite: Consent of graduate advisor.

Completion of a master project demonstrating in-depth research ability at a graduate level. Total credit limited to 9 units. 3 or 6 laboratories.

**ARCH 599. Master's Thesis. 1-9 units.**

Prerequisite: Consent of graduate advisor.

Completion of a thesis embodying original research in an area of environmental design. Total credit limited to 9 units.

## Art (ART)

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### Art Courses

**ART 101. The Fundamentals of Drawing. 4 units.**

GE Area C3

Introduction to the artistic practice and cultural value of drawing from the Renaissance to the 21st Century. Emphasis and expansion of the practical skills of observation, rendering, and understanding the signs of meaning produced in visual art. Development of formal techniques, media experimentation, and content creation through personal expression. Exercises to encourage growth in technical skill, conceptual innovation, critical thinking, and visual communication. 3 lectures, 1 laboratory. Fulfills GE C3.

**ART 105. Foundation: Color Theory. 4 units.**

Beginning color theory covering hue, value, intensity and complimentary mixtures. Spatial effects, cultural context and psychological aspects of color. 3 lectures, 1 laboratory.

**ART 106. Foundation: 2-Dimensional Design. 4 units.**

Prerequisite: ART 105.

Elements and principles of design, the interrelationship between form and content and creative problem solving strategies. 3 lectures, 1 laboratory.

**ART 107. Foundation: 3-Dimensional Design. 4 units.**

Prerequisite: ART 106.

Elements, principles and criticism of three-dimensional design. Historical, contemporary and multidisciplinary topics. 3 lectures, 1 laboratory.

**ART 111. Introduction to Art. 4 units.**

GE Area C3

Designed to acquaint the non-art major with painting, sculpture, drawing, crafts, architecture and printmaking. Development of vocabulary, analytic skills, and research techniques for the understanding of art objects. 4 lectures. Fulfills GE C3.

**ART 112. Survey of Western Art. 4 units.**

GE Area C3

History of major art movements in western civilization from ancient art to the twentieth century. Representative periods of western culture, such as the ancient world, the Middle Ages, the Renaissance, and the modern world. 4 lectures. Fulfills GE C3.

**ART 122. Basic Digital Photography. 4 units.**

GE Area C3

Fundamental techniques in photography. Mechanics of digital cameras and equipment, optics, composition, filters, and subject content. Understanding photographic principles. Digital camera required. 3 lectures, 1 laboratory. Fulfills GE C3. Formerly ART 121.

**ART 148. Beginning Sculpture. 4 units.**

GE Area C3

Exploration of three dimensional form through problems in modeling, casting, carving, and techniques of assembly. Historical and contemporary concepts as applied to the discipline of sculptural styles. 3 lectures, 1 laboratory. Fulfills GE C3.

**ART 182. Photographic Manipulation and Design. 4 units.**

Introduction to photographic image manipulation software for design, photography and studio students. Fundamental technical skills of current software and their potential for content creation, invention and expression. 3 lectures, 1 laboratory.

**ART 183. Digital Illustration and Design. 4 units.**

Prerequisite: ART 182.

Introduction to digital illustration. Fundamental technical skills and their potential for content creation, invention and expression. 3 lectures, 1 laboratory.

**ART 184. Digital Book Making and Design. 4 units.**

Prerequisite: ART 182.

Introduction to book making. Fundamental technical skills of current software as well as their potential for content creation, invention, and expression. Desktop publishing as well as the creation of fine art books. 3 lectures, 1 laboratory.

**ART 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**ART 201. Intermediate Drawing. 4 units.**

Prerequisite: ART 101, 106, or consent of instructor.

Development of additional drawing techniques with emphasis on form content, pictorial space, B/W media, color, mixed media and composition. 3 lectures, 1 laboratory.

**ART 203. Art Theory and Practice. 4 units.**

Prerequisite: ART 101 and ART 106, or consent of instructor.

Contemporary issues in art and design, linking 'ideas' to development of concepts. Emphasis on individual creative process, and problem solving. Focus on contemporary critical thinking regarding aesthetics, techniques, and vocabulary. 3 lectures, 1 laboratory.

**ART 209. Beginning Painting. 4 units.**

Prerequisite: ART 101.

Introduction to technical and formal problems in painting. Exploration of pictorial space, light, and color from observation. Physical characteristics of paint, various tools, studio methods, and styles of painting. 3 lectures, 1 laboratory.

**ART 211. Art Hist - Ancient to Renaissance. 4 units.**

Development of art from antiquity to the early stages of the Renaissance in Europe. Particular emphasis on European art with appropriate references to sources from antiquity which have been particularly influential on European painting and sculpture. Comparison of relevant parallel examples of the art of non-European cultures. 4 lectures.

**ART 212. Art History - Renaissance through Baroque Eras. 4 units.**

The significant visual expressions of Northern and Southern European art of the Renaissance and Baroque period. Relevant parallel examples of the art of non-European cultures. 4 lectures.

**ART 222. Black and White Photography. 4 units.**

Control of tonal range using 35mm cameras and available daylight illumination. Assignments encourage development of composition and visual communication skills. Emphasis on "photographic seeing" and professional quality enlargements. 2 lectures, 2 laboratories.

**ART 224. Introduction to Artificial Lighting for Photography. 4 units.**

Studio lighting is used to introduce the student to contemporary professional studio photography. Quality developing and printing skills are required. Introduction to current examples of professional studio lighting. 3 lectures, 1 laboratory.

**ART 227. Lifestyle Photography. 4 units.**

Prerequisite: ART 224.

Studio and environmental portraiture. Emphasis on light ratios/patterns; posing; personality portrayal. 3 lectures, 1 laboratory. Formerly ART 327.

**ART 237. Graphic Design I. 4 units.**

Prerequisite: ART 107 and ART 184, or consent of instructor; Art and Design majors only.

Exploration of the technical and conceptual underpinnings of graphic design. Focus on the design process and how raw ideas are translated into professional work. 3 lectures, 1 laboratory.

**ART 238. Typography I. 4 units.**

Prerequisite: ART 237 or consent of instructor; Art and Design majors only.

Fundamentals of theory, practice, technology and history of typography. Exercises include the study of letterforms, type with image, proportion and grids, hierarchy, and legibility. 3 lectures, 1 laboratory.

**ART 241. Introduction to Glass Fusing and Forming. 4 units.**

Prerequisite: ART 101 and ART 107 or ART 148 or consent of instructor.

Studio course in the creative processes of fusing, forming, and assembling glass. Introduction to the use of line, color, and texture related to glass as a transparent or opaque material. Total credit limited to 8 units. 1 lecture, 3 activities.

**ART 245. Ceramics I. 4 units.**

Prerequisite: ART 107 or consent of instructor.

Studio course in basic clay working with emphasis on design quality, hand building, and use of the potter's wheel. 3 lectures, 1 laboratory.

**ART 260. Art Critique and Discourse. 4 units.**

Prerequisite: ART 101 and ART 107.

Developing an individual body of artwork. Rigorous critiques, lectures, and seminar-style discussions aimed at forming a process for discussing artwork. Art writing, research, and individual conceptual and formal development. 4 lectures.

**ART 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ART 301. Advanced Drawing. 4 units.**

Prerequisite: ART 201 or ART 302.

Development of advanced methods and techniques in rendering form, composing pictorial space, expanding formats, color, content, and contemporary issues in drawing as a discipline. Emphasis on problem-solving and finished works for a student's portfolio. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 302. Life Drawing I. 4 units.**

Prerequisite: ART 101.

Development of advanced drawing methods and techniques in the study of the human form and structure as it relates to proportion, anatomical analysis, and figure/ground relationships. Understanding materials, techniques, and ideas in the practice of contemporary figure drawing. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 309. Intermediate Painting. 4 units.**

Prerequisite: ART 209, or consent of instructor.

Continued study of technical and formal problems in painting. Emphasis on the creative process, development of individual ideas, and the connection between form and content. Contemporary issues in painting introduced. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 310. Art History - American Art. 4 units.**

Prerequisite: ART 112 or ART 211 or ART 212 or consent of instructor.

Major historical periods of American art from the colonial period to the present. Special emphasis will be given to the broader notion of American art as a process of developing an identity of the varied historical and sociological forces that have shaped images in American art. 4 lectures.

**ART 311. Art History - Nineteenth Century Art. 4 units.**

GE Area C4

Prerequisite: Junior standing; completion of GE Area A and ART 111 or ART 112 or ART 211 or ART 212.

History of painting and sculpture from the French Revolution to the beginning of the 20th century. Focuses on significant movements such as Neo-Classicism, Romanticism, Realism, Impressionism and Post-Impressionism. 4 lectures. Fulfills GE C4 except for Art and Design majors.

**ART 312. Art History - Modern Art, 1900-1945. 4 units.**

Prerequisite: ART 111 or ART 112 or ART 211 or ART 212, or consent of instructor.

History of visual arts from the beginning to the middle of the twentieth century. Focus on significant European movements such as Fauvism, German Expressionism, Cubism, Dada, and Surrealism, as well as American Modernism. 4 lectures.

**ART 313. Design History. 4 units.**

Prerequisite: ART 112 or ART 211 or ART 212 or consent of instructor.

Survey of design from the Victorian era to the present, including major philosophies and movements, political, social, cultural, and technological trends that influenced designers in the 20th century. 4 lectures.

**ART 314. History of Photography. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C3. Recommended: Junior standing.

In-depth survey of the artistic and cultural achievements in photography from its invention to the present day. Significant photographers, the evolution of aesthetic criteria in the context of other visual arts as well as social/cultural impact. 4 lectures. Fulfills GE C4 except for Art and Design majors.

**ART 315. Art History - Art Since 1945. 4 units.**

Prerequisite: ART 111 or ART 112 or ART 211 or ART 212, or consent of instructor.

History of visual art from 1945 to the present. Focus on significant movements such as Abstract, Expressionism, Pop art, minimalism, conceptual art, earthworks, feminism, and postmodernism. Also focus on new media such as performance, video, and installation. 4 lectures.

**ART 316. Women as Subject and Object in Art History. 4 units.**

Prerequisite: ART 111, ART 112 or ART 211 or ART 212, or consent of instructor.

Exploration of the role of women in the visual arts. Women as artists, women as portrayed in art, and feminist theory as it applies to the study of the visual arts and art history. 4 lectures. Crosslisted as ART/WGS 316.

**ART 317. Asian Art Survey. 4 units.**

Prerequisite: ART 111 or ART 112 or ART 211 or ART 212, or consent of instructor.

Survey of the traditional arts of Asia - primarily India, China and Japan. Emphasis on the connections between the visual arts in Asia and the philosophical, social and cultural environments in which they arose. 4 lectures.

**ART 318. Asian Art Topics: National, Religious, and Intellectual Movements. 4 units.**

GE Area C4

Prerequisite: Junior standing; completion of GE Areas A and C3.

In-depth examination of significant art movements in Asia. Each topic will focus on the development of art in Asia within the context of a specific geographical or theoretical framework. Details will vary depending on topic. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for Art and Design majors.

**ART 324. Photographic Expression. 4 units.**

Prerequisite: ART 222.

Emphasis on personal expression and developing style, introduction to symbology, visual source development and the work of contemporary creative photographers. 2 lectures, 2 laboratories.

**ART 325. Advanced Camera Techniques. 4 units.**

Prerequisite: ART 224.

Advanced camera techniques using large format film and/or digital cameras. Use of architectural exteriors, interiors, landscapes and simple studio set-ups to assist mastery of large format cameras. Other topics include perspective and sharpness correction, lighting (available and artificial), digital imaging and studio equipment. High quality imaging for commercial application emphasized. 3 lectures, 1 laboratory.

**ART 329. Editorial Photography. 4 units.**

Prerequisite: ART 325.

Creating, lighting and executing editorial assignments. Producing photography for corporate needs, i.e. annual reports, brochures and in-house publications. Emphasis on selecting subject matter and handling lights. 3 lectures, 1 laboratory.

**ART 330. Book Arts. 4 units.**

Prerequisite: ART 107, or consent of instructor.

Numerous traditional book structures and derivations including accordion, pamphlet, stab, and multiple signature construction. Emphasis on both craftsmanship and experimentation. Hands-on experience and a broad historical overview of paper and book arts. 3 lectures, 1 laboratory.

**ART 334. Illustration I: Techniques and Tools. 4 units.**

Prerequisite: ART 101 or consent of instructor.

Introduction to the basic practices of commercial illustration as used in the visual communications industry. Emphasis on the generation of ideas, rendering techniques and tools, and self marketing methods, with an overview of the history of illustration. 3 lectures, 1 laboratory.

**ART 336. Exhibition Design/Museum Studies. 4 units.**

Prerequisite: ART 107, or consent of instructor.

Theory and applied principles of exhibition design for art objects in the museum or gallery setting. Class responsible for planning and installing actual gallery exhibitions. 3 lectures, 1 laboratory.

**ART 337. Graphic Design II. 4 units.**

Prerequisite: ART 237 and ART 238; Art and Design majors only.

Exploration of identity design problems through the use of symbolism and metaphor. Design and implementation of corporate logos. 3 lectures, 1 laboratory.

**ART 338. Typography II. 4 units.**

Prerequisite: ART 238; Art and Design majors only.

Exploration of typography in the form of text. Application of different typefaces, composition, layout and page systems for the design of periodicals and books. 3 lectures, 1 laboratory.

**ART 341. Glassblowing. 4 units.**

Prerequisite: ART 101 and ART 148, or consent of instructor.

Survey of history of glass and introduction to contemporary glass art, presented through visual examples in slide/lecture format. Development of tools and forming processes introduced while student develops 3-dimensional projects. Total credit limited to 8 units. 3 lectures, 1 activity.

**ART 345. Ceramics II. 4 units.**

Prerequisite: ART 107 and ART 148, or ART 245, or consent of instructor.

Studio course in hand, wheel, mold, extruder, jig, and press forming skills. Design of single and multiple forms and kiln firing procedures. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 348. Intermediate Sculpture. 4 units.**

Prerequisite: ART 107 and ART 148, or consent of instructor.

Intermediate sculpture course in expressive use of form with modeling, casting, carving, and/or assembly. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 353. Intermedia / Art. 4 units.**

Prerequisite: ART 101, ART 106, and ART 148, or consent of instructor.

Studio course emphasizing individual and collaborative creative exploration with project content derived from student's experience. Focus on using traditional as well as new genres of artistic expression such as site specific installations, video art, book works, and performance art. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 360. Professional Practices. 2 units.**

Prerequisite: Junior standing; for Art and Design majors only.

Professional practices in the art, photography, and design fields, including legal and ethical issues, taxes, contracts, fees and copyrights. Current job opportunities are researched and a business plan is prepared. Course lectures augmented by visiting professionals. 2 lectures.

**ART 370. Michelangelo. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A, and one course from Area C3 or ART 211 or ART 212. Recommended: Junior standing.

The art and life of Michelangelo (1475-1564), the renowned painter, sculptor, architect, and poet, with reference to early biographies, his artistic development, and the demands of his patrons. 4 lectures. Fulfills GE C4 except for Art and Design majors.

**ART 371. Topics in Renaissance Art. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A, and one course from Area C3 or ART 211 or ART 212. Recommended: Junior standing.

A thematic analysis of Renaissance Art (1300-1600) with special attention paid to politics, patronage, myth, religion, and the development of new genres and subject matter. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for Art and Design majors.

**ART 380. Design Principles for the Web. 4 units.**

Prerequisite: ART 237 and ART 238; for Art and Design majors only.

Exploration of design principles in the development of websites that are interactive, dynamic, and visually imaginative. Emphasis on color, typography, organization, and content. 3 lectures, 1 laboratory.

**ART 383. Digital Video. 4 units.**

Prerequisite: ART 182.

Video and computer generated multimedia presentation scripting, editing, storyboarding and sound cutting. Emphasis on effective communication using presentation techniques and application software to create high impact applications. 2 lectures, 2 laboratories.

**ART 384. Digital 3D Modeling and Design. 4 units.**

Prerequisite: ART 107 and ART 182, or consent of instructor.

Development of skills and techniques in the use of three-dimensional design and modeling via digital technology. Capabilities of current software in the design and modeling of three-dimensional form. 2 lectures, 2 activities.

**ART 388. Web Design. 4 units.**

Prerequisite: ART 182 or consent of instructor; Art and Design majors only.

Planning and implementation of web sites. Focus on site structure, navigation, HTML, animation, and design considerations. 3 lectures, 1 laboratory.

**ART 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Senior standing and consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**ART 402. Life Drawing II. 4 units.**

Prerequisite: ART 302.

Advanced problems in life drawing. Advanced methods and techniques in the study of the human form as it relates to proportion, anatomy analysis and composition. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 406. Contemporary Issues in Painting. 4 units.**

Prerequisite: ART 309 or consent of instructor.

Focused investigation into contemporary topics in painting, with connections made to traditional approaches. Formal concerns (color, space, light, composition) balanced with conceptual development. Topics may include, but are not limited to, the human figure, landscape, and technological influences. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory.



**ART 409. Advanced Painting. 4 units.**

Prerequisite: ART 309, or consent of instructor.

Advanced problems in painting. Emphasis on the creative process from initial concept to finished work of art. Investigation of traditional, non-traditional and explorative work to encourage development of personal approach. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**ART 410. Art History Methodologies and Research. 4 units.**

Prerequisite: Completion of GE Area A and two art or architectural history courses, including one at the 300- or 400-level.

Current and historical methods for the study of art history including formalism, social history, semiotics, feminism, cultural diversity. Completion of a major research paper or writing project on an art historical topic. 4 seminars.

**ART 425. Contemporary Photography Seminar. 2 units.**

Prerequisite: ART 314.

Survey of significant photographers and developments in the field since 1950. The interaction between photography and the other visual arts as well as its social impact during this period. Student presentations on selected research topics. Total credit limited to 4 units. 2 seminars.

**ART 427. Advertising Photography. 4 units.**

Prerequisite: ART 325 and senior standing.

Applied principles of design and color to produce a photograph that sells an idea, product, or service. Both traditional and digital applications used. Joint projects with ART 432, Advertising Design. Emphasis on thinking, planning, interpreting, and presenting an idea photographically. 3 lectures, 1 laboratory.

**ART 432. Advertising Design. 4 units.**

Prerequisite: ART 337 and ART 338 and senior standing or consent of instructor.

Development of print advertising from concept to final presentation. Emphasis on art direction, photo direction and copywriting. For Art and Design majors only. Computer applications are required for appropriate problems. 3 lectures, 1 laboratory.

**ART 434. Illustration II. 4 units.**

Prerequisite: ART 209, ART 334, or consent of instructor; for Art and Design majors only.

Advanced development of concepts and illustration techniques and skills, both as analogue and digital, for use in a variety of graphic design applications such as editorial/publication, retail, educational, technical, or advertising purposes. 3 lectures, 1 laboratory.

**ART 437. Graphic Design III. 4 units.**

Prerequisite: ART 337 and ART 338; for Art and Design majors only.

Advanced graphic design. The creation of basic 3-D structures, and the application of graphics in 3-D environments (such as package design and signage). Emphasis on integrative communication activity of all elements including: color, graphics, 3-D forms, typography, and constructions, and includes market research. 3 lectures, 1 laboratory.

**ART 438. Typography III. 4 units.**

Prerequisite: ART 338 or consent of instructor; for Art and Design majors only.

Advanced exploration of communication and structural aspects of typography. Focus on experimentation and expressively using type to enhance meaning. 3 lectures, 1 laboratory.

**ART 439. Type in Motion. 4 units.**

Prerequisite: ART 438, ART 488; for Art and Design majors only.

Sequential organization of typographic information in time and how ideas such as intonation, proximity, pacing, rhythm and progression can influence and shape meaning. Focus on animated typography for a range of applications. 3 lectures, 1 laboratory.

**ART 440. Advanced Selected Topics in Glass. 4 units.**

Prerequisite: ART 241 or ART 341, or consent of instructor.

Continued exploration into the expressive use of glass as a creative medium. Topics may include glass casting, glass blowing, cane work, mold making, and kiln work. Total credit limited to 12 units. 2 lectures, 2 activities.

**ART 448. Advanced Topics in Sculpture. 4 units.**

Prerequisite: ART 348.

Studio course specializing in three-dimensional form. Materials include clay, plaster, metal, or wood. Course content will be selected from various topics that are representational, abstraction, non-objective, or conceptual. The Schedule of Classes will list topic selected. Total credit limited to 8 units; may be in same term. 3 lectures, 1 laboratory.

**ART 462. Senior Portfolio Project. 2 units.**

Prerequisite: Senior standing and ART 360.

Preparation of portfolio system for entrance into the professional job market or graduate school. 2 activities.

**ART 468. Portfolio Production. 1 unit.**

Prerequisite: Senior standing. Concurrent: ART 462.

Physical production of final portfolio for the graduating senior. 1 laboratory.

**ART 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**ART 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**ART 474. Collaborative Studio: Rendering, Animation and Modeling. 4 units.**

Prerequisite: ART 384 or consent of instructor.

A collaborative visualization and design studio focusing on rendering, animation and modeling. Modeling and animation software for design conceptualization and expression. Collaboration in teams. Total credit limited to 8 units. 2 lectures, 2 activities.

**ART 484. Animation, Video, and Interactive Design. 4 units.**

Prerequisite: ART 182.

Creation of in-depth animations and interactive presentations. Advanced scripting, storyboarding, video production, and interactive communication techniques. 3 lectures, 1 laboratory.

**ART 486. Photography: Image and Idea. 4 units.**

Prerequisite: ART 222, ART 314.

Advanced communication and expression through primarily digital methods. Emphasis on the development of conceptual skills and problem solving methods and technical skills aimed toward the development of a creative voice. Analysis of contemporary practice in the field of photography and other visual media. 3 lectures, 1 laboratory.

**ART 488. Advanced Web Design. 4 units.**

Prerequisite: Art and Design majors only, ART 388, or consent of instructor.

Conceptual and technical objectives: the development of the theoretical skills necessary to design a successful web user interface, information architecture and visual identity for digital projects, and the development of technical skills necessary to design advanced interactivity with Macromedia Flash and JavaScript. 3 lectures, 1 laboratory.

**ART 489. Advanced Interactive Media Art. 4 units.**

Prerequisite: ART 488, or consent of instructor.

Advanced topics in the digital media field such as interface design, information architecture techniques, digital typography and interactive storytelling. Survey of new applications of design for the new media, and the development of digital portfolio pieces. 3 lectures, 1 laboratory.

**ART 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid. Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 12 units. Credit/No Credit grading only.

**ART 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid. Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 12 units. Credit/No Credit grading only.

## Astronomy and Astrophysics (ASTR)

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## Astronomy and Astrophysics Courses

**ASTR 101. Introduction to the Solar System. 4 units.**

GE Area B3

Descriptive astronomical properties of the Earth, Moon, other planets and their satellites. Comets, asteroids and other members of the Solar System. Theories of the formation of the Solar System. Opportunities for telescope observations of the Moon and planets. Not open to students who have completed or are taking ASTR 301, ASTR 302, or PHYS 132. 4 lectures. Fulfills GE B3.

**ASTR 102. Introduction to the Stars and Galaxies. 4 units.**

GE Area B3

Descriptive astronomical properties of the Sun, stars, galaxies and interstellar material. Expanding universe and cosmological models. Opportunities for telescope observations of the stars and constellation identification. Not open to students who have completed or are taking ASTR 112, ASTR 301, ASTR 302, or PHYS 132. ASTR 101 is not a prerequisite. 4 lectures. Fulfills GE B3.

**ASTR 112. Introduction to the Stars and Galaxies. 4 units.**

GE Area B3; GE Area B4

Descriptive astronomical properties of the Sun, stars, galaxies and interstellar material. Exploration of cosmological models of an expanding universe. Laboratory activities include real and virtual astronomical viewing and experiments. Not open to students who have completed or are taking ASTR 102, ASTR 301, ASTR 302, or PHYS 132. ASTR 101 is not a prerequisite. 3 lectures, 1 activity. Fulfills GE B3 & B4.

**ASTR 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**ASTR 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ASTR 301. The Solar System. 3 units.**

Prerequisite: PHYS 132 or PHYS 122 and MATH 141 or MATH 161.

Quantitative and descriptive properties of the Solar System including the physics of the planets, their satellites, comets and interplanetary media. Possible origins of the Solar System. 3 lectures.

**ASTR 302. Stars and Galaxies. 3 units.**

Prerequisite: PHYS 132 or PHYS 122 and MATH 141 or MATH 161. ASTR 301 is not a prerequisite.

Quantitative and descriptive properties of the stars, galaxies and interstellar media; including stellar structure and evolution, structure and make-up of galaxies and cosmological models. 3 lectures.

**ASTR 324. Longitude, Navigation, and Timekeeping. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B, MATH 119 or equivalent.

The state of navigation prior to 1800 and the world wide problem of determining longitude at sea. Emphasis on historical and modern-day scientific solutions to the longitude problem and navigation technology, time and timekeeping, celestial navigation, and awareness of technological solutions to societal problems. 4 lectures. Fulfills GE Area F.

**ASTR 326. Cosmology. 3 units.**

Prerequisite: PHYS 211 (may be taken concurrently).

Introduction to the basic ideas of modern observational cosmology from the Big Bang to the ultimate fate of the universe. Topics include: special and general relativity, curvature of space, dark matter, dark energy, cosmic microwave background, type Ia supernovae. 3 lectures.

**ASTR 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**ASTR 444. Observational Astronomy. 4 units.**

Prerequisite: ASTR 302.

Introduction to observational astronomy. Coordinate systems, telescopes and observational instruments (CCDs, filters, spectrographs), observational methods and techniques, data reduction and analysis. Laboratory activities include use of a telescope, CCD camera for data acquisition, data reduction and analysis, and presentation of results. 3 lectures, 1 laboratory.

**ASTR 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ASTR 471. Selected Advanced Laboratory. 1-2 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 2 laboratories.

## BioResource and Agricultural Engineering (BRAE)

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## BioResource and Agricultural Engineering Courses

**BRAE 121. Agricultural Mechanics. 2 units.**

Identification and use of tools and materials; shop safety; tool sharpening and care; concrete mixes and materials; simple electric wiring; metal work; pipe fitting; basic woodworking; estimating quantities and costs. Students are required to meet safety regulations in laboratory work. 1 lecture, 1 laboratory.

**BRAE 124. Small Engines. 2 units.**

Operating principles of the small internal combustion engine. Maintenance and trouble-shooting applications of small power units to all types of engine applications. Repair procedures related to economic justifications. 1 lecture, 1 activity.

**BRAE 128. Careers in Bioresource and Agricultural Engineering. 2 units.**

Introduction to careers associated with BioResource and Agricultural Engineering, and Agricultural Systems Management. Professional engineering registration process. Engineering problem solution and report format. Design procedures. Engineering fundamentals. Laboratory includes visits to facilities relating to career opportunities. 1 lecture, 1 laboratory.

**BRAE 129. Laboratory Skills and Safety. 1 unit.**

Prerequisite: BRAE and ASM majors only.

Introduction to fabrication and construction materials used in the field of Agricultural Engineering. Fabrication skills in the development of wood, metal, concrete projects, and creative design. Strength tests of wood, fasteners, concrete, and student design projects. 1 laboratory.

**BRAE 133. Introduction to Engineering Design Graphics. 1 unit.**

Visual communication in engineering design and problem solving. Principles of freehand sketching, engineering graphics, and computer-aided-drafting. Perspective and orthographic sketching, orthographic drawing with instruments and computer, applied descriptive geometry. 1 laboratory.

**BRAE 141. Agricultural Machinery Safety. 3 units.**

Evaluation of safe tractor and equipment operation. Supervised field operation emphasizing the safe and efficient performance of modern farm and utility-industrial equipment. 2 lectures, 1 laboratory.

**BRAE 142. Agricultural Power and Machinery Management. 4 units.**

Prerequisite: MATH 116 or equivalent.

Evaluation of agricultural machinery and tractor power performance. Equipment studied includes primary and secondary tillage tools, grain drills, row crop planters, sprayers, grain and forage harvesters, and specialty crop harvesters. Emphasis on management, selection, cost analysis using computers and efficient operation of agricultural machinery. 3 lectures, 1 laboratory.

**BRAE 151. CAD for Agricultural Engineering. 1 unit.**

Prerequisite: BRAE 133 or equivalent.

Computer aided drafting on a desktop personal computer using Autocad software. Drawing setup. 2-D projections including automatic dimensioning and hatching. Isometric construction, drawing layers, library symbols. Use of 3-D drawing software. 1 laboratory.

**BRAE 152. 3-D Solids Modeling. 1 unit.**

Prerequisite: BRAE 133, BRAE 151 or equivalent courses.

Introduction to 3-dimensional solids modeling using state-of-the-art software. Model generation and modification of associative properties, assembly modeling, extrusions and revolutions. 1 laboratory.

**BRAE 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**BRAE 201. Enterprise Project. 1-4 units.**

CR/NC

Prerequisite: Consent of instructor.

Introductory experience in a bioresource/agricultural engineering or agricultural systems management project. Project participation is subject to approval by the department head and the Cal Poly Corporation. Credit/No Credit grading only.

**BRAE 203. Agricultural Systems Analysis. 4 units.**

Prerequisite: MATH 118 or equivalent.

Agricultural Systems Analysis investigates the interrelationships between sub-components in an overall system. Problem solving algorithms, network analysis, project planning techniques, and optimization. 2 lectures, 2 activities.

**BRAE 213. Bioengineering Fundamentals. 2 units.**

GE Area B2

Prerequisite: MATH 142; for engineering students only. Corequisite: BIO 213. Recommended: CHEM 124.

Treatment of the engineering applications of biology. Genetic engineering and the industrial application of microbiology. Systems physiology with engineering applications. Structure and function relationships in biological systems. The impact of life on its environment. 2 lectures. Crosslisted as BRAE/ENGR 213. Fulfills GE B2.

**BRAE 216. Fundamentals of Electricity. 4 units.**

Prerequisite: BRAE 129, MATH 142, PHYS 131.

Application of electricity in BioResource and Agricultural Engineering, including basic electric circuits. Will include wiring materials, code regulations, electrical measurements, R-L-C circuit fundamentals, system planning, motors, basic electronics, and an introduction to computer usage. 3 lectures, 1 laboratory.

**BRAE 232. Agricultural Structures Planning. 4 units.**

Prerequisite: BRAE 151, PHYS 132.

Planning of facilities required in production systems. Materials and processes used in construction of agricultural structures. Environmental factors affecting crop storage structures and animal housing. Design of structural environments to meet the needs of commodities, animals, and plants. 3 lectures, 1 laboratory.

**BRAE 234. Introduction to Mechanical Systems in Agriculture. 4 units.**

Prerequisite: PHYS 131.

Introduction to elements used in the mechanical transmission of power and force in agricultural systems. Power transmission using v-belts, roller chain, gear and shaft drives, hydraulic actuators. Linear and nonlinear actuation devices including linkages, cams, and hydraulic/pneumatic cylinders. 3 lectures, 1 laboratory.

**BRAE 236. Principles of Irrigation. 4 units.**

Prerequisite: MATH 141, SS 121.

Land grading design, operation, management, and evaluation of irrigation methods. 3 lectures, 1 laboratory.

**BRAE 237. Introduction to Engineering Surveying. 2 units.**

Prerequisite: MATH 119 or equivalent.

An introduction to basic field note keeping as well as the use of steel tapes, automatic levels, total stations and survey tools. Training in the procedures for differential and profile leveling; angle measurement and traversing. Hands-on experience with the use of GPS for surveying. An understanding in computations to determine direction, elevations, and earthwork volumes. Practice in map reading and building layout. 1 lecture, 1 laboratory.

**BRAE 239. Engineering Surveying. 4 units.**

Prerequisite: MATH 119 or equivalent.

Development of proper field note taking and procedures for measuring using automatic levels, total stations and GPS systems. Understanding in the procedures and computations for differential leveling, profiles, traversing, triangulation and topographic surveys. Computations in traverse adjustment, contour mapping, earthwork volumes, curve alignments and building layout. Understanding in map reading, the use of datums, photogrammetry, CAD design and boundary law. 2 lectures, 2 laboratories.

**BRAE 240. Agricultural Engineering Laboratory. 1 unit.**

Prerequisite: Consent of instructor.

Individual projects. Total credit limited to 4 units. 1 laboratory.

**BRAE 247. Forest Surveying. 2 units.**

Prerequisite: NR 215.

Use and care of tapes, staff compass, abney levels, total stations, and GPS receivers. Keeping field notes, measurements by tape. Closed and open traverse by compass and total stations. Turning angles and determining directions of lines. Map reading and public land description. GPS measurements. Weekend field trips required. 1 lecture, 1 laboratory. Crosslisted as BRAE/NR 247.

**BRAE 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**BRAE 301. Hydraulic and Mechanical Power Systems. 4 units.**

Prerequisite: PHYS 121 or PHYS 141.

Selection, application and use of hydraulic components and mechanical power transmission equipment. Use of standardized circuit design procedures. 3 lectures, 1 laboratory.

**BRAE 302. Servo Hydraulics. 4 units.**

Prerequisite: BRAE 216 or BRAE 324 and BRAE 234 or BRAE 301.

Application of microcomputers and programmable logic controllers to hydraulic, pneumatic and mechanical systems. Theory, instrumentation and sensors used in process and control systems used in agricultural equipment. 3 lectures, 1 laboratory.

**BRAE 312. Hydraulics. 4 units.**

Prerequisite: PHYS 132, ME 211.

Static and dynamic characteristics of liquids, flow in open and closed channels, uniform and nonuniform flow, flow measurement, pumps. 3 lectures, 1 laboratory.

**BRAE 320. Principles of Bioresource Engineering. 4 units.**

Prerequisite: BRAE 232, BRAE 236, PHYS 132.

Theory and applications of bioprocess technology in biological and agricultural systems. Engineering properties of biological materials and organisms. Basic unit operations, fluid mechanics and heat/mass transfer as applied to bioprocess technology. Special requirements of agricultural and biological processes. 3 lectures, 1 laboratory.

**BRAE 321. Agricultural Safety. 3 units.**

Prerequisite: Junior standing.

Principles of agricultural safety. Accident causation and prevention, hazard identification and abatement, laws and regulations. Machinery, electrical, chemical, livestock, shop and fire safety. Safety program development. 2 lectures, 1 activity.

**BRAE 324. Principles of Agricultural Electrification. 4 units.**

Prerequisite: MATH 119, PHYS 121.

Applications of DC/AC electricity in agriculture. National Electric Code regulations. The wiring of agricultural structures and electrical distribution. Series, parallel and series-parallel circuits, R-L-C circuits, electric motors, electronics. 3 lectures, 1 laboratory.

**BRAE 328. Measurements and Computer Interfacing. 4 units.**

Prerequisite: EE 321, EE 361, a computer programming course.

Transducers and engineering measurements in agricultural engineering. Covering transducer characteristics, signal processors and controllers, instrumentation techniques, and the use of the computer in the measurement and control of typical engineering problems. 3 lectures, 1 laboratory.

**BRAE 331. Irrigation Theory. 3 units.**

Prerequisite: BRAE 236, or BRAE 340.

Plant-water-soil relations using evapo-transpiration, plant stress, soil moisture deficiency, frequency and depth of irrigation, salinity, infiltration, drainage and climate control. 3 lectures.

**BRAE 335. Internal Combustion Engines. 4 units.**

Prerequisite: Junior standing.

Principles of operation of internal combustion engines. Theory of operation and diagnosis evaluation and repair of small engines, gasoline and diesel engines and economics of operation, use and repair. Power analysis and application. 3 lectures, 1 laboratory.

**BRAE 337. Landscape Irrigation. 4 units.**

Prerequisite: MATH 118 or consent of instructor.

Design of sprinkler and drip irrigation systems including: site characteristics, soil variables affecting water storage and infiltration rate, plant selection and hydrozones, hydraulics, nozzle spacing, selection of system components, back flow prevention, plumbing codes and cost estimating. Irrigation system evaluation and audit irrigation scheduling, and water budget. 3 lectures, 1 laboratory.

**BRAE 339. Internship in Bioresource and Agricultural Engineering. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 6 units. Credit/No Credit grading only.

**BRAE 340. Irrigation Water Management. 4 units.**

GE Area F

Prerequisite: Junior standing, completion of GE Area B, and Math 118 or higher.

Soil-plant-water relationships; evapotranspiration; irrigation schedules; salinity and drainage; irrigation efficiency. Water measurement; soil moisture measurement; irrigation systems and practical constraints affecting scheduling. California water supply and budget; water rights; local, state and federal water institutions; California water issues. 3 lectures, 1 laboratory. Fulfills GE Area F.

**BRAE 342. Agricultural Materials. 4 units.**

Prerequisite: PHYS 121, SS 121, MATH 119.

Physical properties of agricultural materials and their measurement. Strength of materials, material flow and transport, material deformation, shape and size classification, moisture relationships and biological interactions. Interactions between agricultural materials, the environment and equipment used to handle them. 3 lectures, 1 laboratory.

**BRAE 343. Mechanical Systems Analysis. 4 units.**

Prerequisite: BRAE 342.

Use of statics and dynamics to make original calculations, plans, sketches, graphics, drawings, schemes and layouts for the fabrication and construction of machines. 3 lectures, 1 laboratory.

**BRAE 344. Fabrication Systems. 4 units.**

Prerequisite: BRAE 343.

Fabrication systems including cutting, sawing, shearing, bending, welding, grinding, cleaning, painting and proper safety procedures. Experimental projects to include team design and construction, presentation, organization, and evaluation. 2 lectures, 2 laboratories.

**BRAE 345. Aerial Photogrammetry and Remote Sensing. 3 units.**

Prerequisite: MATH 118.

Object recognition, three-dimensional equipment, and interpretation of aerial photographs. Print alignment, stereoscopic viewing, scales, elevation determination, and application. Orthophotos and their relationship to Geographic Information Systems (GIS). Application of aerial photos to regional studies. 2 lectures, 1 laboratory.



**BRAE 348. Energy for a Sustainable Society. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Study of how the transition can be made from fossil fuels to renewable energy sources including hydro, biomass, solar, wind, and energy conservation. Environmental, economic, and political consequences of a renewable energy-based sustainable society. 3 lectures, 1 activity.

Fulfills GE Area F.

**BRAE 400. Special Problems. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems in agriculture. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**BRAE 401. Enterprise Project Management. 1-4 units.**

CR/NC

Prerequisite: BRAE 201 or consent of instructor.

Advanced experience in a bioresource/agricultural engineering or agricultural systems management project. Project leadership and management are stressed. Project participation is subject to approval by the department head and the Cal Poly Corporation. Credit/No Credit grading only.

**BRAE 403. Agricultural Systems Engineering. 4 units.**

Prerequisite: MATH 242 or MATH 244.

Engineering and economic principles combined with mathematical optimization techniques to evaluate parameters in agricultural production and processing systems. Project planning techniques, linear and nonlinear modeling, response surface methodology. Professional responsibilities in Agricultural Engineering including ethics, patents, copyrights, liability. 3 lectures, 1 laboratory.

**BRAE 405. Chemigation. 1 unit.**

Prerequisite: BRAE 236 or BRAE 340.

Fertilizer and chemical injection through irrigation systems. Hardware, fertilizer compounds, and distribution uniformity. Matching chemicals and equipment to specific irrigation methods. Safety. 1 laboratory.

**BRAE 414. Irrigation Engineering. 4 units.**

Prerequisite: BRAE 331 or BRAE 340; BRAE 312 or course in hydraulics with a grade of C or better.

Design of on-farm irrigation systems; micro, surface, and sprinkler irrigation systems; canals and pumps; economic and strategies of pipe design; pipeline protection. 3 lectures, 1 laboratory.

**BRAE 418. Agricultural Systems Management I. 4 units.**

Prerequisite: BRAE 203, AGB 301, AGB 310 and GE A3.

Project management of agricultural systems. Emphasis placed on a team approach to problem solution. Case studies and student projects used to explore the following topics: project leadership, project organization, communication, needs assessment, feasibility studies, cost analysis, decision making, solution implementation, and evaluation. 3 lectures, 1 laboratory.

**BRAE 419. Agricultural Systems Management II. 4 units.**

Prerequisite: BRAE 418.

Project management of agricultural systems. Emphasis placed on a team approach to problem solution. Case studies and student projects used to explore the following topics: project leadership, project organization, communication, needs assessment, feasibility studies, cost analysis, decision making, solution implementation, and evaluation. 2 lectures, 2 laboratories.

**BRAE 421. Equipment Engineering. 3 units.**

Prerequisite: CE 204, ME 212.

Design and construction of specialized agricultural components and equipment. 2 lectures, 1 laboratory.

**BRAE 422. Equipment Engineering. 4 units.**

Prerequisite: BRAE 421.

Design and construction of specialized agricultural components and equipment. 2 lectures, 2 laboratories.

**BRAE 425. Computer Controls for Agriculture. 3 units.**

Prerequisite: BRAE 324.

Computer activated controls as applied to agricultural machinery, agricultural structures, processing and irrigation industries. Encompassing control logic to evaluate stability behavior of systems of computer interfacing, data input and control output. 2 lectures, 1 laboratory.

**BRAE 427. Agricultural Process Engineering. 3 units.**

Prerequisite: BRAE 312, BRAE 430, ME 302.

Agricultural engineering principles applied to air, water, air-water mixtures, drying, heating, refrigeration, fluid flow, size reduction, fan laws and materials handling. 2 lectures, 1 laboratory.

**BRAE 432. Agricultural Buildings. 4 units.**

Prerequisite: PHYS 121, BRAE 342, BRAE 343.

Selection of buildings, storage units, and related equipment for production agriculture. Economics and functionality of various designs and construction materials. Environmental factors affecting crop storage and animal housing. 3 lectures, 1 laboratory.

**BRAE 433. Agricultural Structures Design. 4 units.**

Prerequisite: BRAE 232, CE 204.

Structural analysis and design of agricultural service and processing buildings. Emphasis on use of wood, metals, and reinforced concrete in light construction. 3 lectures, 1 laboratory.

**BRAE 435. Drainage. 4 units.**

Prerequisite: Junior standing, BRAE 312, BRAE 331, or BRAE 340 or SS 432 and consent of instructor.

Relevant principles of hydrology and porous media flow. Flow nets, wells and ground water, design of simple surface and sub-surface drains. 3 lectures, 1 laboratory.

**BRAE 438. Drip/Micro Irrigation. 4 units.**

Prerequisite: BRAE 236 or BRAE 340.

Drip/micro irrigation hardware and management. Emphasizes agricultural drip/micro irrigation with some landscape application. Filtration, emitters, chemical injection, agronomic constraints, and scheduling. Field trip(s) included. 3 lectures, 1 laboratory.

**BRAE 439. Vineyard Water Management. 4 units.**

Prerequisite: BRAE 340 or BRAE 236.

Management of rain and irrigation water in vineyards. Irrigation scheduling, managing water stress, climate control with irrigation methods commonly used. Management for wine, table grapes, and raisins. 3 lectures, 1 laboratory.

**BRAE 440. Agricultural Irrigation Systems. 4 units.**

Prerequisite: BRAE 340 or consent of instructor.

On-farm irrigation system evaluation and management. Drip, micro-spray, furrow, border strip, sprinkler systems. Irrigation efficiency and uniformity. Pumping costs. For non-BRAE majors only. 3 lectures, 1 laboratory.

**BRAE 447. Advanced Surveying with GIS Applications. 4 units.**

Prerequisite: BRAE 239.

Collecting field data; processing the data; generating graphical representation of the data; design based on the data and laying out the design in the field; and available record resources for use in GIS systems and their accuracy. 2 lectures, 2 laboratories.

**BRAE 448. Bioconversion. 4 units.**

Prerequisite: MATH 118 or equivalent, or consent of instructor.

Biological, thermal and physical techniques for converting biomass into useful energy forms for agriculture and industry. Laboratory exercises include experiments with anaerobic digestion of animal wastes into methane, ethanol fermentation of grains and composting of agricultural residues. Technical and economic feasibility of biofuels. 3 lectures, 1 laboratory.

**BRAE 460. Senior Project Organization. 1 unit.**

Prerequisite: GE A3.

Selection and organization of senior project. Involves time management, research techniques, budgeting and project presentation. Documentation of multidisciplinary team experience. 1 lecture.

**BRAE 461. Senior Project I. 2 units.**

Prerequisite: BRAE 460.

Solution of an engineering or systems management problem in agriculture. May involve research methodology, problem statement, analysis, synthesis, project design, construction, and evaluation. Project requires 150 hours with a minimum of faculty supervision.

**BRAE 462. Senior Project II. 2 units.**

Prerequisite: BRAE 461.

Solution of an engineering or systems management problem in agriculture. May involve research methodology, problem statement, analysis, synthesis, project design, construction, and evaluation. Project requires 150 hours with a minimum of faculty supervision.

**BRAE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**BRAE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**BRAE 481. Advanced Agricultural Mechanics. 2 units.**

Prerequisite: Agricultural teacher candidates starting/returning from student teaching, senior or graduate standing or consent of instructor.

Advanced shop skills. Carpentry, electricity, plumbing, surveying, power mechanics, tractor equipment operation and maintenance. 1 lecture, 1 laboratory.

**BRAE 485. Cooperative Education Experience in BioResource and Agricultural Engineering. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience with an approved BioResource and Agricultural Engineering firm engaged in production or related business, industry or governmental agency. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**BRAE 495. Cooperative Education Experience in BioResource and Agricultural Engineering. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full time work experience with an approved BioResource and Agricultural Engineering firm engaged in production or related business, industry or governmental agency. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**BRAE 500. Individual Study. 1-3 units.**

Prerequisite: Consent of instructor.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 6 units, repeatable in same term.

**BRAE 521. Systems Analysis of Agricultural Systems. 4 units.**

Prerequisite: Consent of instructor.

Principles and methods of creative problem solving and systems analysis as applied to the design of agricultural systems. Problem solving using the engineering design process to analyze the need, establish boundaries, and generate creative alternative solutions. Examples worked through in feasibility analysis, transportation and network problems, linear programming, project planning, human factors and ergonomics, and system analysis with an emphasis on optimum system operation. 3 lectures, 1 laboratory.

**BRAE 532. Water Wells and Pumps. 4 units.**

Prerequisite: BRAE 340 or equivalent, or BRAE 312 or equivalent.

Water well drilling, design, and development. Pump characteristics and system head. Series and parallel operation. Design of pump intakes. Variable speed electric drives and engines. Pump testing. 3 lectures, 1 laboratory.

**BRAE 533. Irrigation Project Design. 4 units.**

Prerequisite: BRAE 340 or BRAE 312 or equivalent (hydraulics/fluid mechanics course).

Engineering solutions and social aspects of improved water delivery to farms and canal automation. Flow measurement. Water user associations. Unsteady canal and pipeline controls. PID controls and modeling. 3 lectures, 1 laboratory.

**BRAE 570. Selected Advanced Topics in BioResource and Agricultural Engineering. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**BRAE 571. Selected Advanced Laboratory in Bioresources and Agricultural Engineering. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**BRAE 581. Graduate Seminar in BioResource and Agricultural Engineering. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Group study of current problems of the bioresource and agricultural engineering industry; current experimental and research findings as applied to field of bioresource and agricultural engineering. Class Schedule will list topic selected. Total credit limited to 9 units. 3 seminars.

**BRAE 599. Thesis in BioResource and Agricultural Engineering. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem in bioresource and agricultural engineering. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Biology (BIO)

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### Biology Courses

**BIO 100. Orientation to Biological Sciences. 1 unit.**

CR/NC

Introduction to Biological Sciences faculty, department and campus resources, research opportunities, possible careers, studying science, and current topics in biology. Credit/No Credit grading only. 1 lecture.

**BIO 111. General Biology. 4 units.**

GE Area B2; GE Area B4

Principles of cellular biology, heredity, ecology, biological diversity, and evolution, with emphasis on their relationships to human affairs. Not open to students who have completed BIO 115 or BIO 161. 3 lectures, 1 laboratory. Fulfills GE B2 & B4.

**BIO 112. Environmental Biology and Conservation. 4 units.**

GE Area B5

A biologically centered exploration of our planet focusing on natural resource conservation and contemporary environmental issues. Interactions between components of the biosphere and impacts of human society on interrelationships within ecosystems. Trends in natural resource conservation and biodiversity preservation. 4 lectures. Fulfills GE B5.

**BIO 114. Plant Diversity and Ecology. 4 units.**

GE Area B2; GE Area B4

Plant diversity and ecology in aquatic and terrestrial plant communities including adaptations of plants to their environment. Identification of common, local native plants and plant communities, uses of native plants by Native Americans, and human impacts on native plant communities. 2 lectures, 2 laboratories. Fulfills GE B2 & B4.

**BIO 123. Biology of Sex. 4 units.**

GE Area B2

Fundamental principles of biology related to sexual reproduction: genetics, physiology, behavior, ecology and evolution of sex in a broad range of organisms. 4 lectures. Not open for major credit in Biological Sciences or Microbiology. Fulfills GE B2.

**BIO 160. Diversity and History of Life. 4 units.**

Overview of the history, diversity and genetic relatedness of life on Earth; broad-scale evolutionary framework of the organization and expansion of life on Earth. 3 lectures, 1 laboratory.

**BIO 161. Introduction to Cell and Molecular Biology. 4 units.**

GE Area B4; GE Area B2

Recommended: CHEM 110 or CHEM 111 or CHEM 124 or CHEM 127.

Fundamentals of cellular biology with an emphasis on the molecular perspective of life: metabolism, photosynthesis, cell structure and reproduction, meiosis, immunology, classical and molecular genetics, gene regulation. 3 lectures, 1 laboratory. Fulfills GE B2 & B4.

**BIO 162. Introduction to Organismal Form and Function. 4 units.**

Prerequisite: BIO 161. Recommended: CHEM 110 or CHEM 111 or CHEM 124 or CHEM 127.

Fundamentals of the structure and physiology of tissues and organs of plants and animals: energy acquisition and food distribution, gas exchange and fluid transport, and sensing and responding to the environment. 3 lectures, 1 laboratory.

**BIO 200. Special Problems For Undergrads. 1-2 units.**

CR/NC

Prerequisite: Consent of department chair.

Individual investigation, research, studies or surveys of selected problems. Intended for lower division students in the Biological Sciences Department. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit does not apply to any concentration in the Biological Sciences Department. Credit/No Credit grading only. 1-2 laboratories.

**BIO 211. Biology of Plants and Animals. 4 units.**

Prerequisite: BIO 111; for Liberal Studies majors only. Recommended: STAT 130 or STAT 217.

Plant and animal anatomy, physiology, diversity and life cycles. How plants and animals acquire nutrients, reproduce, and adapt to environments. Emphasis on hands-on activities and model organisms suited for the elementary classroom. 3 lectures, 1 laboratory.

**BIO 213. Life Science for Engineers. 2 units.**

GE Area B2

Prerequisite: MATH 142; for engineering students only. Corequisite: ENGR/BRAE 213. Recommended: CHEM 124.

Fundamentals of life sciences: energetics, cell biology, molecular and classical genetics, microbiology, organismal biology, and ecology. 2 lectures. Fulfills GE B2.

**BIO 227. Wildlife Conservation Biology. 4 units.**

GE Area B2

Historical development of wildlife biology and philosophies. Basic principles of ecology and evolution. Practices applied to wildlife. Current problems involving people-wildlife interactions with special reference to world biodiversity. 4 lectures. Fulfills GE B2.

**BIO 253. Orientation to Health Professions. 1 unit.**

CR/NC

Prerequisite: Consent of instructor.

Observation in a healthcare setting. Students will shadow healthcare practitioners on campus or in a community setting. Specific placement depend on practitioner availability. Total credit limited to 2 units with a maximum of 1 unit per quarter. Credit/No Credit grading only. 1 activity. Priority to BIO and MCRO majors.

**BIO 263. Introductory Ecology and Evolution. 4 units.**

Prerequisite: BIO 160 or BIO 161.

Basic concepts in ecology and evolution. Relationships among organisms in populations, communities and ecosystems, structures and dynamics of populations, communities and ecosystems, ecosystem inputs and energy flows, nutrient cycling, biogeography, population genetics, evolution, patterns of biodiversity and issues in conservation biology. 3 lectures, 1 laboratory.

**BIO 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**BIO 302. Human Genetics. 4 units.**

GE Area B5

Prerequisite: One course from GE Area B1 (Recommended: STAT 217 or STAT 218), and one course from GE Area B2.

Basic principles of human inheritance, including the transmission of genetic traits, chromosomal abnormalities and their effects, gene structure and function, mutations and mutagenic agents, cancer genetics, population genetics, and principles of genetic counseling. 4 lectures. Fulfills GE B5.

**BIO 303. Survey of Genetics. 4 units.**

Prerequisite: BIO 111 or BIO 161 or BOT 121. Recommended: STAT 218.

Principles of heredity and variation, including transmission, population and quantitative genetics; introduction to molecular mechanisms of inheritance. 4 lectures.

**BIO 305. Biology of Cancer. 4 units.**

GE Area B5

Prerequisite: Completion of GE Area B2.

Introduction to the causes, characteristics and treatment of human cancer. Topics include effects of carcinogens and radiation; the genetics of cancer; molecular, cellular and physiological changes in common cancers; conventional chemotherapy and new treatments. Not open for major credit in Biological Sciences, Microbiology or Biochemistry. 4 lectures. Fulfills GE B5.

**BIO 307. World Aquaculture: Applications, Methodologies and Trends. 4 units.**

GE Area F

Prerequisite: One GE Area B2 course in biology (BIO, ZOO, BOT or MCRO prefix). Recommended: Junior standing.

Life histories and habitats of important species of fishes, invertebrates and algae. Methodologies for the commercial propagation of specific forms. Global and regional coverage, including socioeconomic trends, controversies and applications in developed and less developed regions of the world. 3 lectures, 1 activity. Not open for major credit in Biological Sciences. Fulfills GE Area F.

**BIO 325. General Ecology. 4 units.**

Prerequisite: BIO 160 or NR 141 or NR 142; BIO 162 and BIO 263, or consent of instructor.

Relationships between organisms and their physical, chemical, and biological environment in terrestrial and aquatic habitats. Laboratory emphasis on field studies. Occasional field experiences may require participation during non-scheduled times. 3 lectures, 1 laboratory.

**BIO 327. Wildlife Ecology. 4 units.**

Prerequisite: BIO 263 or NR 306. Recommended: STAT 217 or STAT 218.

Principles of ecology as applied to the study of wild vertebrates and their habitats. Emphasis on techniques for collecting and analyzing field data and how these data apply to the study and management of wildlife. Use of the literature, inventory of plants and animal populations, use of maps and databases, quantifying diet and habitat use, determining sex and age and nutritional condition, capture and marking techniques, non-invasive sampling methods. 3 lectures, 1 laboratory.

**BIO 328. Marine Ecology. 4 units.**

Prerequisite: BIO 160, BIO 162, and BIO 263. Recommended: STAT 217 or STAT 218.

Introduction to the functional biology of marine plants and animals and the ecological processes that underlie their distribution and abundance in open oceans, coastal regions, and estuaries. 2 lectures, 2 laboratories. Several field trips.

**BIO 330. Extended Field Biology Activity. 1 unit.**

Concurrent: Enrollment in corresponding field biology course.

Minimum of two days of field instruction in places with significant biological diversity, and an individual or group project. Focus on field notebooks, field identification, survey methods, experimental design, and significant habitat types for various groups of organisms. The Schedule of Classes will list the title of the associated field biology course. Total credit limited to 6 units, each associated with a different field biology course, with no more than 4 units applied as advisor approved electives. 1 activity.

**BIO 351. Principles of Genetics. 5 units.**

Prerequisite: BIO 161. Corequisite: CHEM 216, CHEM 312 or CHEM 316. Recommended: BIO 263.

Principles of genetics and genetic analysis, including underlying molecular mechanisms. Subjects include gene structure and function, inheritance patterns, regulation of gene expression, mutation, recombination, recombinant DNA technology, and an introduction to population genetics. 5 lectures.

**BIO 361. Principles of Physiology. 4 units.**

Prerequisite: BIO 162; and CHEM 216, CHEM 312 or CHEM 316.

Fundamental principles of animal physiology, including cellular mechanisms and integration to whole animals. Membrane transport, fluid/salt balance, excitable cells, metabolic rate, temperature, gas exchange and circulation. 3 lectures, 1 laboratory.

**BIO 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. 1-2 laboratories.

**BIO 401. Conservation Biology. 4 units.**

Prerequisite: BIO 263 or NR 306, or graduate standing in Biological Sciences.

Principles of conservation biology; practical solutions to current threats to biodiversity in terrestrial, freshwater, and marine environments. 3 lectures, 1 laboratory.

**BIO 405. Developmental Biology. 4 units.**

Prerequisite: BIO 161, BIO 162, and BIO 303 or BIO 351 or CHEM 373.

Events and mechanisms of embryonic development, including fertilization, morphogenesis, cell differentiation, and organogenesis, with emphasis on differential gene expression in model organisms. 3 lectures, 1 laboratory.

**BIO 414. Evolution. 4 units.**

Prerequisite: BIO 263 or equivalent, and BIO 303 or BIO 351.

Recommended: BIO 325 or equivalent.

Scientific evaluation of the theories, mechanism, and patterns of biological evolution. 4 lectures.

**BIO 415. Biogeography. 4 units.**

Prerequisite: BIO 263, or graduate standing in Biological Sciences.

Plant and animal distribution patterns in relation to past and present physical and biotic factors; survey of major biomes with major emphasis on North and South America. 4 lectures.

**BIO 419. Ecological Methodology. 4 units.**

Prerequisite: STAT 218 or equivalent, or graduate standing in Biological Sciences. Recommended: BIO 263 or BIO 325 or NR 306 or BOT 326.

Introduction to quantitative methods used in ecology with an emphasis on the design and analysis of field studies. Population estimates, sampling design and analysis, and the determination of community structure. 3 seminars, 1 activity.

**BIO 421. Wetlands. 4 units.**

Prerequisite: BOT 121 or BIO 162, CHEM 111 or CHEM 127, and SS 121 or SS 131. Recommended: BOT 313, NR 306 or BIO 325.

The formation, characteristics, and functions of wetlands. Genesis of hydric soils. Plant adaptations to saturated soils. Wetlands as wildlife habitat. Policies and social issues associated with wetlands. The procedures of wetland delineations. 3 lectures, 1 laboratory. Crosslisted as BIO/NR/SS 421.

**BIO 424. Organizing and Teaching Science. 4 units.**

Prerequisite: Admission to the Single Subject Credential Program or consent of instructor.

Techniques, aims and objectives in the teaching of physical and life sciences at the secondary level. Selection and organization of teaching material, including strategies for English language learners (ELL) and special needs students. Evaluation of results. 3 lectures, 1 activity. Crosslisted as BIO/PSC 424.

**BIO 426. Immunology. 4 units.**

Prerequisite: BIO 351 or CHEM 373. Recommended: CHEM 313 or CHEM 371.

Principles of molecular and cellular immunology. Emphasis on molecular regulation of immune cell development, including generation of unique receptors, lymphocyte signal transduction and selection, programmed cell death and regulation of immune responses. Discussion and demonstration of roles of immunology in disease and as diagnostic tools. 3 lectures, 1 laboratory.

**BIO 427. Wildlife Management. 4 units.**

Prerequisite: One of the following upper-division ecology courses: BIO 325, BIO 327, BIO 328, BIO 401, BIO 444, BOT 326, or NR 306, or graduate standing in Biological Sciences.

Important habitats, such as riparian, wetlands, and habitat features important to wildlife, such as vegetation types and snags. Basic concepts of wildlife management. Emphasis on planning and designing habitats to meet the needs of wildlife. 3 lectures, 1 laboratory.



**BIO 428. Marine Conservation and Policy. 4 units.**

Prerequisite: BIO 160 and BIO 263; BIO 325 or BIO 327 or BIO 328 or BIO 401 or BOT 326, or Graduate standing in Biological Sciences. Recommended: PSC 201.

Examination of how science and policy are used to evaluate and implement marine conservation and resource management. Topics include endangered species, fisheries, climate change, marine protected areas, research and conservation topics and developing policy for management decision-making. Mandatory field trips required. 3 lectures, 1 laboratory.

**BIO 432. Vertebrate/Human Anatomy and Physiology I. 5 units.**

Prerequisite: BIO 361 or consent of instructor.

Anatomy and physiology of the skeletal, muscular, nervous (central and peripheral) systems, and sense organs of vertebrates, with an emphasis on human systems. Not open to students with credit in ZOO 331. 3 lectures, 2 laboratories.

**BIO 433. Vertebrate/Human Anatomy and Physiology II. 5 units.**

Prerequisite: BIO 361 or consent of instructor.

Anatomy and physiology of the digestive, circulatory, urinary, endocrine, and reproductive systems, with an emphasis on human systems. Not open to students with credit in ZOO 332. 3 lectures, 2 laboratories.

**BIO 434. Environmental Physiology. 4 units.**

Prerequisite: BIO 162, or graduate standing in Biological Sciences. Recommended: BIO 263.

Comparative physiological mechanisms involved in the regulation of oxygen uptake, water and ion balance, and temperature regulation in animals. Emphasis is placed on physiological adaptations which maintain or restore homeostasis in animals which are subjected to environmental changes. 3 lectures, 1 laboratory.

**BIO 435. Plant Physiology. 4 units.**

Prerequisite: BOT 121 or BIO 162. Recommended: BIO 161 or BIO 303; CHEM 312 or CHEM 216.

Consideration of the principal physiological and biochemical processes of plants with emphasis on water relations, mineral nutrition, photosynthesis, and the physiology of plant development. 3 lectures, 1 laboratory.

**BIO 438. Aquaculture. 4 units.**

Prerequisite: BIO 160, BIO 162, and BIO 263.

Propagation and rearing of fishes, invertebrates and algae from marine, freshwater, and estuarine habitats. Current methodologies and general life histories. Global perspective including aquacultural development in developed and developing countries. 3 lectures, 1 laboratory.

**BIO 439. Fisheries Science and Resource Management. 4 units.**

Prerequisite: BIO 162. Recommended: ZOO 322.

Scientific investigation of marine and freshwater fisheries. Methodologies and quantitative strategies for study of finfish and invertebrates. Role of oceanographic or limnological processes on stock maintenance. Impact of human exploitation on maintenance of sustainable yields, including user-group conflict issues, and regional/global controversies. Lab/field protocols, basic fisheries statistical procedures, molecular methods, computer simulations. 3 lectures, 1 laboratory.

**BIO 440. Communicating Ocean Sciences to Informal Audiences. 3 units.**

Prerequisite: BIO 328, ZOO 322, ZOO 336 or PSC 201; completion of GE A; and GE Area B2 or BIO 211; Junior standing.

Simultaneous focus on developing a knowledge of ocean sciences and the advanced educational approaches for communicating that knowledge. Teaching skills developed through coursework, outreach events and design of collaborative projects at museums and aquariums. Primary objective is to learn how to present ocean-themed hands-on, inquiry-based science exhibits, in order to improve the scientific literacy of audiences of all ages. Mandatory field trips required. 1 lecture, 2 activities.

**BIO 441. Bioinformatics Applications. 4 units.**

Prerequisite: Junior standing; BIO 161 or BIO 303. Recommended: BIO 302 or BIO 303 or BIO 351 or CHEM 373.

Introduction to new problems in molecular biology and current computer applications for genetic database analyses. Use of software for: nucleic acid, genome and protein sequence analysis; genetic databases, database tools; industrial applications in bioinformatics; ethical and societal concerns. 3 lectures, 1 laboratory. Crosslisted as BIO/CHEM 441.

**BIO 442. Behavioral Ecology. 4 units.**

Prerequisite: BIO 263, or graduate standing in Biological Sciences.

Behavioral adaptations of animals to their environment and way of life. Analysis of behavior patterns, use of patterns in clarifying evolutionary and ecological relationships. 3 lectures, 1 laboratory. Formerly ZOO 437.

**BIO 443. Molecular Ecology and Systematics. 4 units.**

Prerequisite: BIO 160, BIO 162, BIO 263, BIO 351 and STAT 218 or equivalent.

Introduction to the science used to define and recognize the units of biological diversity, including a survey of the types of molecular data and computer programs used at the population and species level. 3 lectures, 1 laboratory.

**BIO 444. Population Ecology. 3 units.**

Prerequisite: BIO 263 or NR 306.

Growth, fluctuations, balance, and natural mechanisms controlling terrestrial wildlife populations. 3 lectures.

**BIO 445. Community Ecology. 4 units.**

Prerequisite: BIO 160, BIO 162, BIO 263, and STAT 218 or Graduate standing in Biological Sciences. Recommended: BIO 325, BIO 327, BIO 328, BIO 401, or BOT 326.

Principles of ecology at the community level including the mechanism that structure ecological communities, and the quantitative methods used to study community ecology such as diversity metrics, community composition analyses, interaction strengths and the application of statistics to field and experimental studies. 3 lectures, 1 laboratory.

**BIO 446. Ecosystem Ecology. 4 units.**

Prerequisite: BIO 263, BOT 326, or NR 306; and STAT 218, or Graduate standing in Biological Sciences. Recommended: SS 121; BIO 327, BIO 328 or BIO 401.

Advanced ecosystem ecology and biology, and the interactions of biological communities with the abiotic environment. Emphasis on climate change, ecosystem services, and major fluxes and pools of organic elements. 4 lectures.

**BIO 450. Undergraduate Laboratory Assistantship. 1-4 units.**  
CR/NC

Prerequisite: Consent of instructor and department chair.

Assisting the instructor in teaching and supervising undergraduate laboratories in the Biological Sciences Department. Total credit limited to 8 units, with a maximum of 4 units per quarter. Credit/No Credit grading only.

**BIO 452. Cell Biology. 4 units.**

Prerequisite: BIO 351 or CHEM 373; and CHEM 216, CHEM 312 or CHEM 316. Recommended: CHEM 313 or CHEM 371.

Introduction to cell structure and function, energy conversions, protein sorting, signaling, cytoskeleton, cell adhesion, and the cell cycle. 3 lectures, 1 laboratory.

**BIO 461. Senior Project - Research Proposal. 2 units.**

Prerequisite: Junior standing.

Completion of a research proposal and literature review, including analysis of experimental results from published peer-reviewed articles in biology. Written and oral presentations. 2 activities.

**BIO 462. Senior Project - Research. 2 units.**

Prerequisite: Junior standing and consent of instructor.

Recommended: BIO 400, BIO 461 or MCRO 461.

Completion of a research project or equivalent in the biological sciences, selected and conducted in consultation with an instructor. Results are presented in written reports. 2 laboratories.

**BIO 463. Honors Research. 2 units.**

Prerequisite: BIO 462 and consent of instructor.

Completion of advanced research in the biological sciences, selected and conducted in consultation with an instructor. Results presented as a written report and/or oral presentation in a public forum. 2 laboratories.

**BIO 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**BIO 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topics selected. Total credit limited to 8 units. 1 to 4 laboratories.

**BIO 472. Current Topics in Biological Research. 1-4 units.**

Prerequisite: Junior standing or consent of instructor.

Applications of biological research topics. Discussions of how selected discoveries in biological research formed the basis for, and were developed into, practical applications, currently accepted theories, generally utilized techniques or decisions affecting society and political policies. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-4 seminars.

**BIO 475. Molecular Biology Laboratory. 3 units.**

Prerequisite: BIO 161, and grade of C- or better in BIO 351 or CHEM 373 or consent of instructor.

Introduction to techniques used in molecular biology and biotechnology; DNA extraction, characterization, cloning, Southern blotting, reverse transcription, polymerase chain reaction, and sequencing analysis. 1 lecture, 2 laboratories. Crosslisted as BIO/CHEM 475. Formerly BIO/CHEM 375.

**BIO 476. Gene Expression Laboratory. 2 units.**

Prerequisite: BIO/CHEM 475; CHEM 313 or CHEM 371, or graduate standing in Biological Sciences.

Heterologous gene expression of a recombinant protein in a microbial system: gene cloning, construction of expression plasmid, DNA sequence analysis, transformation of microbial host, selection and analysis of transformed host cells, expression and purification of recombinant protein. 2 laboratories. Crosslisted as BIO/CHEM 476.

**BIO 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**BIO 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**BIO 500. Individual Study. 1-4 units.**

Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Advanced study planned and completed with the approval of and under the direction of a member of the department faculty. A written scholarly presentation of the results of each BIO 500 project must be included in the graduate student's departmental file. Total credit limited to 4 units. 1-4 laboratories.

**BIO 501. Molecular & Cellular Biology. 4 units.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Principles of molecular and cellular biology including gene function and regulation, energetics, protein trafficking, cytoskeleton, signaling, adhesion, and the cell cycle. 3 lectures, 1 laboratory.

**BIO 502. Biology of Organisms. 4 units.**

Prerequisite: BIO 501 and graduate standing in Biological Sciences, or consent of instructor.

Principles of and current topics in organismal biology, with an emphasis on physiology (including organ systems), behavior, and responses to the environment. 3 lectures, 1 laboratory.

**BIO 503. Population Biology. 4 units.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Considerations of theory and practice in population ecology, evolutionary biology, and biosystematics. 3 lectures, 1 laboratory.

**BIO 511. Trends in Biology. 1 unit.**

CR/NC

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Recent trends in the field of biology for graduate students new to the Biological Sciences master's degree program. Overview of current faculty research to help students choose a thesis project and mentor. Credit/No Credit grading only. 1 activity.

**BIO 524. Developmental Biology Seminar. 2 units.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor. Recommended: BIO 501.

Principles and selected topics in developmental biology. Issues of differentiation, morphogenesis, and pattern formation; specific topics chosen by participants. 2 seminars.

**BIO 534. Principles of Stem Cell Biology. 2 units.**

Prerequisite: Graduate standing in Biological Sciences, Biomedical Engineering, or Agriculture, or consent of instructor. Recommended: BIO 452 or BIO 501.

Principles of stem cell biology including characteristics, types, roles in development, therapeutic uses, historical perspectives and ethical issues. 2 seminars.

**BIO 537. Advanced Behavioral Ecology. 1 unit.**

Prerequisite: BIO 442, or graduate standing.

Function and evolution of behavioral traits as they relate to ecological phenomena. Habitat selection, migration, spacing mechanisms, reproductive strategies, feeding strategies, agonistic, parasitic, altruistic behavior, communication, and comparative social systems. 1 activity. Formerly ZOO 537.

**BIO 542. Multivariate Biometry. 4 units.**

Prerequisite: Two courses in statistics or consent of instructor.

Studies in continuous multivariate statistics, including the multivariate linear model, principal components and factor analysis, discriminant analysis, clustering, and canonical correlation. Use of MINITAB and SAS throughout. 4 lectures.

**BIO 561. Proposal Writing for Biological Research. 3 units.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Written and oral presentations of a proposal for research in biology including a literature review. 3 seminars.

**BIO 570. Selected Topics in Biology. 1-4 units.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Directed group study of selected topics for graduate students. Class Schedule will list topics for selection. Total credit limited to 12 units. 1 to 4 seminars.

**BIO 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**BIO 575. College Teaching Practicum. 1-2 units.**

CR/NC

Prerequisite: Graduate standing and evidence of satisfactory preparation in biology; Department chair and graduate coordinator's approval required.

Part-time teaching assignment in an undergraduate college classroom. Includes teaching and related activities under the supervision of a professor in Biological Science. Total credit limited to 4 units. Credit/No Credit grading only. 1-2 activities.

**BIO 585. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Advanced study, analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 6 units. Credit/No Credit grading only.

**BIO 590. Seminar in Biology. 1 unit.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Problems and topics in advanced biology selected according to the interest and needs of the students enrolled. Total credit limited to 6 units. 1 activity.

**BIO 593. Stem Cell Research Internship. 5 units.**

Prerequisite: Graduate standing in the Specialization in Stem Cell Research for the MS in Biological Sciences or for the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture, and BMED 510, BMED 545, BMED 515, and BIO 534.

Supervised graduate research in stem cell science and engineering. Provides students with an off-campus industrial or university research internship. Total credit limited to 10 units. Crosslisted as ASCI/BIO/BMED 593.

**BIO 594. Applications in Stem Cell Research. 2 units.**

Prerequisite: ASCI/BIO/BMED 593.

Transfer of skills and knowledge gained through ASCI/BIO/BMED 593, in an applied setting at Cal Poly. Demonstration of technical, problem solving, and presentation skills, and familiarity with current research. Part of the culminating experience for the Specialization in Stem Cell Research for the MS in Biological Sciences or for the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture. 1 seminar and supervised work. Crosslisted as ASCI/BIO/BMED 594.

**BIO 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing in Biological Sciences and consent of instructor.

Advanced study, analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 12 units. Credit/No Credit grading only.

**BIO 598. Masters Project in Biology. 2 units.**

Prerequisite: Graduate standing in Biological Sciences or consent of instructor.

Individual investigation or research project for Masters of Arts in Biology. Written report required. Course satisfies culminating experience for the MA degree in Biology. Total credit limited to 4 units. 2 laboratories.

**BIO 599. Thesis. 1-3 units.**

Prerequisite: Graduate standing in Biological Sciences; consent of instructor, and consent of thesis committee.

Individual research under the general supervision of the faculty, leading to a graduate thesis of suitable quality. Total credit limited to 9 units. 1-3 laboratories.

## **Biomedical Engineering (BMED)**

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### **Biomedical Engineering Courses**

**BMED 101. Introduction to the Biomedical Engineering Major. 1 unit.**

Prerequisite: Biomedical or General Engineering Freshmen.

Introduction to major topics in Biomedical Engineering. Time management, study skills and class scheduling necessary for academic success. Overview of university services. Professional pathways and ethics. Review of career opportunities. 1 seminar.

**BMED 102. Introduction to Biomedical Engineering Analysis. 1 unit.**

Prerequisite: BMED 101 and MATH 141.

General introduction to bioengineering analysis applied to representative topics in biomechanics, biofluidics, bioinstrumentation, biomaterials, biotechnology, and related areas. Review of technological needs, testing procedures, governmental regulation, quality of life, and ethical issues. 1 seminar.

**BMED 212. Introduction to Biomedical Engineering. 3 units.**

Prerequisites: Math 143 or consent of instructor.

A general introduction to bioengineering design, including examples of engineering analysis and design applied to representative topics in biomechanics, bioinstrumentation, biomaterials, biotechnology, and related areas. A review of technological needs, design methodology, testing procedures, statistical analysis, governmental regulations, evaluation of costs and benefits, quality of life, and ethical issues. 2 lectures, 1 laboratory.

**BMED 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**BMED 310. Biomedical Engineering Measurement and Analysis. 4 units.**

Prerequisite: EE 201; and CPE/CSC 101, CSC 231, or CSC 234.

Fundamentals of biomedical engineering analysis. Use and application of tools and analytical methods used by bioengineers. 3 lectures, 1 laboratory.

**BMED 355. Electrical Engineering Concepts for Biomedical Engineering. 4 units.**

Prerequisite: EE 201, MATH 344.

An introduction to electrical engineering concepts for biomedical engineers. Continuation of basic circuit analysis. Steady state AC circuit analysis and phasor concepts. Application of the Laplace Transform to transient circuit analysis. An introduction to digital logic gates, combinational and sequential logic circuits. 4 lectures.

**BMED 400. Special Problems for Advanced Undergraduates. 2-4 units.**

Prerequisite: ME 212, junior standing and consent of department chair.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 8 units.

**BMED 404. Applied Finite Element Analysis. 4 units.**

Prerequisite: ME 328 or CE 351 or BMED 410.

Finite element based solutions to engineering problems with an emphasis on elastostatic problems in structural mechanics. The power and pitfalls associated with the finite element method highlighted through practical modeling assignments. Introduces the use of commercial finite element codes. 3 lectures, 1 laboratory. Crosslisted as BMED/CE/ME 404.

**BMED 410. Biomechanics. 4 units.**

Prerequisite: ME 212, CE 204, BMED 310 or consent of instructor.

Introduction to physiological systems, with emphasis on structure and function of major tissues and organs. Application of mechanics to understand the behavior of these tissues and organs at gross and microscopic levels. Bioelastic solids. Rigid body biomechanics. Biofluids, basic mechanical properties of collagen and elastin, bone, cartilage, muscles, blood vessels, and other living tissues. Application of continuum mechanics to hard and soft tissues. Biomechanical engineering design for clinical applications. 3 lectures, 1 laboratory.

**BMED 420. Principles of Biomaterials Design. 4 units.**

Prerequisite: CE 204, MATE 210 or consent of instructor.

Fundamentals of materials science as applied to bioengineering design. Natural and synthetic polymeric materials. Materials characterization and design. Wound repair, blood clotting, foreign body response, transplantation biology, biocompatibility of materials, tissue engineering. Artificial organs and medical devices. Government regulations. Patenting. Ethical issues. 3 lectures, 1 laboratory.



**BMED 425. Biomedical Engineering Transport. 4 units.**

Prerequisite: ME 302, ME 341 or consent of instructor.

Mass transfer in solids, liquids, and gases with application to biological systems. Free and facilitated diffusion. Convective mass transfer. Diffusion-reaction phenomena. Active transport. Biological mass transfer coefficients. Nonequilibrium thermodynamic analysis of transport phenomena. The osmotic effect. Diffusion and exchange in biological systems. 3 lectures, 1 laboratory.

**BMED 430. Biomedical Modeling and Simulation. 2 units.**

Prerequisite: BMED 425 or consent of instructor.

Finite element methods for anatomical modeling and boundary value problems in the biomechanics of tissues and biomedical devices. Nonlinear biodynamics, heat flow, cardiac impulse propagation, anatomic modeling, and biomechanics. 1 lecture, 1 laboratory.

**BMED 434. Microfabrication. 3 units.**

Prerequisite: MATE 210.

Silicon-based fabrication science and technology. Oxidation, diffusion, ion implantation, etching, chemical and physical vapor deposition, photolithography. 3 lectures. Crosslisted as BMED 434/MATE 430.

**BMED 435. Microfabrication Laboratory. 2 units.**

Corequisite: BMED 434/MATE 430.

Basic processes involved in microfabrication; cleanroom protocol, oxidation, diffusion, photolithographic and etching processes, sputtering and evaporation, process development through experimentation, device testing. Each student will be part of a 4-6 person team that will fabricate a micro electronic device or photovoltaic device. 2 laboratories. Crosslisted as BMED/MATE 435.

**BMED 440. Bioelectronics and Instrumentation. 4 units.**

Prerequisites: EE 201, BMED 310 or consent of instructor.

Analog and digital circuits in bioinstrumentation. Biomedical signals in continuous and discrete systems. Sampling and digital signal processing. Ultrasound, MRI, CT, Bioelectromagnetics. Electrokinetics. Biophysical phenomena, transducers, and electronics as related to the design of biomedical instrumentation. Potentiometric and amperometric signals and amplifiers. Biopotentials, membrane potentials, chemical sensors. Mechanical transducers for displacement, force and pressure. Temperature sensors. Flow sensors. Light-based instrumentation. Electrical safety. 3 lectures, 1 laboratory.

**BMED 445. Biopotential Instrumentation. 4 units.**

Prerequisite: BMED 440.

Focus on the principles associated with instrumentation used to detect surface biopotentials. Emphasis on circuit level design and laboratory implementation of systems used to detect ECG, EMG and EEG signals. Development of practical experience with analog electronic instrumentation used in the design and testing process. A system level design project related to surface biopotential detection and recording. 2 lectures, 2 laboratories.

**BMED 450. Contemporary Issues in Biomedical Engineering. 4 units.**

Prerequisite: Senior standing in Biomedical Engineering.

Current and evolving topics in biomedical engineering, including medical and industrial applications. Exploration of contemporary issues in biomedical engineering, including technical and societal implications. The Schedule of Classes will list topic selected. Total credit limited to 16 units. 4 lectures.

**BMED 455. Biomedical Engineering Design I. 4 units.**

Prerequisite: BMED 410 or consent of instructor.

Engineering design methodology, design process, project planning, decision making, modeling, construction, and testing of an open-ended design project. Preparation of formal engineering reports. Statistical analysis. Governmental regulations. Bioethical issues. 2 lectures, 2 laboratories.

**BMED 456. Biomedical Engineering Design II: Senior Project. 4 units.**

Prerequisite: BMED 455 or consent of instructor.

Engineering design methodology, design process, project planning, decision making, modeling, construction, and testing of an open-ended design project. Preparation of formal engineering reports. Statistical analysis. Governmental regulations. Bioethical issues. 2 lectures, 2 laboratories.

**BMED 460. Engineering Physiology. 4 units.**

Prerequisite: ZOO 331 or ZOO 332, and BMED 310 or graduate standing, or consent of instructor.

Physiology for biomedical engineering students, with an emphasis on control mechanisms and engineering principles. Engineering aspects of basic cell functions; biological control systems; muscle; neural; endocrine, and circulatory systems, digestive, respiratory, renal, and reproductive systems; regulation of metabolism, and defense mechanisms. 3 lectures, 1 laboratory.

**BMED 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**BMED 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**BMED 481. Senior Project Design Laboratory I. 1 unit.**

Prerequisite: MATH 244, IME 314, ME 302 or consent of instructor.

Selection and development of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research. Formulation of outline, literature review, and project schedule. 1 laboratory.



**BMED 482. Senior Project Design Laboratory II. 1 unit.**

Prerequisite: BMED 481 or consent of instructor.

Continuation of BMED 481. Continuation of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research. Formulation of outline, literature review, and project schedule. 1 laboratory.

**BMED 483. Senior Project Design Laboratory III. 2 units.**

Prerequisite: BMED 482 or consent of instructor.

Continuation of BMED 482. Continuation of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research. Formulation of outline, literature review, and project schedule. 2 laboratories.

**BMED 500. Individual Study. 2-4 units.**

Prerequisite: Graduate standing and consent of department chair.

Individual investigation, research, studies or surveys of selected problems. Advanced study planned and completed under the direction of faculty. Open to graduate students who have demonstrated the ability to do independent work. Total credit limited to 8 units.

**BMED 510. Principles of Tissue Engineering. 4 units.**

Prerequisite: An upper division course in physiology.

Exploration of areas including cell source and isolation, scaffold selection and modification, tissue cultivation and bioreactor design, and patient implantation. Applications of tissue engineering for creating skin, cartilage, blood vessels, and other tissues. 3 lectures, 1 laboratory.

**BMED 512. Biomedical Engineering Horizons. 4 units.**

Prerequisite: Graduate standing, MATH 143, CHEM 125, PHYS 131 or PHYS 141, BIO 161 or consent of instructor.

Examination of the advances in nanotechnology, micro-electro-mechanical systems, materials and clinical technology. Relationship between modern medical achievements and advances in engineering and science, the biomedical engineering industry, and the use of technology in a human context. 4 lectures.

**BMED 515. Introduction to Biomedical Imaging. 4 units.**

Prerequisite: PHYS 132, MATH 244, and graduate standing.

Fundamental principles and applications of biomedical imaging, modalities in medicine. Topics focus on optical imaging techniques, such as brightfield, fluorescence, confocal, multiphoton, DIC, OCT, SEM, and other advanced microscopy techniques. 2 lectures, 2 laboratories.

**BMED 520. Introduction to Biomedical Engineering. 4 units.**

Prerequisite: Graduate standing.

Advanced treatment of the basic engineering sciences in the biomedical engineering context. For the student who has had little prior exposure to biomedical engineering, but has either a strong engineering or a strong science background. 4 lectures.

**BMED 525. Skeletal Tissue Mechanics. 4 units.**

Prerequisite: CE 204, BMED 460.

Overview of the mechanical properties of various tissues in the musculoskeletal system, the relationship of these properties to anatomic and histologic structures, and the changes in these properties caused by aging, disease, overuse, and disuse. Tissues covered include bone, cartilage and synovial fluid, ligament, and tendon. 4 lectures.

**BMED 530. Biomaterials. 4 units.**

Prerequisite: BIO 161, or BIO 213 and ENGR 213; MATE 210 and graduate standing or consent of instructor.

Structure-function relationships for materials in contact with biological systems. Interactions of materials implanted in the body. Histological and hematological considerations including foreign body responses, inflammation, carcinogenicity, thrombosis, hemolysis, immunogenic and toxic properties. Microbial interaction with material surfaces, degradation. 4 lectures. Crosslisted as BMED/MATE 530.

**BMED 531. Micro Systems. 4 units.**

Prerequisite: Graduate standing.

Fundamentals of intelligent systems employing sensors, actuators and intelligent controls. Impact on material properties as devices shrink in the micrometer realm. Applications toward exploring nanotechnology. 4 lectures. Crosslisted as BMED 531/MATE 550.

**BMED 535. Bioseparations. 4 units.**

Prerequisite: BMED 425, ME 341 or consent of instructor.

Advanced topics in physicochemical hydrodynamics, bioseparations and microfluidic bioseparations, which include the key aspects of electrokinetics, colloid science and suspension mechanics in bioseparations. Understanding key separation design parameters through theoretical and numerical models. 4 lectures.

**BMED 540. Microcirculation. 4 units.**

Prerequisite: BMED 460 or BIO 433 or equivalent.

Anatomy and physiology of microcirculation, including wall structure, flow regulation, nutrient exchange, inflammation, and angiogenesis. Additional focus on experimental approaches, the primary literature, microcirculatory patho-physiology, and the role of engineering approaches to assess and treat microvascular dysfunction. 3 lectures, 1 laboratory.

**BMED 545. Cell Transplantation and Biotherapeutics. 4 units.**

Prerequisite: Statistics - STAT 312 or STAT 218; Physiology - BMED 460, BIO 361, or ASCI/VS 438.

Lecture topics include patho-physiology, disease models, rodent anatomy, and therapeutic strategies. Laboratory topics include rodent handling, survival surgery, therapy delivery, and measurements of organ function or repair. Focus on experimental design, data collection and analysis, and literature integration. 2 lectures, 2 laboratories.

**BMED 550. Current and Evolving Topics in Biomedical Engineering. 4 units.**

Prerequisite: Graduate standing in biomedical engineering or consent of department chair.

Current topics in biomedical engineering, including medical and industrial applications. Exploration of detailed technical treatment of contemporary issues in biomedical engineering, and examination of technical and societal implications of these subjects. The Schedule of Classes will list topics selected. Total credit limited to 8 units. 4 lectures.

**BMED 555. Neural Systems Simulation and Modeling. 4 units.**

Prerequisite: MATH 244, BMED 440.

The biophysical basis of the Hodgkin-Huxley active membrane model. A detailed description of the dynamics of voltage gated ion channels. The complete Hodgkin-Huxley active membrane model, with an emphasis on its use in simulating the electrical activity of nerve cells. Equivalent circuit/ circuit simulator based approaches to modeling Hodgkin-Huxley neurons. 4 lectures.

**BMED 563. Biomedical Engineering Graduate Seminar. 2 units.**

Prerequisite: Graduate standing or consent of instructor.

Selected topics of interest to biomedical engineering and other graduate students. Open to graduate students and selected seniors. A forum to share information about research and research tools; an opportunity to discuss topics of interest with professionals in the field, academics, and other graduate students. The Schedule of Classes will list topic selected. Total credit limited to 4 units. 1 seminar, 1 laboratory.

**BMED 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**BMED 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**BMED 591. Thesis Project Design Laboratory I. 2 units.**

Prerequisites: Graduate standing.

Selection and completion of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research and may involve students from several disciplines. Formulation of outline, literature, review and project schedule. 2 laboratories.

**BMED 592. Thesis Project Design Laboratory II. 2 units.**

Prerequisite: BMED 591 or consent of instructor.

Continuation of BMED 591. Completion of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research. Formulation of outline, literature review, and project schedule. 2 laboratories.

**BMED 593. Stem Cell Research Internship. 5 units.**

Prerequisite: Graduate standing in the Specialization in Stem Cell Research for the MS in Biological Sciences or for the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture, and BMED 510, BMED 545, BMED 515, and BIO 534.

Supervised graduate research in stem cell science and engineering. Provides students with an off-campus industrial or university research internship. Total credit limited to 10 units. Crosslisted as ASCI/BIO/BMED 593.

**BMED 594. Applications in Stem Cell Research. 2 units.**

Prerequisite: ASCI/BIO/BMED 593.

Transfer of skills and knowledge gained through ASCI/BIO/BMED 593, in an applied setting at Cal Poly. Demonstration of technical, problem solving, and presentation skills, and familiarity with current research. Part of the culminating experience for the Specialization in Stem Cell Research for the MS in Biological Sciences or for the MS in Biomedical Engineering, or the Animal Science Specialization in the MS in Agriculture. 1 seminar and supervised work. Crosslisted as ASCI/BIO/BMED 594.

**BMED 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing.

Selection by individual or group, with faculty guidance and approval, of topic for independent research or investigation resulting in a thesis or project to be used to satisfy the degree requirement. An appropriate experimental or analytical thesis or project may be accepted. Total credit limited to 9 units.

## Botany (BOT)

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### Botany Courses

**BOT 121. General Botany. 4 units.**

GE Area B2; GE Area B4

The anatomy, physiology, reproduction, and importance of plants. 3 lectures, 1 laboratory. Fulfills GE B2 & B4.

**BOT 238. Central Coast Flora and Vegetation. 3 units.**

Prerequisite: BOT 121.

Field identification of native plants and plant communities of the California Central Coast. Factors that affect plant growth in natural environments. 2 lectures, 1 laboratory.

**BOT 311. Plants, People and Civilization. 4 units.**

GE Area B5

Prerequisite: One course from GE Area B2.

Human uses of plants for food, beverage, medicine, fiber, recreation, and rituals. Uses of plants by different cultures throughout the world and the social, economical, and environmental importance of plants in our lives. 3 lectures, 1 laboratory. Fulfills GE B5.

**BOT 313. Taxonomy of Vascular Plants. 4 units.**

Prerequisite: BIO 114 or BIO 162 or BOT 121.

Introduction to classification and identification of vascular plants, emphasizing major plant families; field and herbarium techniques. 2 lectures, 2 laboratories.

**BOT 323. Plant Pathology. 4 units.**

Prerequisite: BIO 162 or BOT 121.

Comprehensive study of the causes and effects of disease in plants. Designed to lead to an understanding of the science and modern control methods. 2 lectures, 2 laboratories.

**BOT 326. Plant Ecology. 4 units.**

Prerequisite: BIO 114, BIO 162, BIO 211, or BOT 121. Recommended: BIO 263 and STAT 217 or STAT 218.

Plant communities, population dynamics, and effects of the following environmental factors on plant growth and development: soil, water, temperature, light, atmosphere, topography, organisms, and fire. 3 lectures, 1 laboratory.

**BOT 329. Plants, Food, and Biotechnology. 4 units.**

GE Area F

Prerequisite: Completion of one of the following: BIO 111, BIO 114, BIO 161, BOT 121, or HCS 120. Recommended: Junior standing.

Agriculture as applied biology and its impact on civilization. Application of technology to increase the efficiency of food production. Genetics and biotechnology; culminating in an assessment of genetically engineered foods, the myths, the controversy, the science. Not open to CRSC or FRSC majors. 3 lectures, 1 laboratory. Crosslisted as BOT/HCS 329. Fulfills GE Area F.

**BOT 431. Advanced Plant Pathology. 4 units.**

Prerequisite: BOT 323.

Methods, instruments, and materials used in diagnosis of plant diseases and in plant disease research. 2 lectures, 2 laboratories.

**BOT 433. Field Botany. 4 units.**

Prerequisite: BOT 313, or graduate standing in Biological Sciences, or consent of instructor.

Field studies of California's diverse vegetation and flora. Factors affecting the distribution of plants and plant communities and their ecological relationships. Identification of plants and plant communities in the field. Several field trips required including two weekend trips to California's deserts and mountains. 2 lectures, 2 laboratories.

**BOT 437. Marine Plants. 4 units.**

Prerequisite: Junior standing and BIO 162.

Comprehensive examination of the ecology, life histories, functional morphology, physiology, and taxonomy of marine algae and seagrasses. Laboratory emphasizes species endemic to the central coast of California. 3 lectures, 1 laboratory.

## Business (BUS)

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## Business Courses

**BUS 100. Student Orientation and College Success. 1 unit.**

CR/NC

Orientation to academic areas (majors, minors, concentrations) within the Orfalea College of Business, including the development of a comprehensive personalized four-year plan to graduation. Career exploration to assist with future career planning and concentration selection. Exploration of skills needed for academic success: effective goal setting, time management, study skills, registration systems/strategies, and adjustment to college life. Credit/No Credit grading only. 1 lecture.

**BUS 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of area coordinator.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**BUS 205. Personal Finance. 4 units.**

Introduction to personal financial planning, including budgeting and savings, tax planning, insurance planning, equity and fixed income investments, and estate and retirement planning. Course offered online only. 4 lectures.

**BUS 207. Legal Responsibilities of Business. 4 units.**

Examination of the American legal system and important legal principles for business operations, such as those involved with contracts, torts, agency, business organizations, and employment. Emphasis on how legal principles help define socially responsible conduct. Case studies. 4 lectures.

**BUS 212. Financial Accounting for Nonbusiness Majors. 4 units.**

Introduction to financial accounting theory and practice with an emphasis on financial statement preparation and analysis. Not open to Business majors. 4 lectures.

**BUS 214. Financial Accounting. 4 units.**

Principles of financial accounting for Business majors. The course prepares students to understand and interpret financial statement information. Financial reporting standards are explored to give students an understanding of how financial events are reflected in financial statements. 4 lectures.

**BUS 215. Managerial Accounting. 4 units.**

Prerequisite: Demonstrated competency in electronic spreadsheet, word processing, and presentation applications; BUS 212 or BUS 214 or equivalent.

Applications of accounting for making business decisions. Content includes planning and control issues including cost behavior, budget preparation, performance reporting; addresses social responsibility and employee motivational and behavioral considerations. Preparation of spreadsheet applications useful for decision-making. 4 lectures.

**BUS 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**BUS 290. Introduction to Systems Development. 4 units.**

Fundamentals of computer programming related to business applications. Application development using graphical user interface controls, variables, data types, and input/output with text files. 4 lectures.

**BUS 301. Global Financial Institutions and Markets. 4 units.**

Prerequisite: ECON 222.

Role of private and public financial institutions in allocating capital globally and promoting international commerce. Financial institutions covered include the FED, IMF, World Bank, investment banks and others. Detailed exploration of the history and functions of these institutions. 4 lectures.

**BUS 302. International and Cross Cultural Management. 4 units.**

Prerequisite: GE Area A, C1, C2, D1-D4.

Dimensions of culture and its variations within and across nations. Impact of culture on managing in a global context. Development of managerial competencies requisite to working in and supervising multicultural groups in international corporations. Frameworks for analyzing cultural and contextual influences on organizational behavior, culture shock and readjustment, expatriation and repatriation, cultural change and innovation, intercultural conflict, and ethical dilemmas. Case studies, behavioral simulations, self-assessments and fieldwork. 4 lectures.

**BUS 303. Introduction to International Business. 4 units.**

Prerequisite: A grade of C- or better in ECON 222.

Special terms, concepts, and institutions associated with the environment in which international companies operate. Students will be enabled to understand, analyze and offer solutions to global business problems. 4 lectures.

**BUS 304. Establishing International Supply Chains. 4 units.**

Prerequisite: Consent of instructor. Recommended: ECON 201 or ECON 221 or ECON 222.

Development of effective supply chains that cross national boundaries with specific examples of import/export between the United States and target country. Study tour to target country as an essential course activity. Pre-trip lectures, readings and assignments; on-the-road business tours, and post-trip import-export proposal. Conducted in English; no prior international business or travel experience required. Passport and Visa required. Schedule of Classes will list country selected. 3 lectures, 1 activity.

**BUS 308. Business Law II. 4 units.**

Prerequisite: BUS 207 or equivalent.

Legal aspects of management decisions, including problems arising in sales, commercial paper, personal property and bailments, secured transactions, bankruptcy, and securities regulation, with emphasis on the uniform commercial code. Case studies. 4 lectures.

**BUS 310. Introduction to Entrepreneurship. 4 units.**

Prerequisite: GE Area A.

Role and impact of entrepreneurship; characteristics and traits of entrepreneurs; social, economic, cultural and policy conditions conducive to entrepreneurship; entrepreneurial thinking; opportunity identification and assessment; the management team; organizational and legal issues; business models; acquiring social and financial capital; managing startup to growth; entrepreneurial behavior in existing organizations; realizing and harvesting value. 4 lectures.

**BUS 311. Managing Technology in the International Legal Environment. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Areas A, D1 and D2.

Analysis of U.S. and international laws regarding technological innovations from economic, social and political perspectives. Copyrights, patents, trademarks, trade secrets, contracts, products liability and privacy. The Internet, computer programs and biotechnology. 4 lectures. Fulfills GE Area D5 except for Business Administration majors.

**BUS 319. Accounting Information Systems. 4 units.**

Prerequisite: BUS 214.

Comprehensive coverage of manual and computerized accounting processes and internal controls. 3 lectures, 1 activity.

**BUS 320. Federal Income Taxation for Individuals. 4 units.**

Prerequisite: BUS 319 or consent of instructor.

Federal income taxation and planning for individuals. Federal role of taxation in the business decision-making process. Issues related to individual income tax preparation and introduction to basic property transactions. 4 lectures.

**BUS 321. Intermediate Accounting I. 4 units.**

Prerequisite: BUS 319.

Comprehensive coverage of financial reporting issues. Covers financial statements, assets other than investments and intangibles, and liabilities. 4 lectures.

**BUS 322. Intermediate Accounting II. 4 units.**

Prerequisite: BUS 321 with minimum grade of C-; Business majors must have formally declared their concentration to enroll.

Comprehensive coverage of financial reporting issues. Covers investments, intangibles, equities, revenue recognition and the Cash Flows Statement. 4 lectures.

**BUS 342. Fundamentals of Corporate Finance. 4 units.**

Prerequisite: A grade of C- or better in BUS 214; STAT 252, or any 300 level statistics course.

Theory and applications of financing business operations. Financial management of current and fixed assets from internal and external sources. Analysis, planning, control, and problem solving. Some discussion of corporate social responsibility in the context of corporate objective functions. The use of technology in the form of financial calculators and/or spreadsheets. 4 lectures.

**BUS 346. Principles of Marketing. 4 units.**

Prerequisite: A grade of C- or better in the following: for Business Administration and Economics majors, ECON 222 and BUS 207; for Industrial Technology majors, ECON 201; for RPTA majors, either RPTA 210 or RPTA 260; and for all other majors, either ECON 201 or ECON 222.

Development of an understanding of the marketing process: identifying target markets; developing and launching products or services; and managing pricing, promotion, and distribution strategies. 2 lectures, 2 discussions.

**BUS 382. Organizations, People, and Technology. 4 units.**

Prerequisite: GE Area A, C1, C2, D1-D4; Business majors must have formally declared their concentration to enroll.

Evaluation of macro dimensions of business organizations including environment, mission, goals, strategies, structure, people, technology, and internal management systems and processes. Case analysis, experiential class activities. Application to business solutions in technology-oriented settings. 4 lectures.

**BUS 384. Human Resources Management. 4 units.**

Prerequisite: GE Area A, C1, C2, D1-D4.

Introduction to functional areas of the discipline including staffing, compensation, employee development and labor relations. Additional workplace issues addressed include performance and human capital management, employer legal and social responsibility for employee wellbeing, managing a diverse/global workforce, and using human resource information systems. 4 lectures.

**BUS 386. Employee Training and Development. 4 units.**

Prerequisite: BUS 384.

Needs assessment, including organization, person, and task or competency analysis. Design, delivery and evaluation of employee training and human resource development in knowledge-based organizational settings. Performance management and feedback systems; development of learning organizations; human resource information systems (HRIS) applications in career management and training administration. 4 lectures.

**BUS 387. Organizational Behavior. 4 units.**

Prerequisite: GE Area A, ECON 221 and BUS 207. Recommended: STAT 252.

Application of behavioral, social and organizational science concepts to management. Exploration of the interactions between individuals and the organizations in which they work and live. Individual, interpersonal, team, intergroup and organizational levels of analysis included in topics such as expectations, perception, communications, creativity, leadership style, cultural and ethical behavior, group dynamics, team effectiveness and work design. 4 lectures.

**BUS 391. Information Systems. 4 units.**

Prerequisite: BUS 214.

Computer applications in business and industry. Information systems and integrated systems concepts, computer hardware and software, strategic uses of information systems, databases, data warehousing, decision support systems and artificial intelligence, network basics, electronic commerce, systems development, ethical use of information, employing technology in a socially responsible manner, and emerging trends and technologies in information systems. 4 lectures.

**BUS 392. Business Application Development. 4 units.**

Prerequisite: BUS 391.

The fundamental concepts and models of application development needed to understand the key processes related to building functioning business applications and appreciate the complexity of application development. The concepts of computer programming, data structures, problem solving, programming logic, and fundamental design techniques. Up-to-date application development tools and technologies currently used by business enterprises. 4 lectures.

**BUS 393. Database Systems in Business. 4 units.**

Corequisite: BUS 392; Business and Economics majors must have formally declared their concentration to enroll.

Design, development, testing, and implementation of databases for business applications. Data modeling with entity relationship diagrams (ERD) and class diagrams (UML). Data normalization, data integrity, the effect of business rules on data normalization. Advanced queries using structured query language (SQL). Database application development culminating in a database project. 4 lectures.

**BUS 394. System Analysis and Design. 4 units.**

Prerequisite: BUS 391; Business and Economics majors must have formally declared their concentration to enroll.

Systems analysis and design. Project team creation and performance monitoring. Systems development life cycle and project management, process modeling using data flow diagrams, data modeling with Entity/Relationship (E/R) diagrams, Computer Assisted Software Engineering (CASE) tools, object modeling with Unified Modeling Language (UML), and prototype development. 4 lectures.

**BUS 395. Systems Design and Implementation. 4 units.**

Prerequisite: BUS 394 (with a minimum grade of C- or better).

Systems design and implementation, with focus on project management and incorporating software quality into the software development process, including software testing. 4 lectures.

**BUS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Senior standing or consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**BUS 401. General Management and Strategy. 4 units.**

Prerequisite: BUS 342, BUS 346, BUS 387, BUS 391, senior standing, and completion of one of the following: IT 303, IT 326, IT 330, IT 341, or IT 371.

Application of interdisciplinary skills to business and corporate strategy analysis formulation and implementation of business, corporate and global level strategies. Consideration of interdependence between external environments and internal systems. Focus on responsibilities, tasks, and skills of general managers, including socially responsible behavior and governance. Case studies, group problem solving, experiential class activities. Capstone course of Business core curriculum. 4 seminars.

**BUS 402. International Business Management. 4 units.**

Prerequisite: BUS 342, BUS 346, BUS 387 or consent of instructor.

Managerial concepts and techniques for analysis and decision making within international businesses. Environmental and organizational factors influencing multinational operations. Assessing international market opportunities and entry modes. Complexities of multinational management strategy, structure and systems, especially during initial stages of internationalization. Case studies and simulations. 4 lectures.



**BUS 403. Advanced Seminar in International Management. 4 units.**

Prerequisite: BUS 302 and BUS 402; Business majors must have formally declared their concentration to enroll.

Integration of management concepts within complex multinational organizations. Interdisciplinary approach to identifying and assessing multinational and global competitive environments and strategies; structuring and managing interdependent multinational operations; addressing conflicts between domestic and international policies and practices in multinational enterprises. Case studies, simulations, group analysis and problem solving. 4 seminars.

**BUS 404. Governmental and Social Influences on Business. 4 units.**

Prerequisite: BUS 207 and ECON 222.

Analysis from legal, economic, political, and ethical perspectives, of the changing domestic and international environments of the business enterprise. Topics include administrative law, agencies and regulatory policy, antitrust law, public policy analysis, business-government relations, and corporate responsibility. Case studies. 4 lectures.

**BUS 405. Joint Ventures and Alliances. 4 units.**

Prerequisite: BUS 342, BUS 346, and BUS 387.

Examination of joint ventures and alliances between organizations, using cross-cultural, interdisciplinary perspective. Alliance motives, types and traits. Processes for partner selection, negotiation, structure, operation, and performance assessment of international and cross-cultural alliances. Lectures, case studies, and simulation. 4 lectures.

**BUS 406. Managing Mergers, Acquisitions and Divestitures. 4 units.**

Prerequisite: BUS 342, BUS 346, and BUS 387.

Issues associated with analyzing, negotiating, and managing mergers, acquisitions and divestitures (MADS) using cross-cultural, interdisciplinary perspective. Rationale for decision to pursue MADS and processes for identifying targets; valuing and negotiating MADS; staffing and human resource management issues; strategic control and integration; and cross-cultural conflict and divided loyalties in domestic and international MADS. Lectures, case studies and simulation. 4 lectures.

**BUS 407. Managing People in Global Markets. 4 units.**

Prerequisite: BUS 387.

Impact of cultural and strategic differences on management of people in multinational organizations. Critical human resource issues in domestic and international operations. 4 lectures.

**BUS 409. Law of Real Property. 4 units.**

Prerequisite: Senior standing.

Legal problems of acquisition, ownership and transfer of real property. Contracts, agency, estates, and co-ownership, mortgages and deeds, covenants, conditions, and restrictions, easements, landlord-tenant, and zoning. 4 lectures.

**BUS 410. The Legal Environment of International Business. 4 units.**

Prerequisite: BUS 207 and ECON 222.

U.S., foreign, and international law affecting international business transactions. U.S. and foreign cultural, ethical, and political norms and legal institutions, and their effect on law and business. 4 lectures.

**BUS 412. Advanced Managerial Accounting. 4 units.**

Prerequisite: BUS 215.

Product costing systems including hybrid costing systems, management control systems, cost allocation, activity based costing, cost information for decision making, new manufacturing environments, and strategic control systems. International dimension integrated in the course content. 4 lectures.

**BUS 416. Volunteer Income Tax Assistance - Senior Project. 4 units.**

Prerequisite: BUS 320 or equivalent, senior standing.

Training and practice in the preparation of state and federal individual income tax returns. Coverage of the deductions and credits applicable to individuals. Students provide free tax assistance and income tax preparation to community residents under the supervision of qualified professionals. 2 lectures, 2 activities.

**BUS 417. Taxation of Corporations and Partnerships. 4 units.**

Prerequisite: BUS 320 or equivalent.

Comparative study of the taxation of C corporations and flow-through tax entities, including S corporations, partnerships and limited liability companies. 4 lectures.

**BUS 418. Listening to the Customer. 4 units.**

Prerequisite: BUS 346.

Revelation of customer insights based on a project-oriented introduction to the research process. Development of research questions, and design and application of multiple research methods (e.g. secondary, observation, interview, focus group, and survey research). Exploratory and confirmatory approaches leading to the analysis, interpretation, and presentation of results. 4 lectures.

**BUS 419. Strategic Marketing Measurement. 4 units.**

Prerequisite: BUS 418, STAT 252; Business majors must have formally declared their concentration to enroll.

Development of skills to gather, analyze, and report information critical for marketing decision making. Focus on primary data collection and analytical techniques (e.g. experimental design, descriptive statistics, cross-tabulation, ANOVA, and regression). Other methods may include data mining, GIS, and customer relationship management (CRM). 4 lectures.

**BUS 422. Accounting for Government and Not-For-Profit Entities. 4 units.**

Prerequisite: BUS 321.

Accounting and reporting by state and local governments and not-for-profit entities. State and local governmental topics include: fund structures, budgetary accounting, the modified accrual basis of accounting, reporting concepts and practices, contributions, restricted resources, endowments. 4 lectures.

**BUS 424. Accounting Ethics. 4 units.**

Prerequisite: Consent of instructor.

Study of professional values underlying the accounting profession. Methods for incorporation of ethical reasoning into accounting decision-making. Role of accounting ethics in development of financial statements. 4 lectures.

**BUS 425. Auditing. 4 units.**

Prerequisite: BUS 322.

Survey of the auditing environment including institutional, ethical, and legal liability dimensions. Introduction to audit planning, assessing materiality and audit risk, collecting and evaluating audit evidence, considering the internal control structure, substantive testing, and reporting. 4 lectures.

**BUS 427. International Accounting. 4 units.**

Prerequisite: BUS 321 or equivalent.

Consideration of conceptual, managerial, professional and institutional issues of international accounting. 4 lectures.

**BUS 430. Internship/Cooperative Education. 2-12 units.**

CR/NC

Prerequisite: Approval of area chair, junior standing, and a CPSLO cumulative GPA of at least 2.5 without being on academic probation.

Work experience in business, industry, government and other areas of student career interest. Periodic written progress reports, final report, and evaluation by work supervisor required. Credit/No Credit grading. Major credit limited to 4 units; total credit limited to 12 units.

**BUS 431. Security Analysis and Portfolio Management. 4 units.**

Prerequisite: BUS 342, ECON 339, or STAT 324; Business majors must have formally declared their concentration to enroll.

In-depth analysis of equity market and its instruments. Detailed study of leading stock valuation models. Impact of changes in the firm's fundamentals and in macroeconomic factors on stock prices. Brief introduction to equity and index derivatives. 4 lectures.

**BUS 432. Insurance Planning and Risk Management. 4 units.**

Prerequisite: BUS 342.

Introduction to insurance planning and risk management and its role in financial planning. Key concepts include determining risk exposure and selecting insurance products. Legal aspects of property and liability policy, life, health, and social insurance. 4 lectures.

**BUS 433. International Finance. 4 units.**

Prerequisite: BUS 431 or BUS 439.

Financial management of international business. International capital and money markets, international financial institutions, special problems in evaluating direct foreign investment, and financial techniques used in international business operations. 4 lectures.

**BUS 434. Real Estate Finance. 4 units.**

Prerequisite: BUS 342.

Analyses of real estate financing techniques and funding sources for development projects. Effects of federal, state, and local taxes on real estate investments. In-depth investigation and computer analyses of real estate investment projects. 4 lectures.

**BUS 435. Real Estate Investment. 4 units.**

Prerequisite: BUS 342.

Intensive investigation and computer analysis of real estate investment opportunities. Problems in real estate and property management. 4 lectures.

**BUS 436. Entrepreneurial Finance. 4 units.**

Prerequisite: BUS 342.

Process of financing new and fast-growing firms. Readings on the venture capital process, from seed capital through the initial public offering. Valuation of firms seeking venture capital, and those planning their initial public offering. Valuing convertible securities. Real options valuation. 4 seminars.

**BUS 437. Retirement and Estate Planning. 4 units.**

Prerequisite: BUS 342.

Retirement planning and employee benefits; Social Security and Medicare; types of retirement plans; qualified plan characteristics; distribution options; and group insurance benefits. Trusts, power of attorney, and probate. 4 lectures.

**BUS 438. Advanced Corporate Finance. 4 units.**

Prerequisite: BUS 431 and BUS 439.

Corporate finance with an emphasis on managing the corporation to create shareholder value. Detailed treatment of topics such as capital budgeting, capital structure, economic value-added, corporate distribution policy, financial distress, and mergers and acquisitions. 4 lectures.

**BUS 439. Fixed Income Securities Market. 4 units.**

Prerequisite: BUS 342; Business majors must have formally declared their concentration to enroll.

Development of analytical skills for properly valuing fixed income securities. Bond pricing, yields, and volatility; interest rate term structure and yield curve; securities, market structure, and analytical techniques; bond portfolio strategies and an introduction to interest rate derivatives. 4 lectures.

**BUS 441. Computer Applications in Finance. 4 units.**

Prerequisite: BUS 342.

A combination lecture/computer lab course focusing on computer acquisition of financial data and the subsequent application of financial theory and analysis to this data so as to facilitate financial decision making. 3 lectures, 1 activity.

**BUS 442. Introduction to Futures and Options. 4 units.**

Prerequisite: BUS 431.

An in-depth analysis of derivatives markets and instruments. Emphasis on the valuation of futures, options, swaps, and other derivative securities. 4 seminars.

**BUS 443. Case Studies in Finance. 4 units.**

Prerequisite: BUS 431 or BUS 439.

Development of analytical and decision-making techniques in applying financial theory to business management problems. Emphasizes working capital management, financial analysis and forecasting, mergers and acquisitions, and other current topics in finance, including financial ethics. Cases are used to emphasize practical problems. 4 lectures.

**BUS 444. Financial Engineering and Risk Management. 4 units.**

Prerequisite: BUS 431.

Advanced course synthesizing concepts from corporate finance, derivative securities, statistics, and computer science. Emphasis on both computer programming in a matrix programming language (Matlab) to solve practical risk management and valuation problems, and analytical training in the area of stochastic calculus, and its application to derivative security pricing. Practical applications of derivatives for controlling risk in an international corporate environment. 4 lectures.

**BUS 445. Ethics and Behavior Finance. 4 units.**

Prerequisite: BUS 342.

Contemporary theoretical and empirical issues including agency theory, reputation building, game theory, and financial ethics. Discussion of the application of ethics theory to financial decisions. May include lectures, case analyses, student presentations, and guest speakers. 4 lectures.

**BUS 446. International Marketing. 4 units.**

Prerequisite: BUS 346.

Development of an understanding of global marketing strategy. Acquisition of information about international markets and its use to describe customers, understand markets, and make marketing mix decisions. 4 lectures.

**BUS 451. New Product Development and Launch. 4 units.**

Prerequisite: BUS 418, STAT 252; Business and Economics majors must have formally declared their concentration to enroll.

Project-based skills for developing new products and planning for their launch. Major phases of new product development: opportunity identification and analysis, idea identification and selection, concept development, product design and positioning, pre-market testing and planning for the launch. Introduction to data-gathering methods used to design successful new products. 4 lectures.

**BUS 452. Product Management. 4 units.**

Prerequisite: BUS 419.

Development of individual and project-based skills in managing products in the growth, maturity, and decline stages of their life cycles. Emphasis on distribution, pricing, and communication strategies required to maintain distinctive product advantages. May include developing a comprehensive communication plan and acquiring market-tracking skills. 4 lectures.

**BUS 454. Marketing Projects. 4 units.**

Prerequisite: BUS 451 and BUS 452.

Client-based course providing an opportunity to apply marketing abilities. Teams draw upon research, analytical, and strategic marketing skills to develop an actionable plan that addresses a critical marketing challenge faced by an organization. Deliverables include research findings and written and verbal presentation to the organization and instructor. 4 lectures.

**BUS 455. Marketing Strategy. 4 units.**

Prerequisite: BUS 451 and BUS 452.

Integration of key marketing concepts using tools such as computer simulations, readings, and/or case studies. Development and implementation of strategic and tactical decisions for companies and brands. 4 lectures.

**BUS 461. Senior Project I. 2 units.**

Prerequisite: Senior standing.

Selection and analysis of a problem under faculty supervision. Problems typical of those which graduates must solve in their fields of employment. Formal report is required. Minimum 120 hours total time.

**BUS 462. Senior Project II. 2 units.**

Prerequisite: Senior standing.

Selection and analysis of a problem under faculty supervision. Problems typical of those which graduates must solve in their fields of employment. Formal report is required. Minimum 120 hours total time.

**BUS 463. Senior Project: Applied Accounting, Auditing and Tax Research. 4 units.**

Prerequisite: Senior standing, BUS 322 and Graduation Writing Requirement.

Practice with multiple authoritative accounting, auditing and tax databases, actual published financial reports, actual tax returns, and business writing. Real world accounting, auditing and tax issues. Activity will include participation in the Low Income Taxpayer Clinic.

**BUS 464. Applied Senior Project Seminar. 4 units.**

Prerequisite: Senior standing.

Selection and analysis of business problems and opportunities in directed individual or group-based projects. Problems typical to those which graduates could encounter in their fields of employment. Formal report required. 4 seminars.

**BUS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**BUS 471. Compensation. 4 units.**

Prerequisite: BUS 384 and STAT 252, or equivalent.

Design and management of compensation systems. Job analysis, job evaluation, wage and salary surveys, incentive systems, gainsharing, benefit administration, pay equity and legal regulation. Simulation and case study development of a wage structure, pay level and individual raise policies, administrative controls, salary and program budgets. 4 lectures.

**BUS 472. Labor Relations. 4 units.**

Prerequisite: BUS 384 or equivalent.

Union organizing. Negotiation and administration of collective agreements. Simulation of bargaining, grievance, and arbitration processes. 4 lectures.

**BUS 473. Employment Law. 4 units.**

Prerequisite: BUS 207, BUS 384 or equivalent.

Federal and state labor policy as expressed in common law, relevant statutes, and executive orders. Effects upon employees, management, protected groups, and the public. Current rules analyzed in a contemporary and historical context. Understanding important workplace and employment problems. 4 lectures.

**BUS 474. Independent Study in Accounting. 4 units.**

Prerequisite: BUS 322.

Individual investigation, research, study or survey of selected topics in accounting, auditing or taxation. Total credit limited to 8 units, repeatable in the same term. Class Schedule will list topic selected.

**BUS 475. Staffing. 4 units.**

Prerequisite: BUS 384 and STAT 252, or equivalent.

Processes by which individuals and organizations become matched to form the employment relationship. Specific issues related to human resources planning, internal and external recruitment and selection. 4 lectures.

**BUS 477. Managing Change and Development. 4 units.**

Prerequisite: BUS 387 or BUS 382 or consent of instructor.

Analysis of development and trends in the field of organization change and development. Application of behavioral and organizational science knowledge and social technology to growth and change of organizations for the purpose of improving effectiveness and sustainability. 4 seminars.

**BUS 478. Organization Design. 4 units.**

Prerequisite: BUS 382 or consent of instructor.

Impact of changing business environment and strategy on design of organizations. Organization design programs, including design models, redesign processes, and guiding principles. Case studies, current redesign projects and field studies. 4 lectures.

**BUS 483. Seminar in Managerial Consultation. 4 units.**

Prerequisite: BUS 382 and BUS 387.

Management consulting in the private and public sectors. Analysis of substantive and process skills required to provide independent and objective advice to clients. Application of consulting knowledge and skills to real client problems and facilitation of change. 4 seminars.

**BUS 486. Human Resource Information Systems. 4 units.**

Prerequisite: BUS 384 and BUS 391.

Application of computers to the management of human resources. Human resource decision support systems and routine transaction processing. Ethical use of information systems in managing the human resource function. Basic system design decisions. Use of information systems to support traditional human resource functional areas. Exposure to enterprise-wide, integrated software. 4 lectures.

**BUS 488. Planning and Managing New Ventures. 4 units.**

Prerequisite: BUS 215, BUS 310, BUS 342, BUS 346 and BUS 436; Business majors must have formally declared their concentration to enroll.

The purpose and process of business planning and the challenges of managing a start-up enterprise. Preparation of a complete business plan: management and organization; product or service; marketing; finance; operating and control systems; growth. 4 seminars.

**BUS 489. Negotiation. 4 units.**

Prerequisite: BUS 387.

Theory and practice of negotiation in a variety of professional and managerial contexts (e.g., labor relations, business acquisitions, compensation, business disputes) and in one-on-one, group, and team-based arrangements. Includes impact of culture, ethics, dispute resolution, coalitions and use of creativity to develop integrative solutions. 4 lectures.

**BUS 491. Decision Support Systems. 4 units.**

Prerequisite: BUS 391, STAT 251 or equivalent; Business and Economics majors must have formally declared their concentration to enroll.

Modeling organizational systems and processes such as computer networks, transportation systems, manufacturing systems, retail systems, etc. Developing computer simulation models and animation of systems to provide decision support in selecting system design alternatives. Applying quantitative methods to model uncertainty and conduct statistical performance analysis. 4 lectures.

**BUS 494. Integrated Information Systems. 4 units.**

Prerequisite: BUS 391; Business and Economics majors must have formally declared their concentration to enroll.

Information systems in an integrated business environment. Collaborative learning with teams analyzing, designing, implementing and evaluating enterprise software. Determine and implement organizational policies and procedures to assure system performance. Coverage of business processes in the areas of accounting, procurement, human resource, production customer relationship and supply chain management. Ethical use of information systems in managing businesses. Role of information systems in conducting business in a socially responsible manner. 4 lectures.

**BUS 495. Software Testing. 4 units.**

CR/NC

Prerequisite: BUS 392.

Theory and practice of software testing, including state-of-the-art practices, design issues, staffing issues, test management issues, and other related areas. Software testing tools utilized for applications testing, and test management. 4 lectures.

**BUS 496. Electronic Commerce. 4 units.**

Prerequisite: BUS 392.

Focus on the technology of electronic commerce, including programming, development environments and security, through a series of lectures, guest speakers, demonstrations, exercises and case studies. Networking, client/server computing, and web/database design concepts. Working e-commerce application required at end of course. 4 lectures.

**BUS 498. Directed Topics in Information Systems. 4 units.**

Prerequisite: BUS 392 (formerly BUS 390) and BUS 393.

Specialized Information Systems (IS) topic selected from the IS areas of current interest. Intended for advanced IS concentration students who want to learn and acquire in-depth IS knowledge and skills. The Schedule of Classes will list topic selected. 4 lectures.

**BUS 499. Data Communications and Networking. 4 units.**

Prerequisite: BUS 391; Business and Economics majors must declare their concentrations in order to enroll.

Combines the fundamental concepts of data communications and networking with practical applications in business. Provides a basic understanding of the technical and managerial aspects of business telecommunication. Introduction to data communications and applications and technical fundamentals, and to network products, technologies, applications, and services. 4 lectures.

**BUS 536. Taxation of Trusts and Estates, and Transfer Taxes. 4 units.**

Prerequisite: Graduate standing or approval from the program director.

Income taxation of trusts and estates as flow-through entities; transfer taxation of gifts and estates, including generation-skipping transfers. 4 lectures.

## Chemistry (CHEM)

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### Chemistry Courses

**CHEM 101. Introduction to the Chemical Sciences. 1 unit.**

CR/NC

Prerequisite: CHEM/BCHEM major or consent of instructor.

Introduction to the chemistry and biochemistry disciplines. Orientation, advising, career opportunities and introduction to the faculty. Designed for first-year CHEM and BCHEM majors. Credit/No Credit grading only. 1 lecture.

**CHEM 106. Introductory Chemistry. 3 units.**

Prerequisite: Passing score on ELM examination, or an ELM exemption, or MATH 104.

Introductory course in chemistry. Measurement, metric system, properties of matter, chemical symbols, atomic structure, chemical formulas, nomenclature, chemical equations, the mole concept, stoichiometry. 3 lectures. Not open to students majoring in Chemistry or Biochemistry. Not open to students with credit for CHEM 110, CHEM 111, CHEM 124, or CHEM 127.

**CHEM 110. World of Chemistry. 4 units.**

GE Area B4; GE Area B3

Prerequisite: Passing score on ELM examination, or an ELM exemption, or MATH 104.

The fundamentals of chemical cause and effect-structure/function relationships. The basic principles of chemistry and their applications to solving human problems in organic materials science, biochemistry, toxicology, environmental science, agriculture, nutrition, and medicine. Not open to students majoring in Chemistry or Biochemistry. Not open to students with credit in CHEM 111, CHEM 124, or CHEM 127. 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

**CHEM 111. Survey of Chemistry. 5 units.**

GE Area B3; GE Area B4

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104. Recommended: High school chemistry or CHEM 106 or equivalent.

Introduction to atomic theory, chemical reactions, bonding, stoichiometry, nomenclature, and solutions. Intended for students who are preparing for CHEM 212/312. Not open to students with credit in CHEM 124 or CHEM 127. Credit will be granted in only one of the following courses: CHEM 110, CHEM 111. 4 lectures, 1 laboratory. Fulfills GE B3 & B4.

**CHEM 124. General Chemistry for the Engineering Disciplines I. 4 units.**

GE Area B4; GE Area B3

Prerequisite: Passing score on ELM, or an ELM exemption, or credit in MATH 104. Recommended: High school chemistry or CHEM 106 or equivalent.

General chemistry concepts presented using a materials science approach with engineering applications. Thermochemistry, bonding, solid-state structures, fundamentals of organic chemistry including polymers. Classwork is presented in an integrated lecture-laboratory format, with an emphasis on computer-based data acquisition, collaborative methods and multimedia-based presentation. Not open to students with credit in CHEM 127. Credit will be granted in only one of the following courses: CHEM 110, CHEM 111, CHEM 124. Equivalent to 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

**CHEM 125. General Chemistry for the Engineering Disciplines II. 4 units.**

GE Area B4; GE Area B3

Prerequisite: CHEM 124, or AP Chemistry score of 5.

A continuation of general chemistry designed for engineering students. Topics include solution chemistry, thermodynamics, kinetics, equilibrium, acids and bases, electrochemistry, and nuclear chemistry. Integration of laboratory with theoretical concepts. Use of computers for data acquisition and multimedia resources. Guided inquiry and collaborative methods emphasized. Not open to students with credit for CHEM 128. 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

**CHEM 127. General Chemistry for Agriculture and Life Science I. 4 units.**

GE Area B4; GE Area B3

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104. Recommended: High school chemistry or equivalent.

Introduction to atomic theory, chemical reactions, bonding, stoichiometry, nomenclature, gas laws, thermochemistry, molecular structure, and intermolecular forces. Intended primarily for students in agriculture and life sciences. Not open to students with credit in CHEM 124. Credit will be granted in only one of the following courses: CHEM 110, CHEM 111, CHEM 127. 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

**CHEM 128. General Chemistry II. 4 units.**

Prerequisite: CHEM 127 or AP Chemistry score of 5.

Continuation of CHEM 127. Colligative properties, colloids and solutions, oxidation-reduction reactions, electrochemistry, kinetics, equilibria, and thermodynamics. Intended primarily for students whose majors are in the College of Science and Mathematics. Not open to students with credit for CHEM 125. 3 lectures, 1 laboratory.

**CHEM 129. General Chemistry III. 4 units.**

Prerequisite: CHEM 125 or CHEM 128.

Continuation of CHEM 128. Acid and base equilibria, buffers, transition elements, solubility, complex ions, hybrid orbital theory, molecular orbital theory, and nuclear chemistry. Laboratory study of the chemical properties and semi-micro qualitative analysis of the representative group elements of the periodic table. 3 lectures, 1 laboratory.



**CHEM 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: CHEM 111, CHEM 124, or CHEM 127 and consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**CHEM 201. Undergraduate Research. 1-3 units.**

CR/NC

Prerequisite: Consent of instructor.

Laboratory research under faculty supervision. Credit/No Credit grading only. Total credit limited to 6 units.

**CHEM 212. Introduction to Organic Chemistry. 5 units.**

Prerequisite: CHEM 111, CHEM 124 or CHEM 127.

Structure, isomerism, nomenclature, fundamental reactions of major functional groups and applications of organic chemicals in agriculture, medicine, industry, and the home. CHEM 212 accepted in lieu of CHEM 312, but not for upper division credit. Not open to students with credit in CHEM 312, CHEM 216/316. 4 lectures, 1 laboratory.

**CHEM 216. Organic Chemistry for Life Sciences I. 5 units.**

Prerequisite: CHEM 125 or CHEM 129.

Structure, bonding, nomenclature, isomerism, stereochemistry and physical properties of organic compounds. Introduction to spectroscopy. Reactions and mechanisms of alkanes, alkenes, alkylhalides. Applications of organic chemistry to biological systems. Microscale laboratory techniques in organic chemistry. CHEM 216 accepted in lieu of CHEM 316, but not for upper division credit. Not open to Biochemistry or Chemistry majors. Not open to students with credit in CHEM 316. 4 lectures, 1 laboratory.

**CHEM 217. Organic Chemistry for Life Sciences II. 4 units.**

Prerequisite: CHEM 216/316.

Properties and reactions of carbonyl compounds, alcohols, and organic halides with an overview of the mechanisms of the reactions. Introductory concepts and applications of infrared and NMR spectroscopy. CHEM 217 accepted in lieu of CHEM 317, but not for upper division credit. Not open to Biochemistry or Chemistry majors. Not open to students with credit in CHEM 317. 3 lectures, 1 laboratory.

**CHEM 218. Organic Chemistry for Life Sciences III. 3 units.**

Prerequisite: CHEM 217/317.

Properties and reactions of amines, heterocyclic and aromatic compounds with an overview of the mechanisms of the reactions. Introductory concepts and applications of ultraviolet spectroscopy and mass spectrometry. CHEM 218 accepted in lieu of CHEM 318, but not for upper division credit. Not open to Biochemistry or Chemistry majors. Not open to students with credit in CHEM 318. 3 lectures.

**CHEM 219. Organic Chemistry Laboratory III for Life Sciences. 1 unit.**

CR/NC

Prerequisite: C- or better in CHEM 217. Corequisite: CHEM 218/318.

Practice in multistep organic synthesis, enzymatic organic chemistry, biomimetic organic chemistry. Not open to Biochemistry or Chemistry majors. 1 laboratory.

**CHEM 222. Introduction to Computational Chemistry. 2 units.**

Prerequisite: CHEM 129; CHEM 216 or CHEM 316; MATH 142 or MATH 162.

Introduction to chemical structure and behavior by computational chemistry techniques. Applications include scientific visualization, molecular modeling, geometry optimization, transition states and molecular dynamics. 1 lectures, 1 laboratory.

**CHEM 231. Quantitative Analysis. 5 units.**

Prerequisite: CHEM 129.

Theory and application of chemical equilibrium to analytical problems. Survey of important analytical methods with stress placed on the theory and application associated with titrimetric and spectrophotometric analysis. 3 lectures, 2 laboratories.

**CHEM 252. Laboratory Glassblowing. 1 unit.**

Prerequisite: CHEM 111, CHEM 124 or CHEM 127.

Techniques of glassblowing applied to the making of simple laboratory apparatus. 1 laboratory.

**CHEM 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CHEM 312. Survey of Organic Chemistry. 5 units.**

Prerequisite: CHEM 111, CHEM 124 or CHEM 127.

Structure, isomerism, nomenclature, fundamental reactions of major functional groups and applications of organic chemicals in agriculture, medicine, industry, and the home. Not open to students with credit in CHEM 212 or CHEM 216/316. 4 lectures, 1 laboratory.

**CHEM 313. Survey of Biochemistry and Biotechnology. 5 units.**

Prerequisite: CHEM 212, CHEM 216, CHEM 312, or CHEM 316.

Chemistry of biomolecules including carbohydrates, proteins, fats, vitamins, enzymes and hormones. Basic molecular biology with applications to biotechnology and genetic engineering. Practical intermediary metabolism of prokaryotic and eukaryotic systems. 4 lectures, 1 laboratory.

**CHEM 316. Organic Chemistry I. 5 units.**

Prerequisite: CHEM 125 or CHEM 129.

Structure, bonding, nomenclature, isomerism, stereochemistry and physical properties of organic compounds. Introduction to spectroscopy. Reactions and mechanisms of alkanes, alkenes, alkynes, cycloalkanes and aromatic compounds. Laboratory techniques in organic preparations. Not open to students with credit in CHEM 216. 4 lectures, 1 laboratory.

**CHEM 317. Organic Chemistry II. 5 units.**

Prerequisite: CHEM 216/316.

Reactions and reaction mechanisms of organic halides, alcohols, phenols, epoxides, ethers, carboxylic acids and their derivatives, aldehydes, ketones; acidity and basicity; infrared and NMR spectroscopy. Not open to students with credit in CHEM 217. 3 lectures, 2 laboratories.

**CHEM 318. Organic Chemistry III. 3 units.**

Prerequisite: CHEM 217/317.

Chemistry of amines, aromatic compounds, heterocycles, macromolecules, some biomolecules, carbanions, rearrangement and ultraviolet and mass spectrometry. Not open to students with credit in CHEM 218. 3 lectures.

**CHEM 319. Advanced Organic Chemistry Laboratory. 2 units.**

Prerequisite: Concurrent or prior enrollment in CHEM 218/318.

Practice in multiple step organic synthesis, column chromatography, vacuum distillation, enzymes as chemical reagents, inert atmosphere techniques, introduction to FT NMR spectroscopy and mass spectrometry, survey of organic chemical literature. 2 laboratories.

**CHEM 331. Quantitative Analysis. 5 units.**

Prerequisite: CHEM 129.

Theory and application of chemical equilibrium to analytical problems. Survey of important analytical methods with stress placed on the theory and application associated with titrimetric and spectrophotometric analysis. 3 lectures, 2 laboratories.

**CHEM 341. Environmental Chemistry: Water Pollution. 3 units.**

Prerequisite: CHEM 129 and CHEM 212/312 or CHEM 216/316.

Chemical aspects of water and water pollution: alkalinity; acid deposition, particularly relating to lake and stream acidification and forest decline; drinking water treatment and THMs; wastewater treatment; detergents, builders, and eutrophication; pesticides; other toxic organic compounds such as PCBs and dioxin; hazardous wastes; toxic elements such as Pb, Hg, Sn, Cd, and Se. 3 lectures.

**CHEM 349. Chemical and Biological Warfare. 4 units.**

GE Area F

Prerequisite: Junior standing, completion of GE Area B, including a chemistry course (CHEM), and a course in biology (BIO, MCRO or ZOO).

History, development, and use of chemical and biological warfare (CBW). Chemical and biological disarmament. Production and destruction of CBW agents. Uses of CBW. CBW terrorism. Ethics of CBW. 2 lectures, 2 seminars. Fulfills GE Area F.

**CHEM 350. Chemical Safety. 1 unit.**

Prerequisite: CHEM 212/312 or CHEM 216/316.

Laboratory regulations, equipment hazard analysis, hazardous chemicals, classification of chemicals, toxic materials handling, reaction hazards, radiation, emergency procedures, safety management programs and legal concerns. Includes project. 1 lecture.

**CHEM 351. Physical Chemistry I. 3 units.**

Prerequisite: CHEM 129, PHYS 122 or PHYS 132, MATH 143.

Basic physical chemistry for the study of chemical and biochemical systems. Kinetic-molecular theory, gas laws, principles of thermodynamics. Not open to students with credit in CHEM 305. 3 lectures.

**CHEM 352. Physical Chemistry II. 3 units.**

Prerequisite: CHEM 351.

Application of physical chemistry to chemical and biochemical systems. Electrochemistry, kinetics, viscosity, surface and transport properties. 3 lectures.

**CHEM 353. Physical Chemistry III. 3 units.**

Prerequisite: CHEM 352.

Principles and applications of quantum chemistry. Chemical bonding and molecular structure. Spectroscopy and diffraction. 3 lectures.

**CHEM 354. Physical Chemistry Laboratory. 2 units.**

Prerequisite: CHEM 231/331. Corequisite: CHEM 352.

Experimental studies of gases, solutions, thermochemistry, chemical and phase equilibria, electrochemistry, chemical and enzyme kinetics, computational methods and applications to chemistry and biochemistry. Applicable literature and databases. 2 laboratories.

**CHEM 357. Physical Chemistry III Lab. 1 unit.**

Corequisite: CHEM 353.

Experimental and computational investigations of quantum chemistry, spectroscopy, symmetry and statistical chemistry. 1 laboratory.

**CHEM 371. Biochemical Principles. 5 units.**

Prerequisite: CHEM 217 or CHEM 317; and BIO 161. Recommended: CHEM 231/331.

Chemistry and function of major cellular constituents: proteins, lipids, carbohydrates, and membranes. 4 lectures, 1 laboratory.

**CHEM 372. Metabolism. 4 units.**

Prerequisite: CHEM 371.

Intermediary metabolism of carbohydrates, lipids, amino acids and nucleotides, regulation and integration of metabolic pathways, bioenergetics, photosynthesis, electron transport, nitrogen fixation, biochemical function of vitamins and minerals. 4 lectures.

**CHEM 373. Molecular Biology. 3 units.**

Prerequisite: CHEM 371.

Structure of nucleic acids and chromosomes. Mechanisms and regulation of nucleic acid and protein synthesis. Molecular biology techniques. 3 lectures.

**CHEM 377. Chemistry of Drugs and Poisons. 3 units.**

Prerequisite: CHEM 313 or CHEM 371.

Introduction to pharmacology and toxicology: history, sources, development and testing, physical and chemical properties, biochemical and physiological effects, mechanisms of action, and the therapeutic uses and toxicology of common drugs and poisons. 3 lectures.

**CHEM 400. Special Problems for Advanced Undergraduates. 1-3 units.**

Prerequisite: Junior standing and consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 3 units per quarter. 1-3 laboratories.

**CHEM 401. Advanced Undergraduate Research. 1-3 units.**

CR/NC

Prerequisite: Consent of instructor.

Laboratory research under faculty supervision. Credit/No Credit grading only. Total credit limited to 6 units. 4 units may be applied to approved chemistry electives. 1-3 laboratories. Crosslisted as CHEM/SCM 401.

**CHEM 405. Advanced Physical Chemistry. 3 units.**

Prerequisite: CHEM 353 or consent of instructor.

Selected advanced topics in physical chemistry, which may include statistical mechanics, computational chemistry, nonequilibrium thermodynamics, lasers in chemistry, solid-state and/or advanced spectroscopy. Total credit limited to 6 units. 3 lectures.

**CHEM 414. Advanced Organic Chemistry - Mechanisms. 3 units.**

Prerequisite: CHEM 318.

A mechanistic study of organic reactions; correlation of structure with reactivity; reaction intermediates and species involved in reactions; methods of probing reaction mechanisms. 3 lectures.

**CHEM 419. Bioorganic Chemistry. 3 units.**

Prerequisite: CHEM 218 or CHEM 318; CHEM 313 or CHEM 371.

Methods of investigating reaction mechanisms, mechanisms of chemical catalysis, organic models of enzymes, chemistry of vitamins that serve as enzyme cofactors, chemistry of the phosphate group, synthesis of biomolecules. 3 lectures.

**CHEM 420. Advanced Organic Chemistry - Synthesis. 3 units.**

Prerequisite: CHEM 218/318.

Modern methods of organic synthesis. Carbon-carbon bond forming reactions, functional group transformations, protecting groups, strategies of total synthesis of natural products. 3 seminars.

**CHEM 439. Instrumental Analysis. 5 units.**

Prerequisite: CHEM 231/331, CHEM 354. Recommended: CHEM 353.

Theory, practice and method selection of modern instrumental analytical techniques, including spectroscopic, electrochemical, chromatographic and thermal methods. Current industrial applications. Laboratory work emphasizes optimization of experimental parameters. 3 lectures, 2 laboratories.

**CHEM 441. Bioinformatics Applications. 4 units.**

Prerequisite: Junior standing; BIO 161 or BIO 303. Recommended: BIO 302 or BIO 303 or BIO 351 or CHEM 373.

Introduction to new problems in molecular biology and current computer applications for genetic database analyses. Use of software for: nucleic acid, genome and protein sequence analysis; genetic databases, database tools; industrial applications in bioinformatics; ethical and societal concerns. 3 lectures, 1 laboratory. Crosslisted as BIO/CHEM 441.

**CHEM 444. Polymers & Coatings I. 3 units.**

Prerequisite: CHEM 212/312 or CHEM 216/316.

Physical properties of polymers and coatings and their measurement. Molecular weight averages, glass transition, thermodynamics of polymers. Viscoelastic properties, rheology, molecular weight determination. Thermal analysis, spectroscopic analysis, mechanical testing. 3 lectures.

**CHEM 445. Polymers & Coatings II. 3 units.**

Prerequisite: CHEM 217/317 and CHEM 444.

Introduction to polymerization methods and mechanisms. Chemistry of initiators, catalysts and inhibitors, kinetics of polymerization. Uses of representative polymer types. Synthesis, film formation, structure and properties of polymers commonly used in coatings and adhesives. 3 lectures.

**CHEM 446. Surface Chemistry of Materials. 3 units.**

Prerequisite: CHEM 351, MATE 380 or ME 302.

Surface energy. Capillarity, solid and liquid interface, adsorption. Surface areas of solids. Contact angles and wetting. Friction, lubrication and adhesion. Relationship of surface to bulk properties of materials. Applications. 3 lectures. Crosslisted as CHEM/MATE 446.

**CHEM 447. Polymers and Coatings Laboratory I. 2 units.**

Corequisite: CHEM 444.

Experimental techniques of producing and characterizing coatings. Polymer characterization and analysis. Molecular weight analysis using viscometry, light scattering, and gel permeation chromatography. Thermal analysis using differential scanning calorimetry, thermal mechanical analysis and dynamic mechanical analysis. Polymer rheology. Infrared, Raman and FT-NMR spectroscopy. Atomic force microscopy. 2 laboratories.

**CHEM 448. Polymers and Coatings Laboratory II. 2 units.**

Prerequisite: CHEM 447. Corequisite: CHEM 445.

Polymer synthesis using solution, suspension, bulk, emulsion techniques. Synthesis of chain growth polymers using free radical, anionic, cationic, and other catalysts. Synthesis of step-growth polymers. Kinetics of polymer reactions. Synthesis of resins used in modern coatings. 2 laboratories.

**CHEM 449. Polymers and Coatings Internship. 2 units.**

Prerequisite: CHEM 444 or consent of instructor.

Selected students will spend up to 12 weeks with an approved polymers and coatings firm engaged in production or related business. Time will be spent applying and developing production and technical skills and abilities in the polymers and coatings industry.

**CHEM 450. Polymers and Coatings III. 3 units.**

Prerequisite: CHEM 444 or CHEM 544.

Formulation of modern coatings. Raw materials including resins, solvents, pigments, and additives. Formulation principles for solvent-borne and coatings, waterborne, powder, radiation cure and architectural coatings. Regulatory issues; VOC's. Coating properties, film formation, film defects, application methods, color and color acceptance. Not open to students with credit in CHEM 550. 3 lectures.

**CHEM 451. Polymers and Coatings Laboratory III. 2 units.**

Prerequisite: CHEM 447 or CHEM 547. Corequisite: CHEM 450. Recommended: CHEM 445 or CHEM 545; CHEM 448 or CHEM 548; CHEM 446.

Preparation and characterization of coatings - solvent based and waterborne. Thermoplastic and thermosetting coatings. Coating film preparation methods. Applications of spectroscopy, scanning probe microscopy, thermal analysis, rheology in characterizing coatings. VOC, long-term exposure testing. Measurement of appearance (color, gloss). Not open to students with credit in CHEM 551. 2 laboratories.

**CHEM 458. Instrumental Organic Qualitative Analysis. 3 units.**

Prerequisite: CHEM 324.

Separation, purification, and identification of organic molecules using chemical and instrumental methods, including nuclear magnetic resonance, infrared and ultraviolet spectroscopy and mass spectroscopy, and techniques in high resolution FT-NMR. 1 lecture, 2 laboratories.

**CHEM 459. Undergraduate Seminar. 2 units.**

Corequisite: CHEM 318 and junior standing.

Oral presentation of current developments in chemistry based on current literature. Searching for, organizing and presenting developments from current literature in chemistry and biochemistry. Preparation for employment and for independent work, including senior project, in chemistry and biochemistry. 2 seminars.

**CHEM 461. Senior Project Report. 1 unit.**

Prerequisite: Consent of instructor.

Completion of a senior project report under faculty supervision. Minimum 30 hours time commitment.

**CHEM 463. Honors Research. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Advanced laboratory research. Results are presented in a poster session or other public forum. Total credit limited to 2 units with a maximum of 1 unit per quarter. 1 laboratory.

**CHEM 465. College Teaching Practicum. 1-2 units.**

CR/NC

Prerequisite: Junior standing, CHEM 231/331 (or permission of instructor), evidence of satisfactory preparation in chemistry; department chair approval required.

Teaching assignment in an undergraduate college classroom. Includes teaching and related activities under the direction of a permanent faculty member in the Department of Chemistry and Biochemistry. Total credit limited to 4 units.

**CHEM 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: CHEM 351, CHEM 217 or CHEM 317.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**CHEM 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**CHEM 474. Protein Techniques Laboratory. 2 units.**

Prerequisite: CHEM 371 or consent of instructor.

Experiments in protein purification and analysis from recombinant sources. Ion-exchange and affinity chromatography, electrophoresis and blotting. UV, chemical, immune, and fluorescent detection. Enzyme kinetic analysis. 2 laboratories.

**CHEM 475. Molecular Biology Laboratory. 3 units.**

Prerequisite: BIO 161, and grade of C- or better in BIO 351 or CHEM 373 or consent of instructor.

Introduction to techniques used in molecular biology and biotechnology; DNA extraction, characterization, cloning, Southern blotting, reverse transcription, polymerase chain reaction, and sequencing analysis. 1 lecture, 2 laboratories. Crosslisted as BIO/CHEM 475. Formerly BIO/CHEM 375.

**CHEM 476. Gene Expression Laboratory. 2 units.**

Prerequisite: BIO/CHEM 475; CHEM 313 or CHEM 371, or graduate standing in Biological Sciences.

Heterologous gene expression of a recombinant protein in a microbial system: gene cloning, construction of expression plasmid, DNA sequence analysis, transformation of microbial host, selection and analysis of transformed host cells, expression and purification of recombinant protein. 2 laboratories. Crosslisted as BIO/CHEM 476.

**CHEM 477. Biochemical Pharmacology. 3 units.**

Prerequisite: CHEM 218 or CHEM 318.

Consideration of current selected topics in pharmacology and drug targeting. 3 lectures.

**CHEM 478. Pharmaceutical Development. 3 units.**

Prerequisite: CHEM 218 or CHEM 318.

Process of drug development from research clinical candidate to market. Chemical process development, including synthesis optimization, scale up, pilot plant work, manufacturing, and good manufacturing procedure (GMP's). Role of pharmaceuticals in drug development, including various forms of formulation, analytical development requirements, and quality assurance. Project planning and timeline management, clinical trials, and regulatory affairs, including FDA filings. 3 lectures.

**CHEM 481. Inorganic Chemistry. 3 units.**

Prerequisite: CHEM 352, and CHEM 231/331 or consent of instructor.

A systematic study of chemical and physical properties of inorganic compounds based on periodic groupings with emphasis on chemical bonding and structure. Topics will include coordination chemistry and kinetics, organometallic chemistry, advanced acid-base relationships and bonding theories plus other selected topics. 3 lectures.

**CHEM 484. Inorganic Chemistry Laboratory. 2 units.**

Prerequisite: CHEM 481.

Laboratory techniques in inorganic chemistry. Synthetic and analytic techniques as applied to inorganic and organometallic chemistry. 2 laboratories.

**CHEM 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. 2 units only applicable to approved chemistry electives. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

**CHEM 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. 2 units only applicable to approved chemistry electives. Major credit limited to 4 units; total credit limited to 24 units. Credit/No Credit grading only.



**CHEM 500. Special Problems for Graduate Students. 1-3 units.**

Prerequisite: Graduate standing and consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 3 units per quarter.

**CHEM 528. Nutritional Biochemistry. 3 units.**

Prerequisite: CHEM 313 or CHEM 372 or consent of instructor.

Nutritional aspects of biochemistry. Lecture, library research and student presentations. Topics include vitamins and minerals, essential and energy providing nutrients, deficiency, degenerative and genetic diseases of metabolism. Emphasis on current research and controversy. 3 lectures.

**CHEM 544. Polymer Physical Chemistry and Analysis. 3 units.**

Prerequisite: CHEM 212/312 or CHEM 216/316 or equivalent; CHEM 351 or equivalent.

Physical properties of polymers and coatings and their measurement; molecular weight averages, glass transition, thermodynamics of polymers, viscoelastic properties, rheology; molecular weight determination, thermal analysis, spectroscopic analysis, mechanical testing, atomic force microscopy. Special individual project. Not open to students with credit in CHEM 444. 3 lectures.

**CHEM 545. Polymer Synthesis and Mechanisms. 3 units.**

Prerequisite: CHEM 544.

Polymerization methods and mechanisms; chemistry of initiators, catalysts and inhibitors; use of representative types; synthesis, structure and properties of polymers commonly used in coatings and adhesives. Special individual project. Not open to students with credit in CHEM 445. 3 lectures.

**CHEM 547. Polymer Characterization and Analysis Laboratory. 2 units.**

Corequisite: CHEM 544.

Polymer characterization and analysis. Molecular weight analysis using viscometry, light scattering, and gel permeation chromatography. Thermal analysis using differential scanning calorimetry, thermal mechanical analysis and dynamic mechanical analysis. Polymer rheology. Infrared, Raman and FT-NMR spectroscopy. Atomic force microscopy. Special individual project. Not open to students with credit in CHEM 447. 2 laboratories.

**CHEM 548. Polymer Synthesis Laboratory. 2 units.**

Prerequisite: CHEM 547. Corequisite: CHEM 545.

Polymer synthesis using solution, suspension, bulk, emulsion techniques. Synthesis of chain growth polymers using free radical, anionic, cationic, and other catalysts. Synthesis of step-growth polymers. Kinetics of polymer reactions. Synthesis of resins used in modern coatings. Special individual project. Not open to students with credit in CHEM 448. 2 laboratories.

**CHEM 550. Coatings Formulation Principles. 3 units.**

Prerequisite: CHEM 444 or CHEM 544.

Formulation of modern coatings. Raw materials including resins, solvents, pigments, and additives. Formulation principles for solvent-borne and high solids coatings, water-borne coatings, powder coatings, radiation cure coatings and architectural coatings. Regulatory issues; VOC's. Coating properties, film formation, film defects, application methods, color and color acceptance. Special individual project. 3 lectures.

**CHEM 551. Coatings Formulation Laboratory. 2 units.**

Corequisite: CHEM 550.

Laboratory formulation of modern coatings. Formation of pigment dispersions. Formulation of solvent-borne and high solids coatings, water-borne coatings, powder coatings, radiation cure coatings and architectural coatings. VOC measurements. Measurement of coating properties, film formation, film defects, application methods, color and color acceptance, hiding, gloss. Accelerated weathering. Special individual project. 2 laboratories.

**CHEM 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**CHEM 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**CHEM 590. Graduate Seminar in Polymers and Coatings. 1 unit.**

Prerequisite: Graduate standing in the Polymers and Coatings program or consent of instructor.

Problems and topics in polymers and coatings selected according to the interest and needs of the students enrolled. Total credit limited to 3 units. 1 seminar.

**CHEM 598. Graduate Project. 3 units.**

Prerequisite: CHEM 545, CHEM 547, CHEM 548, CHEM 550, CHEM 551.

Supervised industrial graduate internship in polymers and coatings science. Provides students with industrial research experience. Requires approval of graduate advisor. Students engage in industrial research and development at an approved industry, make regular reports back to graduate advisor, and present formal report and seminar on work each quarter. Total credit limited to 9 units.

**CHEM 599. Graduate Thesis. 3 units.**

Prerequisite: CHEM 545, CHEM 547, CHEM 548, CHEM 550, CHEM 551.

Directed graduate research in specialized advanced topics related to polymers and coatings science, leading to a graduate thesis of suitable quality. Requires approval of graduate advisor. Students are expected to work independently and report weekly to faculty advisor. Total credit limited to 9 units.

## Child Development (CD)

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### Child Development Courses

**CD 102. Orientation to the Child Development Major. 2 units.**

Prerequisite: CD majors only or consent of instructor.

Introduction to the child development major, self-assessments, career opportunities, university and community resources, and the program at Cal Poly. 2 lectures.



**CD 131. Observing and Interacting with Children. 4 units.**

Observation methods and guidance techniques for adults working with children in family, community, and educational settings. 3 lectures, 1 activity.

**CD 200. Special Problems. 1-4 units.**

Supervised investigation, including a written report, of a topic chosen with prior approval of instructor. Total credit limited to 6 units, with a maximum of 4 units per quarter.

**CD 207. The Learner's Development, Culture and Identity in Educational Settings. 4 units.**

Prerequisite: PSY 201 or PSY 202, or admission to the Multiple Subject Credential Program.

Theoretical background of child and early adolescent development within diverse cultural settings and implications for the teaching-learning process. Observations of children in everyday settings. 3 lectures, 1 activity. Participation in public schools requires mandated fingerprint clearance. Crosslisted as CD/EDUC 207.

**CD 230. Preschool Laboratory. 4 units.**

Prerequisite: CD 131, PSY 256, or consent of instructor.

Preliminary teaching experience with children in a preschool laboratory setting. Participant planning, execution and evaluation of age-appropriate activities. Observation is used as the basis for planning for the development of the whole child. 2 lecture, 2 laboratories.

**CD 254. Family Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Introduction to research and theory on family relationships and behavior across the lifespan. Contextual influences, diversity of family forms, and topics such as love, mate selection, marital quality, parenting, gender, household work, divorce, and remarriage. 4 lectures. Crosslisted as CD/PSY 254.

**CD 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CD 304. Infant and Toddler Development. 4 units.**

Prerequisite: PSY 256.

Human development from conception through the second year of life. Examination of theory and research in multiple domains of development. Consideration of environments and activities which enhance the emerging capabilities of infants and toddlers. 4 lectures.

**CD 305. Early and Middle Childhood Development. 4 units.**

Prerequisite: PSY 256 or CD/EDUC 207.

In-depth study of theory and research on development in early and middle childhood, especially within physical, cognitive, social, and emotional domains. Consideration of case studies and current practices in light of theoretical perspectives and current research. 4 lectures.

**CD 306. Adolescence. 4 units.**

Prerequisite: PSY 256 or CD/EDUC 207.

Psychological analysis of the years from prepubescence to young adulthood. Current research on behavior and development during adolescence with emphasis on physical, affective, cognitive, sociocultural, historical, family, peer and school aspects of life during the post-child, pre-adult years. 4 lectures. Crosslisted as CD/PSY 306.

**CD 329. Research Methods in Child Development. 4 units.**

Prerequisite: PSY 256, STAT 217.

Introduction to research methods in child development. Critically evaluating research literature, generating research questions, and conducting observations and interviews with children and adolescents. 3 lectures, 1 activity.

**CD 330. Supervised Internship. 4 units.**

CR/NC

Prerequisite: Psychology and Child Development majors only; CD 230, PSY 323, junior standing and consent of instructor.

Faculty-supervised internship. Role of professional apprentice is experienced and analyzed by each student. Credit/No Credit grading only.

**CD 350. Developmental Issues in Education. 4 units.**

Prerequisite: PSY 256 or CD/EDUC 207.

Current issues concerning how human beings develop and learn. Topics may include motivation, intelligence, peer relations, creativity, learning competence, moral development, and the implications these topics have for education. 4 lectures.

**CD 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Junior standing.

Supervised investigation, including a written report, of a topic chosen with prior approval of instructor. Total credit limited to 6 units, with a maximum of 4 units per quarter.

**CD 401. Perspectives on Child and Adolescent Development. 4 units.**

Prerequisite: CD 304, CD 305, CD 306, CD 329, senior standing or consent of instructor.

Advanced study of theoretical perspectives and research on the development of children and adolescents and the implications for current practice and policy. 4 seminars.

**CD 404. Administration of Children's Programs. 4 units.**

Prerequisite: CD 305.

Organization and administration of programs for young children, preschool and child care centers. Staffing, finance, equipment, records, program evaluations, regulations, public policy and community relations. 4 lectures.

**CD 413. Children, Adolescents & Technology. 6 units.**

Prerequisite: CD 305, CD 306, CD 329.

Examination of research and theory on how children and adolescents use digital technologies and influences on cognitive, social, and identity development. Observations of children's use of various digital technologies, and design of activities that use technology tools to support learning goals. 4 lectures, 2 laboratories.

**CD 424. Children's Learning in Families and Communities. 4 units.**

Prerequisite: Two of the following: CD 304, CD 305, CD 306; junior standing or consent of instructor.

Examination of research on children's learning and development in diverse families and community settings. Effective organizational practices, and formal and informal instructional activities. Further study of sociocultural perspectives and cross-cultural research. 4 lectures.

**CD 430. Advanced Internship. 4 units.**

CR/NC

Prerequisite: CD 330 and consent of instructor; Psychology and Child Development majors only.

Faculty-supervised preprofessional experience in a career-related setting which complements the CD 330 internship. Such roles as master teacher, caseworker, therapeutic intern, administrative aide or program specialist are experienced and analyzed by each student. Credit/No credit grading only.

**CD 431. Assessing Children's Development and Environments. 4 units.**

Prerequisite: CD 304 and CD 305 or two of the following: PSY 419, PSY 420, PSY 421; and CD 329 or PSY 329.

Current developmental and environmental assessments used in childcare and educational settings and in research. Practice using, creating, and evaluating child assessments. 3 lectures, 1 activity. Crosslisted as CD/PSY 431.

**CD 432. Research Internship. 4 units.**

CR/NC

Prerequisite: CD 329, CD 330, or consent of instructor.

Faculty-supervised research experience on various topics related to child and adolescent development. Student apprenticeship with a department faculty member to conduct aspects of a research project. Total credit limited to 8 units. Credit/No Credit grading only.

**CD 461. Senior Project Seminar. 2 units.**

Prerequisite: Completion of GWR, CD 329, and consent of instructor; Psychology and Child Development majors only.

Senior project expectations and skills. Students work alone or in groups to identify appropriate topics, methods and content for the senior project; to be presented in a series of progress reports. Begin literature reviews for completion in CD 462. 2 seminars.

**CD 462. Senior Project. 2 units.**

Prerequisite: CD 461.

Completion of a project under faculty supervision.

**CD 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

## Chinese (CHIN)

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## Chinese Courses

**CHIN 101. Elementary Mandarin Chinese I. 4 units.**

Beginning Mandarin Chinese. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing and introduction to Chinese culture. 3 lectures, 1 activity.

**CHIN 102. Elementary Mandarin Chinese II. 4 units.**

Prerequisite: CHIN 101 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing and introduction to Chinese culture. To be taken in numerical sequence. 3 lectures, 1 activity.

**CHIN 103. Elementary Mandarin Chinese III. 4 units.**

Prerequisite: CHIN 102 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing and introduction to Chinese culture. To be taken in numerical sequence. 3 lectures, 1 activity.

**CHIN 201. Intermediate Mandarin Chinese I. 4 units.**

GE Area C5

Prerequisite: CHIN 103 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Mandarin Chinese within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5. Formerly CHIN 121.

**CHIN 202. Intermediate Mandarin Chinese II. 4 units.**

GE Area C5

Prerequisite: CHIN 201 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Mandarin Chinese within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5. Formerly CHIN 122.

**CHIN 203. Intermediate Mandarin Chinese III. 4 units.**

GE Area C5

Prerequisite: CHIN 202 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Mandarin Chinese within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5.

## City and Regional Planning (CRP)

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### City and Regional Planning Courses

**CRP 101. Introduction to the Profession of City and Regional Planning. 1 unit.**

CR/NC

Introduction to what professional planners do in the public and private sectors and how they help manage growth and change. Credit/No Credit grading only. 1 lecture.

**CRP 201. Basic Graphic Skills. 4 units.**

Basic techniques used in graphic communication for representation of the real world on two-dimensional planes. Use of scale, drawing conventions, orthographic and isometric projections, perspective drawings. Basic design and site analysis skills. Sketching, delineation and rendering including the use of black and white and color techniques. 4 laboratories.

**CRP 202. Urban Design Studio I. 4 units.**

Prerequisite: CRP 201, CRP 211 or consent of instructor.

Exploring elements and principles of environmental design. Understanding the form and character of the designed urban environment. Introduction to problem analysis and problem solving in environmental design. Implications of design decisions and solutions on urban context. Assignments of object, project and system scale in an urban context. 4 laboratories.

**CRP 203. Urban Design Studio II. 4 units.**

Prerequisite: CRP 202.

Applications of basic design fundamentals and skills to the design of environments through design exercises applied to planning. Problem analysis and problem solving skills as applied to environmental design issues. 4 laboratories.

**CRP 204. Theories and Methods of Urban Design. 3 units.**

Prerequisite: CRP 201.

Definition/nature of urban design: a typology of procedures and products. Urban design as a field between planning, architecture, and landscape architecture. Visual assessment and townscape movement. Environmental perception, behavior and spatial fit. Typo-morphology and the architecture of the city. 1 lecture, 2 activities.

**CRP 211. Cities: Form, Culture and Evolution. 4 units.**

Historical overview of the evolution of cities - how the form and function of cities evolved among different societies from antiquity to contemporary times. Includes early cities in Mesopotamia, Central America; Greece and Rome; Renaissance, Baroque; and North and South America. 4 lectures.

**CRP 212. Introduction to Urban Planning. 4 units.**

Understanding the issues of contemporary urban growth and change. Development of theories of urban planning and design. Introduction to zoning, planning regulations and codes, and professional practice. Relationship of environmental design disciplines, citizen groups, and individuals to urban planning. 4 lectures.

**CRP 213. Population, Housing and Economic Applications. 4 units.**

Prerequisite: CRP 212, or consent of instructor.

Collection, organization, and presentation of information and data related to population, housing and employment. Analytical applications to estimate population over time, housing demand by type and income and employment by standard classification. Application of urban economic theory related to jobs and housing. 3 lectures, 1 laboratory.

**CRP 214. Land Use and Transportation Studies. 4 units.**

Prerequisite: CRP 212, or consent of instructor.

How cities and regions work. Relationship between human activities and patterns of land use and circulation. Spatial analysis and location theories. Methods for conducting studies to describe, analyze, and map land uses. Regional-scale transportation analysis, traffic impact studies, and multimodal transportation plans. 3 lectures, 1 activity.

**CRP 215. Planning for and with Multiple Publics. 4 units.**

USCP

Prerequisite: Completion of GE Area D1. Recommended: ES 112.

How the social/spatial relationships among racial/ethnic and gender groups are expressed in terms of human settlement patterns, civic involvement and everyday negotiations. Ways in which segregation and marginalization are expressed in western and non-western contexts. 4 lectures. Crosslisted as CRP/ES 215. Fulfills USCP.

**CRP 216. Computer Applications for Planning. 2 units.**

Introduction to the use of computer applications for planners. Includes spreadsheets, statistical applications, database, geographic information systems, and graphics. 1 lecture, 1 laboratory.

**CRP 240. Additional Planning Laboratory. 1-2 units.**

Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 or 2 laboratories.

**CRP 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CRP 314. Planning Theory. 4 units.**

Prerequisite: CRP 212.

Theories of planning. Role of planner in society, purpose of planning, administrative framework in which planning takes place. Alternative approaches to planning, values, ethics in planning. Activities aimed at exploring communicative and participatory aspects of planning theory. 3 lectures, 1 activity.

**CRP 315. Fiscal and Project Feasibility. 4 units.**

Prerequisite: Completion of GE Area D2.

Analysis of the revenue streams and costs involved in project development. Impact analysis of costs and revenues on private and public sectors included. Construction of pro-formas for various project types. 3 lectures, 1 laboratory.

**CRP 334. Cities in a Global World. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of Area A and two courses from D1, D2, D3, D4.

Examination of the changes in the social and spatial organization of urban settlements in the twenty-first century caused by the urbanization and globalization processes. Comparative analysis of the traditional and contemporary cities in the Pacific Rim, South America and Eastern Europe. 4 lectures. Fulfills GE D5 except for City and Regional Planning majors.

**CRP 336. Introduction to Environmental Planning. 4 units.**

Prerequisite: CRP 212.

Examination of the challenges that arise when human and natural systems interact and the tools planners have to manage this interaction. Relevant principles from a variety of disciplines are used to assess environmental problems and identify solutions in human-dominated systems. 4 lectures.

**CRP 338. Digital Cities. 4 units.**

GE Area F

Prerequisite: Junior standing; completion of Area B.

Explores changes in urban form and urban experience associated with advances in digital technology. Implications for the design of places and the distribution of economic and social benefit. Lecture-discussions and opportunities to explore technology initiatives in community building. 4 lectures. Fulfills GE Area F.

**CRP 339. Disaster-Resistant Sustainable Communities. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Creation of safer, more resilient cities through systematic application of urban disaster risk reduction methods that utilize the technology of GIS combined with principles from the engineering and geo-sciences. Emphasis on hazard identification and methods to lower disaster risk. 3 lectures, 1 activity. Fulfills GE Area F.

**CRP 341. Urban Design Studio III. 4 units.**

Prerequisite: CRP 203, CRP 213, or CRP 214.

Urban design theories and methods related to planning and urban development. Integration of circulation, environmental, land-use, and design aspects. Infill or new development projects at the scale of a neighborhood, large PUD, complex circulation corridor, small town or planned community. 4 laboratories.

**CRP 342. Environmental Planning Methods. 4 units.**

Prerequisite: CRP 336 or consent of instructor.

Case studies and applications of theory and methods to regional and environmental systems. Interrelationships between natural, economic, and social and political systems. Application of California Environmental Quality Act and environmental impact assessment methods. Environmental equity and sustainable bioregions. 2 lectures, 2 laboratories.

**CRP 351. Introduction to Emergency Management in California. 3 units.**

Prerequisite: Completion of GE Area B3 or D.

Emergency management emphasizing the Standardized Emergency Management System (SEMS) and Emergency Operations Center (EOC) operations. Earthquake hazard used as the case to explore potential wide geographic impacts, multiple secondary hazards, and multidisciplinary problem-solving methods in natural disasters faced by local governments and communities. 2 lectures, 1 activity. Crosslisted as CRP/DMHS/NR 351.

**CRP 375. Technology and the Environment: A Seminar on Contemporary Issues. 4 units.**

Prerequisite: Completion of GE Area A and two courses from Areas D1, D2, D3.

Interdisciplinary exploration of significant environmental issues (local, regional, national, or global) where technology is a major cause and/or offers a possible solution. 4 seminars. Honors Program membership or nomination by CRP department head. Crosslisted as CRP/HNRS 375.

**CRP 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual or group investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**CRP 401. Disaster Recovery. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Strategies and procedures for public sector management of recovery from disasters. Understanding the role of, and relationship between, federal, state and local agencies to provide assistance to individuals and communities in the post-disaster environment. Issues in the recovery process. 2 lectures, 1 activity. Crosslisted as CRP/DMHS/NR 401.

**CRP 402. Contemporary Urban Design. 4 units.**

Prerequisite: ENGL 134, CRP 203 or graduate standing.

Study of contemporary urban design through the detailed examination of major city/country case studies. Analysis of the cultural, social and political factors influencing the practice of urban design and its major trends in different countries. 4 lectures.

**CRP 404. Environmental Law. 3 units.**

Prerequisite: Junior standing.

Detailed examination of the law governing use and protection of natural resources with focus on the legal institutions entrusted with the public duty of protecting the environment. 3 lectures. Crosslisted as CRP/NR 404.

**CRP 408. Water Resource Law and Policy. 3 units.**

Prerequisite: Junior standing.

Detailed examination of the various legal systems of water use, regulation and management in California and the United States. Discussion on the key concepts and principles of state, federal and interstate water quantity and quality control; focusing on issues and problems, why conflicts occur and how solutions evolve. 3 lectures. Crosslisted as CRP/NR 408.

**CRP 409. Planning Internship. 2 units.**

CR/NC

Prerequisite: Consent of instructor.

Work experience as a supervised employee in a planning-related agency or private firm. Prior contract specifying the product of internship required between student, agency and faculty. Sixty hours work experience for two units of credit. Credit/No Credit grading.

**CRP 410. Community Planning Laboratory I. 4 units.**

Prerequisite: CRP 336, CRP 341 or consent of instructor.

Application of planning theory and methods to the analysis and creation of community plans. Interrelationships in the natural and built environments related to land use, circulation, social and other conditions. Includes field trips and individual, team and interdisciplinary approaches. 4 laboratories.

**CRP 411. Community Planning Lab II. 4 units.**

Prerequisite: CRP 342, CRP 410, or consent of instructor.

Continuation of CRP 410. Application of planning theory and methods to the analysis and creation of community plans. Interrelationships in the natural and built environments related to land use, circulation, social and other conditions. Includes field trips and individual, team and interdisciplinary approaches. 4 laboratories.

**CRP 412. Plan Implementation. 4 units.**

Prerequisite: CRP 212 or consent of instructor.

Theory and practice of plan implementation. Regulation and nonregulatory approaches to plan implementation, including development regulation, economic development, growth management, habitat conservation planning, capital improvement planning, redevelopment programs, and transportation system management. The California Specific Plan will serve as the course model. 4 lectures.

**CRP 420. Land Use Law. 4 units.**

Prerequisite: CRP 212 and upper division standing, or consent of instructor.

Public controls protecting natural environmental systems. Land use and environmental controls. Review of control mechanisms. State and federal legislation. Legal implications of controls, public planning and policy issues. 4 lectures.

**CRP 424. Reflections of Planning in Cinema. 3 units.**

Prerequisite: CRP 212 (or CRP 501 for graduate students), or equivalent.

Analysis of the depiction of planning and related themes in film. Critical reflection through these depictions on the effects of planning practices, institutions, and idiosyncrasies on society. Dialectical discussion of planning history, theory, and practice with themes that emerge from particular films. 2 lectures, 1 activity.

**CRP 427. Local Economic Development Planning. 3 units.**

Prerequisite: Senior standing, or graduate standing, or consent of instructor.

Processes, skills and approaches for planning local economic development. Analysis of theoretical principles and assumptions underlying local economic development programs. Practical applications of alternative strategies and techniques for implementing economic development. 3 seminars.

**CRP 430. Professional Planning Practice. 3 units.**

Prerequisite: CRP 212.

Relationships of planning organizations to other governmental bodies, public agencies and citizen groups. Working in a public planning agency and private practice. Current topics in planning practice. 3 lectures.

**CRP 435. Transportation Theory. 4 units.**

Prerequisite: CRP 212, senior standing, or graduate standing, or consent of instructor.

Circulation and transportation elements of the General Plan. Transportation planning theory, methods and tools related to systematic analysis of city and regional transportation problems including environmental impact assessment. Application of techniques for assessing transportation systems, gravity models, route selections, land use models and relationship to transportation. 3 seminars, 1 activity.

**CRP 436. Collaborative Planning. 4 units.**

Prerequisite: CRP 212 or graduate standing or consent of instructor.

Focus on processes and skills of citizen participation and consensus building. Application of mediation and negotiation techniques. Use of collaboration in forming visions of the future and reaching agreements among multiple interests. Use of group process skills to establish effective communication and agreements. Organizing and operating public meetings. 3 lectures, 1 laboratory.

**CRP 438. Pollution Prevention and Control. 4 units.**

Prerequisite: Senior standing, or graduate standing, or consent of instructor.

Interdisciplinary exploration of policy and planning associated with pollution prevention and control, including institutional, legal, economic, political, social, and technology-related aspects. Includes hands-on activity in small groups. 4 lectures.

**CRP 440. Climate Action Planning. 4 units.**

Prerequisite: CRP 212 or CRP 501. Recommended: CRP 336.

Introduction of the planning role in reducing greenhouse gas emissions and adapting to climate change. Basic climate science, greenhouse gas emissions inventories, politics of climate change, and federal/state policy. Focus on development and implementation of local climate action plans. 4 lectures.

**CRP 442. Housing and Planning. 3 units.**

Prerequisite: Upper division standing or graduate standing.

Understanding housing issues, policies and programs from a planning perspective. Analysis of the economic underpinnings of land markets and housing markets, housing plans, finance, public programs, affordable housing. 3 seminars.

**CRP 444. Infrastructure and Planning Management. 4 units.**

Prerequisite: Senior standing or graduate standing.

Basic infrastructure systems necessary to support urban development. Basic components of systems and how they are planned, financed and managed. 4 seminars.

**CRP 445. Planning and Urban Ecology. 4 units.**

Prerequisite: Upper division or graduate standing.

Introduction to urban ecology as an organizing framework for addressing environmental problems. Provides the opportunity to explore an urban ecological research question through quantitative stream assessment and qualitative social survey data collection and analysis. 3 lectures, 1 laboratory.



**CRP 446. Development Review and Entitlement. 4 units.**

Prerequisite: Upper division standing or graduate standing.

Application of zoning regulations, subdivision ordinances, design standards, building codes, exactions, fees, and related requirements within the development review process leading to land use entitlement. Land development is evaluated from permit application submittal to condition compliance during the plan check, construction, and operational phases of a project. 4 lectures.

**CRP 452. Community Design Methods. 4 units.**

Prerequisite: CRP 201 and CRP 202, Upper division or graduate standing.

Introduction to community design as an interdisciplinary subject. Focus on the active involvement of end-users in the creation and management of built environments. Principles and techniques of participatory design and planning, including charrettes, design games and participatory technologies. Demonstration of participatory techniques through case studies and application. 3 lectures, 1 laboratory.

**CRP 457. GIS Applications in Planning. 3 units.**

Prerequisite: CRP 216 and junior standing, or graduate standing.

GIS applications using computer-based systems in gathering, managing and analyzing information pertinent to planning. Development of skills in systematic data acquisition, processing and maintenance with applied planning problems within the convenient medium of GIS and general information systems. 2 seminars, 1 laboratory.

**CRP 458. Local Hazard Mitigation Planning and Design. 4 units.**

Prerequisite: GE Areas D2, D3 and F or graduate standing.

Creation of safer, more resilient cities through systematic application of urban disaster risk reduction and regeneration planning principles and methods. Integration of insights from the design, resource management, and urban administration professions for minimizing disaster losses and improving recovery activities. 4 lectures.

**CRP 461. Senior Project I. 2 units.**

Prerequisite: CRP 341, CRP 342.

Research and problem analysis in planning. Selection and completion of a project under faculty supervision. Projects typical of problems addressed in planning practice. Project results presented in a formal report. To be completed in two quarters. Minimum 120 hours time.

**CRP 462. Senior Project II. 2 units.**

Prerequisite: CRP 410.

Research and problem analysis in planning. Selection and completion of a project under faculty supervision. Projects typical of problems addressed in planning practice. Project results presented in a formal report. To be completed in two quarters. Minimum 120 hours time.

**CRP 463. Senior Project Professional Practice. 4 units.**

Prerequisite: CRP 410 and senior standing.

Practical applications of city and regional planning theory and practice solving problems related to the built environment. Assembly of project documents and reports that meet the senior project requirement. 4 seminars.

**CRP 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CRP 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**CRP 472. Planning Colloquium. 1 unit.**

CR/NC

Prerequisite: Upper division standing or graduate standing.

Lecture and discussion by faculty members and invited guests on controversial or topical planning related subject matter at campus and/or off-campus locations. Topics to be announced in advance by CRP Department. Total credit limited to 3 units. Credit/No Credit grading only. 1 seminar.

**CRP 483. Special Studies in City and Regional Planning. 1-12 units.**

Prerequisite: Upper division or graduate standing.

Study of special issues and problems through field research and other forms of investigation and involvement in an off-campus setting. Requirements determined prior to individual project through contractual arrangement between the student and the department. Departmental Off-Campus Study Program guidelines apply. The Schedule of Classes will list topic selected.

**CRP 500. Individual Study. 2-3 units.**

Prerequisite: Graduate standing with minimum of 12 core units.

Independent research, studies, or surveys of selected subjects. Total credit limited to 9 units.

**CRP 501. Foundations of Cities and Planning. 4 units.**

Prerequisite: Graduate standing.

Origins and evolutionary stages of settlement patterns and the use of land and natural environment. Changing spatial structure in the development of cities and regions. Beginnings and the historical development of the planning profession. 4 lectures.

**CRP 504. Sustainable Communities. 4 units.**

Prerequisite: Graduate standing.

Introduction to the theory and practice of sustainable communities. Addresses creating communities that foster economic and environmental health, social equity, and citizen participation. Promotes comprehensive planning through urban design, transportation, environment, and community development. Includes hands-on learning and field study. 3 seminars, 1 laboratory.

**CRP 505. Principles Regional Plan. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

History, development and major philosophical approaches of regions and regional planning, both in urban-centered and resource-based regions. Effects of relaxing natural, economic and infrastructure limiting factors on growth and development of regions. Normative hierarchical emphasis of contemporary regional planning compared to emerging paradigms that alter the regional/local planning relationship. 4 seminars.

**CRP 509. Professional Development. 1-3 units.**

CR/NC

Prerequisite: Graduate standing.

Professional development course, including environmental assessment workshop, applied research workshop, internship seminar, and other events. Total credit limited to 3 units. Credit/No Credit grading only. 1-3 activities.

**CRP 510. Planning Theory. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Theory of planning. Development of contemporary planning thought from varying sources and perspectives. Political and social context of planning. Alternative professional roles, and planning processes. Values and ethical issues in planning. 4 seminars.

**CRP 512. Introduction to Visual Communication and GIS. 4 units.**

CR/NC

Prerequisite: Graduate standing.

Introduction to geographic information systems (GIS) as a tool for analyzing and managing spatial information pertinent to planning. Introduction to various drawing media and delineation techniques for planners, including three-dimensional visualization and graphic skills. Integration of visual and digital media in presentations. Credit/No Credit grading only. 4 laboratories.

**CRP 513. Planning Research and Analysis. 4 units.**

Prerequisite: Graduate standing.

Application of research design to planning issues. Comparison of case study, comparative and problem-solving methods. Primary and secondary data sources, including field survey techniques. 4 seminars.

**CRP 516. Demographic and Analytic Tools. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Problem recognition, data selection, analysis and synthesis with applications of system design, statistical techniques and symbolic modeling to urban design and regional growth and development policies. 3 seminars, 1 laboratory.

**CRP 518. Policy Development. 4 units.**

Prerequisite: CRP 501 or POLS 360 or consent of instructor.

Analysis of the social, economic, environmental, political contexts of public policy decisions. Public policy issues and use of concepts and tools related to monitoring and assessment. 4 lectures.

**CRP 520. Feasibility Studies. 4 units.**

Prerequisite: CRP 501 or consent of instructor.

Fundamental analysis for assessing feasibility of public and private development projects. Principles and techniques for analyzing markets and assessing cash flow for individual projects. Economic, fiscal and tax impacts as factors determining public participation in private projects. 4 seminars.

**CRP 525. Plan Implementation. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Theory and practice of plan implementation. Regulatory and non-regulatory frameworks for plan implementation. Growth management, development regulation, capital improvement programs, redevelopment. 4 seminars.

**CRP 530. Planning Agency Management. 4 units.**

Prerequisite: CRP 501 or graduate standing.

Preparation for professional practice in public planning agencies and private firms. Applications of organization theory to planning agencies and firms. Work programs, staff development, budgets, contracting, proposal preparation, conflict management. Relationships with other agencies and firms, clients, public and media. 4 seminars.

**CRP 535. Land Use and Planning Law. 4 units.**

Prerequisite: Graduate standing, or consent of instructor.

The role of law in the planning and regulation of land use. Constitutional constraints on land use regulation. Legal and policy issues for environmental protection and public administration. Relevant legislation and case law. 4 lectures.

**CRP 545. Principles of Environmental Planning. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Environmental planning as a field of inquiry and action. Several parallel streams of knowledge are pursued: environmental planning theory; ecological process and assessment in human-dominated settings; environmental impact assessment; and the review and application of environmental planning tools. 3 seminars, 1 laboratory.

**CRP 548. Principles of Urban Design. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Introduction to philosophies and theories of urban design. Holistic comprehension of forces generating the city form. Exploration of evaluation criteria and critical analysis of the built environment. Cultural, economic, political, behavioral, visual, perceptual, and morphological aspects of urban form. 4 seminars.

**CRP 552. Community and Regional Planning Studio I. 4 units.**

Prerequisite: CRP 501, CRP 525, or consent of instructor.

Application of planning theory and methods to community and regional planning projects. Structured for research, analysis, synthesis, and implementation practice. Interrelationships of natural and built environments, transportation systems, and economic and social conditions at various planning scales. Includes field trips and individual, team and interdisciplinary approaches. 2 seminars, 2 laboratories.

**CRP 553. Project Planning and Design Studio. 4 units.**

Prerequisite: CRP 512 or consent of instructor.

Project-scale planning problems. Arranging structures, circulation systems, utilities and plant material on natural and urban sites to support human activity while minimizing disruption to natural systems. Includes planned unit developments, waterfronts, hillsides, campuses and commercial centers. Field trips. 4 laboratories.

**CRP 554. Community and Regional Planning Studio II. 4 units.**

Prerequisite: CRP 552.

Application of planning theory and methods to community and regional planning projects. Structured for research, analysis, synthesis, and implementation practice. Interrelationships of natural and built environments, transportation systems, and economic and social conditions at various planning scales. Includes field trips, and individual, team and interdisciplinary approaches. 2 seminars, 2 laboratories.

**CRP 556. Community and Regional Planning Studio III. 4 units.**

Prerequisite: CRP 554, or consent of instructor.

Application of planning theory and methods to community and regional planning projects. Individual faculty-assigned laboratory work leading to the completion of a professional quality project focused on a real-world planning task. Structured for research, analysis, synthesis and implementation practice. 3 seminars and supervised work.

**CRP 570. Selected Topics in Planning. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected planning topics. Total credit limited to 12 units. 4 seminars.

**CRP 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**CRP 596. Professional Project. 2-4 units.**

Prerequisite: CRP 513, and consent of the graduate program coordinator.

Individual research under the supervision of the faculty, leading to completion of a professional project based on a real world planning task or carefully constructed simulation. Must be taken in all quarters requiring supervision; minimum of 6 units required for degree. Total credit limited to 8 units.

**CRP 599. Thesis. 2-4 units.**

Prerequisite: CRP 513, and consent of the graduate program coordinator.

Individual research under the general supervision of the faculty, leading to a graduate thesis. Must be taken in all quarters requiring supervision; minimum of 6 units required for degree. Total credit limited to 8 units.

## Civil Engineering (CE)

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### Civil Engineering Courses

**CE 111. Introduction to Civil Engineering. 1 unit.**

CR/NC

Broad overview of the field of civil engineering, including professional societies and their student chapters, professional licensing and registration, professional codes of ethics, the elements of engineering design, and the scope of analysis and design activities undertaken by private- and public-sector civil design professionals. Credit/No Credit grading only. 1 lecture.

**CE 112. Design Principles in Civil Engineering. 2 units.**

Prerequisite: MATH 141.

The civil and environmental engineering design process. Illustration and quantification of design alternatives. Practice in creating and evaluating typical designs drawn from different specialty areas of the field. 2 lectures.

**CE 113. Computer Aided Drafting in Civil Engineering. 2 units.**

Prerequisite: ENVE 111 or CE 112 (may be taken concurrently).

Computer-aided drawing (CAD) and related software to display and quantify engineering designs. Elements of engineering design drawings. Related topics in information technology. 2 laboratories.

**CE 200. Special Problems. 1-2 units.**

CR/NC

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit/No Credit grading only.

**CE 201. Mechanics of Materials. 6 units.**

Prerequisite: ME 211.

Stresses, strains, and deformations associated with torsion, axial, shear, moment, and pressure vessel loadings. Combined loadings and principle representations of the states of stress and strain at a point. Basic failure criteria. Introduction to stability including buckling of columns. Equivalent in content to CE 204 and CE 207. 6 lectures.

**CE 204. Mechanics of Materials I. 3 units.**

Prerequisite: ME 211.

Stresses, strains, and deformations associated with axial, torsional, and flexural loading of bars, shafts, and beams. Analysis of elementary determinate and indeterminate mechanical and structural systems. 3 lectures.

**CE 207. Mechanics of Materials II. 3 units.**

Prerequisite: CE 204.

Combined stress states including torsion, axial, shear, moment, and pressure vessel loadings. Principle stress/strain states. Basic failure criteria. Analysis of beam forces, moments, deflections, and rotations. Introduction to stability concepts including column buckling. 3 lectures.

**CE 240. Additional Engineering Laboratory. 1-2 units.**

CR/NC

Special assignments undertaken by students who need or wish to acquire abilities supplementary to their standard pattern of courses. Assignments must be primarily of shop or laboratory nature. Work done with minimum faculty supervision. Total credit limited to 6 units. Credit/No Credit grading only. 1-2 laboratories.

**CE 251. Programming Applications in Engineering. 2 units.**

Prerequisite: CE 113, CE 204 and MATH 244.

Concepts from basic programming theory introduced in the context of engineering applications. Topics include the application of programming constructs to demonstrate finite precision calculations, linear systems, linear programming, basic nonlinear systems, plotting, statistics, least squares, approximations, and solve related problems from civil and environmental engineering. 2 activities.

**CE 259. Civil Engineering Materials. 2 units.**

Prerequisite: CE 204.

Experimental determination of mechanical properties of concrete, asphalt, and soils as required for engineering applications. Experimental verification of assumptions made in mechanics of materials procedures. Use of strain measuring devices. Preparation of technical reports. 2 laboratories.

**CE 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CE 321. Fundamentals of Transportation Engineering. 3 units.**

Prerequisite: PHYS 141; CE 259 or graduate standing.

The characteristics and functions of highway, air, rail, transit and other modes of urban and intercity transportation. Fundamentals of transportation design, operations, and planning. Evaluation of costs, benefits, and environmental considerations. 3 lectures.

**CE 322. Fundamentals of Transportation Engineering Laboratory. 2 units.**

Prerequisite or concurrent: CE 321.

Application of principles of transportation planning, operations, and design. Emphasis on urban transportation planning and operations, and the design of urban and intercity highway and rail facilities. Experimental determination of the physical and mechanical properties of pavement materials through laboratory and field testing. Analysis of data and preparation of testing reports. 2 laboratories.

**CE 336. Water Resources Engineering. 4 units.**

Prerequisite: ME 341 or ENVE 264. Concurrent: CE 337.

Hydraulics of pipe flow. Open channel flow, groundwater, and hydrology. 4 lectures.

**CE 337. Hydraulics Laboratory. 1 unit.**

Prerequisite: ME 341 or ENVE 264. Concurrent: CE 336.

Application of basic fluid dynamic principles to various mechanical systems. Exposure to experimental problems and techniques with guided laboratory projects related to civil engineering discipline. 1 laboratory.

**CE 351. Structural Analysis. 4 units.**

Prerequisite: CE 251 and either CE 201 or CE 207.

Analysis for member forces and deflections of determinate and indeterminate structures, including trusses, beams, and frames. General theorems, influence diagrams, and energy methods. 3 lectures, 1 laboratory.

**CE 355. Reinforced Concrete Design. 4 units.**

Prerequisite: CE 259, CE 351.

Analytical and design principles of reinforced concrete in designing civil engineering systems. Origin of code requirements. Fundamentals of proportioning. Details of elements and structural systems. 3 lectures, 1 laboratory.

**CE 356. Structural Steel Design. 4 units.**

Prerequisite: CE 351.

Design and behavior of the elements of steel structures. Design and analysis of bolted, welded and eccentric connections. Proportioning of members and connections. Introduction to plastic design, end plate connection, composite construction, shear connections and design of composite beams. 3 lectures, 1 laboratory.

**CE 371. Construction Management and Project Planning. 4 units.**

Prerequisite: ARCE 106, CE 259 or CM 113.

Theory and practice of planning, scheduling, estimating, and reporting for construction projects. Fundamentals of scheduling logic including critical path, deterministic, and probabilistic scheduling; including the impact of constraints. Identifying resources and estimating time requirements for design activities and project operations. Not open to Architectural Engineering or Construction Management majors. 3 lectures, 1 activity. Crosslisted as CE/CM 371.

**CE 381. Geotechnical Engineering. 4 units.**

Prerequisite: CE 207; ME 341 or ENVE 264. Concurrent: CE 382 (CE majors only).

Engineering geology, elementary mass-volume relations, clay-water interaction, soil classification, soil compaction, geostatic stress distributions, 1-D and 2-D steady-state flow, shear strength under drained and undrained conditions. 4 lectures.

**CE 382. Geotechnical Engineering Laboratory. 1 unit.**

Corequisite: CE 381.

Use of standard laboratory test methods to determine physical, mechanical, and hydraulic properties of soil. 1 laboratory.

**CE 400. Special Problems. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**CE 401. Advanced Mechanics of Materials. 4 units.**

Prerequisite: CE 351 or ME 328.

Introduction to linear elasticity as a means for development of reduced order theories such as torsion, beams, columns, and plates from the general three-dimensional continuum. Energy methods as well as the application and limitation of these theories. 4 lectures.

**CE 404. Applied Finite Element Analysis. 4 units.**

Prerequisite: ME 328 or CE 351 or BMED 410.

Finite element based solutions to engineering problems with an emphasis on elastostatic problems in structural mechanics. The power and pitfalls associated with the finite element method highlighted through practical modeling assignments. Introduces the use of commercial finite element codes. 3 lectures, 1 laboratory. Crosslisted as BMED/CE/ME 404.

**CE 405. Concrete Materials. 4 units.**

Prerequisite: CE 259.

Supplementary cementitious materials and chemical admixtures and their incorporation into concrete mix designs. Design and testing of concrete for durability and other specialized properties. 3 lectures, 1 laboratory.

**CE 407. Structural Dynamics. 4 units.**

Prerequisite: CE 351, ME 212.

Effect of vibration and transient loads on structural elements. Dynamics load factors, support motion, damping and natural frequencies of multidimensional structural systems. Modal analysis. 3 lectures, 1 laboratory.

**CE 421. Traffic Engineering. 4 units.**

Prerequisite: CE 321 or consent of instructor.

Principles of traffic circulation on highway systems and other modes. Traffic control. Traffic data collection and analysis. Capacity analysis. Traffic modeling. New technologies. 3 lectures, 1 laboratory.

**CE 422. Highway Geometrics and Design. 4 units.**

Prerequisite: CE 321 or consent of instructor.

Alignment location and safe geometric design of highways. Earthwork and drainage related to highway. Theory and practice in design of alignments, highway cross-sections, intersections, interchanges, and freeways in urban and rural areas. Application of advanced computer software to highway geometrics. 2 lectures, 2 laboratories.

**CE 423. Intelligent Transportation Systems. 4 units.**

Prerequisite: CE 321, graduate standing, or consent of instructor.

Specification and operation of Intelligent Transportation Systems (ITS). Traffic surveillance and control systems including applications to freeways, urban streets, rural highways, and public transportation. Standards include the National Architecture for ITS. 3 lectures, 1 laboratory.

**CE 424. Public Transportation. 4 units.**

Prerequisite: CE 321 or consent of instructor.

Interdisciplinary aspects of public transportation problems, systems-team design approach to solutions. History and present state of public transportation; role of public transportation in urban environment; legislative, political, social, and economic aspects of public transportation systems. Methodology and procedures for transit planning. Review of transit studies. 3 lectures, 1 laboratory.

**CE 431. Coastal Hydraulics I. 4 units.**

Prerequisite: ME 341 or ENVE 264.

Waves and their characteristics, types of waves, water wave theories, orbital velocities, refraction of waves, wave diffraction, wave reflection, application of linear theory to wave forces on cylindrical structures, submerged pipelines and vertical flat barriers (sea walls), wave uprush, rubble mound breakwaters. 4 lectures.

**CE 432. Coastal Hydraulics II. 4 units.**

Prerequisite: CE 431.

Reformed breaker height determination, wave runup analysis using a reformed breaker height. Wave setback analysis. Pile height determination. Criteria for types of breaking waves. Revetment analysis, rip-rap revetment design, wave forces on pilings. 4 lectures.

**CE 433. Open Channel Hydraulics. 4 units.**

Prerequisite: CE 336.

Analysis and characteristics of flow in open channels; critical flows; uniform flow; gradually varied flow; channel design problems, channel transitions and controls. Rapidly varied flow; hydraulic jump and energy dissipaters. Unsteady flows, waves and wave propagation, flood routing. Applications of numerical methods in hydraulic engineering. 4 lectures.

**CE 434. Groundwater Hydraulics and Hydrology. 4 units.**

Prerequisite: CE 336.

Differential equations of groundwater flow, Darcy's Law, solutions of the steady and unsteady flow, differential equations for confined and unconfined flows. Pumping test design. Groundwater models, leaky aquifers. Saltwater intrusion. 4 lectures.

**CE 435. Engineering Hydrology. 4 units.**

Prerequisite: CE 336.

Analysis of hydrologic cycle components such as precipitation, infiltration and evaporation. Rainfall-runoff analysis to determine peak flows and runoff hydrographs. Hydrologic river and reservoir routings and their applications for flood plain management. Application of frequency analysis methods to determine design rainfalls and design flows. 4 lectures.

**CE 440. Hydraulic Systems Engineering. 4 units.**

Prerequisite: CE 336.

Water and wastewater flows. Design of water distribution systems, trans-mission and storage reservoirs, wastewater collection systems, and storm water systems. Pumps and pump systems, flow measurements. Water sources for municipal supply. 3 lectures, 1 laboratory.

**CE 454. Structural Design. 4 units.**

Prerequisite: CE 351, CE 355, CE 356.

Design of reinforced concrete, steel and timber structures. Loading standards, code design methods, connection design. Comprehensive design projects. 2 lectures, 2 laboratories.

**CE 455. Design of Timber Structures. 4 units.**

Prerequisite: CE 355 or CE 356.

Analysis and design of timber structures with emphasis on construction methodology, and material behavior. Topics include: physical and mechanical properties of structural lumber and glulams; lateral load paths; diaphragms; connections; shear wall design; and combined load design. 3 lectures, 1 laboratory.

**CE 456. Seismic Principles for Civil and Environmental Engineering. 4 units.**

Prerequisite: CE 207.

Basic principles in seismic analysis and design of civil and environmental systems. Seismological aspects of earthquakes. Simple concepts in structural dynamics. Simplified code-based analysis and design. 4 lectures. Not open to students with credit in CE 557.

**CE 457. Bridge Engineering. 4 units.**

Prerequisite: CE 355.

Fundamentals of the structural analysis and design of highway bridges. Construction materials in bridges. Loads on highway bridges. Load path and distribution in bridge superstructure. Design of reinforced concrete, pre-stressed concrete, and composite bridges. 3 lectures, 1 laboratory.



**CE 458. Fiber Reinforced Polymer (FRP) Design. 4 units.**

Prerequisite: CE 351 and CE 355. Concurrent: CE 356.

Properties and mechanical characteristics of Fiber Reinforced Polymer (FRP) composite materials; applications in civil engineering structures as primary or secondary reinforcement; and design techniques based on newly developed ACI 440 design guidelines and worldwide experience in FRP design. Not open to students with credit in CE 558. 3 lectures, 1 laboratory.

**CE 459. FRP Strengthening of Reinforced Concrete Structures. 4 units.**

Prerequisite: CE 355.

Flexural and shear strengthening reinforced and prestressed concrete members using fiber reinforced polymer composite plates and laminates; seismic repair and rehabilitation of columns, slabs, beams and structures. Focus on design philosophy and design methodology, based on the current understanding of FRP-strengthening techniques. Not open to students with credit in CE 556. 3 lectures, 1 laboratory.

**CE 461. Senior Project I. 2 units.**

Prerequisite: Senior standing and consent of the supervising faculty member.

Completion of a 120-hour integrated civil research, analysis, and/or design project that is representative of those encountered in professional practice.

**CE 462. Senior Project II. 2 units.**

Prerequisite: Senior standing and consent of the supervising faculty member.

Completion of a 120-hour integrated civil research, analysis, and/or design project that is representative of those encountered in professional practice.

**CE 464. Professional Practice. 3 units.**

Prerequisite: Senior standing.

Examination of the non-technical issues that are dealt with on a regular basis by the design professional, including professional ethics, marketing and business development, professional engagement, personnel and project management, risk management, professional liability insurance, and dispute resolution. 3 seminars.

**CE 466. Senior Design Project I. 3 units.**

Prerequisite: CE 321, CE 322, CE 336, CE 337, CE 355, CE 381, CE 382, senior standing, and consent of instructor.

Work on multi-disciplinary teams to complete an integrated civil design project. Focus of formal instruction on selected topics in geotechnical, structural, transportation, and water resources engineering design. Topics, related to interpersonal communication, teamwork, leadership, ethics, and professional practice, addressed to promote understanding of the non-technical issues and skills that must be mastered to become a successful design professional. 2 lectures, 1 laboratory.

**CE 467. Senior Design Project II. 3 units.**

Prerequisite: CE 466.

Continuation of CE 466. Continuation of work on multi-disciplinary teams to complete an integrated civil design project. Focus of formal instruction on technical and non-technical issues. Summarization of team project results in formal written reports and oral presentations. 2 lectures, 1 laboratory.

**CE 468. Community Engineering Senior Design Project I. 3 units.**

Prerequisite: CE 321, CE 322, CE 336, CE 337, CE 355, CE 356, CE 381, CE 382, senior standing, and consent of instructor.

Two-part series. Student teams work in cooperation with a local community organization to complete an integrated civil design project. Projects representative of those encountered in professional practice. Focus on professional as well as design issues. Volunteer service required. 2 lectures, 1 laboratory.

**CE 469. Community Engineering Senior Design Project II. 3 units.**

Prerequisite: CE 321, CE 322, CE 336, CE 337, CE 355, CE 356, CE 381, CE 382, senior standing, and consent of instructor.

Two-part series. Student teams work in cooperation with a local community organization to complete an integrated civil design project. Projects representative of those encountered in professional practice. Focus on professional as well as design issues. Volunteer service required. 2 lectures, 1 laboratory.

**CE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**CE 474. Environmental Compliance and Permitting. 2 units.**

Prerequisite: Senior standing.

Fundamentals of State and Federal environmental laws essential to getting Civil Engineering projects permitted. 2 lectures.

**CE 475. Civil Infrastructure and Building Systems. 4 units.**

Prerequisite: Senior standing in CE or ARCE.

Principles and practices for the sustainable design, fabrication, and installation of systems for the civil infrastructure and building; including structural, air/gas, water/wastewater, electrical, and control systems. Methods and materials used for fabrication and installation; including cost and schedule considerations. 4 lectures. Crosslisted as ARCE/CE 475.

**CE 481. Analysis and Design of Shallow Foundations. 4 units.**

Prerequisite: CE 381 and CE 382.

Evaluation of shear strength for foundation design. Analysis of bearing capacity for generalized conditions. Design of reinforced concrete spread footings. Stress distributions beneath loaded areas. Immediate settlement, consolidation settlement, rate of consolidation, and creep. 4 lectures.

**CE 482. Conventional Subsurface Exploration. 4 units.**

Prerequisite: CE 481.

Subsurface exploration and sampling techniques. Laboratory analysis of material variability. Preparation of subsurface exploration reports. 2 lectures, 2 laboratories.

**CE 486. Introduction to Geological Engineering. 4 units.**

Prerequisite: CE 381, CE 382, and GEOL 201.

Identification and characterization of consolidated geologic materials for the purpose of civil analysis and design. Interpretation of geologic maps, cross sections, and reports. Interpretation of aerial photographs. Engineering considerations important in dealing with transported soils. 4 lectures.

**CE 487. Design of Foundations and Slopes in Rock. 4 units.**

Prerequisite: CE 381, CE 382, and GEOL 201.

Evaluation of the engineering properties of rocks. Rock core description. Slope stability analyses in rock. Discontinuity analysis. Rockfall hazard assessment and mitigation. Design of shallow foundations on rock. 4 lectures.

**CE 488. Engineering Risk Analysis. 4 units.**

Prerequisite: CE 381 and STAT 312.

Introduction to the basic concepts of probability theory, statistics, and decision theory as they pertain to problems in civil and environmental engineering. Emphasis placed on the use of probabilistic modeling, Bayesian statistics, risk analysis, and decision theory. 4 lectures.

**CE 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**CE 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**CE 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**CE 500. Individual Study. 1-3 units.**

Prerequisite: Consent of department chair, graduate advisor and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition.

**CE 501. Advanced Matrix Analysis of Structures I. 4 units.**

Prerequisite: CE 351 or consent of instructor.

Matrix terminology and operations. Matrix procedures for analysis of two-dimensional frameworks. Development of stiffness, flexibility and mixed methods. Development of algorithms and programs for use in the analysis of structural frameworks. Discussion of modeling issues and limitations. 3 lectures, 1 laboratory.

**CE 502. Advanced Matrix Analysis of Structures II. 4 units.**

Prerequisite: CE 501 or consent of instructor.

Matrix procedures for analysis of three-dimensional frameworks. Development of algorithms and programs for use in the analysis of structural frameworks. Additional topics to include: member releases, nonprismatic members, elastic supports, offset connections and oblique supports. 3 lectures, 1 laboratory.

**CE 504. Finite Element Analysis I. 4 units.**

Prerequisite: CE/ME 404 and CE 511 or ME 501 or consent of instructor.

Linear finite element theory and analysis. Strong, weak and variational formulations. Physical and isoparametric spaces. Error estimates and numerical integration. Development of finite element algorithms. Use of commercial finite element codes to illustrate course concepts including modeling issues and limitations. 3 lectures, 1 laboratory. Crosslisted as CE/ME 504.

**CE 505. Finite Element Analysis II. 4 units.**

Prerequisite: CE/ME 504.

Nonlinear and dynamic finite element theory and analysis. Variational formulations and their significance. Isoparametric formulation and numerical integration. Development of two and three-dimensional finite element algorithms. The limitations of FEA. 3 lectures, 1 laboratory. Crosslisted as CE/ME 505.

**CE 511. Continuum Mechanics and Elasticity. 4 units.**

Prerequisite: Graduate standing.

Introduction to continuum mechanics. Kinematics, stress, and balance laws. Constitutive theory for isotropic and anisotropic solids and viscous fluids. Applications including design of beams and pressure vessels, stress concentrations, fiber-reinforced composites, and non-homogeneous biological materials. 4 lectures. Crosslisted as CE 511/ME 501.

**CE 513. Inelastic Stress Analysis. 4 units.**

Prerequisite: ME 501 or CE 511.

Perfectly plastic and work hardening materials; von Mises and Tresca yield, isotropic and kinematic hardening flow rules, boundary-value problems. Finite elasticity: kinematics, Cauchy- and Green-elasticity, invariance, constraints, Neo-Hookean and Mooney-Rivlin materials, experimental approaches, non-uniqueness, anisotropy, residual stress, thermoelasticity, boundary-value problems. 4 lectures. Crosslisted as CE 513/ME 503.

**CE 521. Highway Pavement Designs. 4 units.**

Prerequisite: CE 321, CE 259, CE 381, graduate standing or consent of instructor.

Theories, principles, and procedures in the structural design of highway pavements. Design of flexible and rigid pavements. Performance of flexible and rigid pavements in the field and the characterization of pavement materials. Practical and direct exposure to laboratory testing of pavement materials. 3 lectures, 1 laboratory.

**CE 523. Transportation Systems Planning. 4 units.**

Prerequisite: CE 321, graduate standing, or consent of instructor.

Planning of urban and regional multimodal transportation systems. Modeling of transportation networks and travel demand. Travel survey design. Urban data systems. Evaluation of alternatives based on economic, social, technological, and other factors. 2 lectures, 2 laboratories.

**CE 524. Pavement Performance and Management Systems. 4 units.**

Prerequisite: CE 321, CE 322, CE 259.

Introduction to pavement management; pavement distress data collection; deflection measurements and analysis; pavement performance modeling; pavement structure design; maintenance planning and rehabilitation strategies; prioritization and optimization; computer applications in pavement management. 2 lectures, 2 laboratories.

**CE 525. Airport Planning and Design. 4 units.**

Prerequisite: CE 321, graduate standing, or consent of instructor.

Historical background of aviation and airport development; financing; estimating demand; aircraft characteristics; airport capacity; airspace and air traffic control; site selection; airport configuration; geometric design of landing area; planning and development of terminal areas; lighting; pavement design and drainage. 3 lectures, 1 laboratory.

**CE 526. Transportation Safety. 4 units.**

Prerequisite: CE 321, CE 322, STAT 312.

Introduction to nature and extent of transportation safety problem worldwide and in the United States. Several sub-areas of transportation safety: road safety, human factors, vehicle safety; crash data collection and management; safety planning; hot spot identification; methodologies for conducting transportation accident studies; statistical applications to accident data; predictive model building; 'before-after' studies; countermeasure design. 3 lectures, 1 laboratory.

**CE 527. Sustainable Mobility. 4 units.**

Prerequisite: CE 321 or CRP 435 or consent of instructor.

Presentation and analysis of concepts and designs for sustainable mobility from a global-to-local, interdisciplinary perspective, including pedestrians, bicyclists, and public transportation. Addresses economy, environment, and equity (social issues) through lectures, panels, excursions and a planning/design project in San Luis Obispo County. 3 lectures, 1 laboratory.

**CE 528. Transportation Economics and Analysis. 4 units.**

Prerequisite: CE 321, graduate standing, or consent of instructor.

Principles of engineering systems analysis and applications to transportation using examples from different modes. Identification of transportation benefits, costs, user and non-user impacts, transportation cost models, pricing, and optimization. 3 lectures, 1 laboratory.

**CE 529. Modeling and Simulation in Transportation. 4 units.**

Prerequisite: CE 321, graduate standing, or consent of instructor.

Theory and operation of transportation systems, the systems approach, simulation techniques. Use of available software packages. Simulation model development, calibration and use. 2 lectures, 2 laboratories.

**CE 533. Advanced Water Resources Engineering. 4 units.**

Prerequisite: CE 336, graduate standing or consent of instructor.

Matrix and simulation methods in hydrology, statistical studies in hydrology and their applications to civil engineering problems. Generalized hydrologic characteristics. Hydrologic simulation, computer applications, urban and small watershed hydrology, macroscopic and microscopic approach. Storm water management models. Hydrologic design. 4 lectures.

**CE 535. Water Resources Systems Planning and Analysis. 4 units.**

Prerequisite: CE 336, graduate standing or consent of instructor.

Water resources planning, development, system analysis and optimization. Dynamic programming, multi-objective water resource systems. 4 lectures.

**CE 536. Computer Applications in Water Resources with Geographic Info Systems (GIS). 4 units.**

Prerequisite: CE 336, graduate standing or consent of instructor.

Modeling, design and analysis of water, wastewater, stormwater systems. Integration of water resource systems with Geographic Information Systems (GIS). 3 lectures, 1 laboratory.

**CE 537. Groundwater Contamination. 4 units.**

Prerequisite: CE 113. Corequisite: CE 336 and ENVE 331.

Recommended: CE 434.

Sources and types of groundwater contamination, contamination transport mechanisms. Sorption and other chemical reactions. Numerical modeling of contaminant transport. Nonaqueous phase liquids. Groundwater remediation and design. 4 lectures.

**CE 538. Urban Water Systems. 4 units.**

Prerequisite: CE 440, graduate standing or consent of instructor.

Integration of water delivery, wastewater collection, drainage systems, and associated treatment components in urbanizing areas. Relationships between surface and groundwater elements of water sources and disposal. Use of current design models to quantify the benefits of non-traditional options. 4 lectures.

**CE 539. Environmental Hydraulics. 4 units.**

Prerequisite: CE 336, graduate standing or consent of instructor.

Application of fluid mechanics principles to environmental flows. Emphasis on advection, dispersion, stratification and mixing effects. Stratified flows, turbulent jets and plumes, wastewater and thermal diffusers, cooling ponds and channels, control of environmental problems. 4 lectures.

**CE 552. Analysis and Seismic Design of Reinforced Concrete. 4 units.**

Prerequisite: CE 454. Recommended: Concurrent enrollment in CE 557.

Emphasis placed on reinforced concrete behavior and seismic design. Topics include moment curvature analysis and plastic hinge modeling, strut and tie, design of structural walls, design of concrete moment frames and seismic detailing. 4 lectures.

**CE 553. Ductile Design of Steel Structures. 4 units.**

Prerequisite: CE 356 and senior or graduate standing. Recommended: CE 454 and CE 407.

Plastic analysis and capacity design principle; design of ductile steel structures including moment frames, concentrically braced frames, eccentrically braced frames, buckling-restrained braced frames, and steel plate shear walls according to the AISC Seismic Provisions for Structural Steel Buildings. 3 lectures, 1 activity.

**CE 555. Advanced Civil Engineering Materials Laboratory. 2 units.**

Prerequisite: CE 259 or graduate standing.

Fundamental properties of new and advanced materials. Experimental techniques. Fracture characteristics and composite response of cement matrix composites. New materials and products to advanced applications such as automation. 2 laboratories.

**CE 556. Advanced Fiber Reinforced Polymer (FRP) Strengthening of Reinforced Concrete Structures. 4 units.**

Prerequisite: CE 355.

Flexural and shear strengthening reinforced and pre-stressed concrete members using FRP composite laminates and plates; seismic repair and rehabilitation of columns, beams, slabs and whole structures. Design philosophies based on the current ACI 440 and the most up to date research in FRP composites. Durability, fire protection and blast mitigation of structures utilizing FRP laminates. Not open to students with credit in CE 459. 3 lectures, 1 laboratory.

**CE 557. Seismic Analysis and Design for Civil Engineers. 4 units.**

Prerequisite: CE 407.

Extension of the basic principles of structural dynamics to analysis of civil structures (buildings, bridges, tanks, etc.) to earthquake loading. Code based (Uniform Building Code and AASHTO) earthquake resistant design of civil structures. Not open to students with credit in CE 456. 3 lectures, 1 laboratory.

**CE 558. Advanced Fiber Reinforced Polymer (FRP) Design. 4 units.**

Prerequisite: CE 355.

Properties and mechanical characteristics of FRP composites and design methodologies based on the current understanding and usage of FRP composites. Applications of composite rebars in civil engineering structures as primary reinforcement. Design and analysis of reinforced concrete structures utilizing FRP rebars based on the ACI 440 design guidelines. Not open to students with credit in CE 458. 3 lectures, 1 laboratory.

**CE 559. Prestressed Concrete Design. 4 units.**

Prerequisite: CE 355 or graduate standing.

Advanced analysis, design and behavior of prestressed and precast concrete elements and structures. Origin of code requirements. Detailed design of prestressed concrete components of civil engineering systems for buildings and highway construction. Creep and shrinkage of concrete and relaxation of steel applied to prestressing losses. 4 lectures.

**CE 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 seminars.

**CE 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**CE 573. Public Works Administration. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Management and engineering of infrastructure and related systems in public jurisdictions. Utility systems, streets and highways, illumination, distribution systems, etc. Personnel management, financing, public relations, and contract management. 3 seminars.

**CE 574. Computer Applications in Civil Engineering. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Overview of computer application, hardware and software alternatives, use of selected application programs, CAD, microcomputers, management and application of resources. 1 lecture, 2 laboratories.

**CE 581. Advanced Geotechnical Engineering. 4 units.**

Prerequisite: CE 481 or graduate standing.

Advanced topics in saturated flow, unsaturated flow, and consolidation. Stress-strain-deformation response of soils under both drained and undrained loading. Conventional and advanced laboratory strength testing. 3 lectures, 1 laboratory.

**CE 582. Geotechnical In-Situ Testing. 4 units.**

Prerequisite: CE 481 or graduate standing.

Standard penetration, cone penetration, and flat-plate dilatometer testing. Equipment operation and maintenance. Interpretation of SPT/CPT/DMT sounding data. Stratigraphic analysis. CPT/DMT-based analysis and design of shallow and deep foundations. 2 lectures, 2 laboratories.

**CE 583. Geotechnical Earthquake Engineering. 4 units.**

Prerequisite: CE 481 and CE 407 or graduate standing.

Introduction to engineering seismology and ground motion evaluation. Dynamic behavior of soils. Seismic site response analysis. Soil liquefaction evaluation methods and mitigation techniques. Seismic stability of slopes and retaining walls. Computer-aided analysis. 4 lectures.

**CE 584. Lateral Support Systems. 4 units.**

Prerequisite: CE 481 or graduate standing.

Classical and modern earth pressure theories. Lateral earth pressure calculations for general subsurface conditions. Analysis and design of reinforced concrete cantilever walls, sheetpile walls, soldier-pile walls, tie-back walls, and mechanically-stabilized earth. Computer-aided analysis and design. 4 lectures.

**CE 585. Slope Stability Analysis. 4 units.**

Prerequisite: CE 481 or graduate standing.

Analysis of stability by planar, circular arc, piecewise-linear, and composite-surface techniques. Analysis of earth-fill dams and reservoirs for static, steady flow, sudden drawdown, and seismic loading conditions. Field instrumentation. Methods for slope remediation and stabilization. Computer-aided analysis. 4 lectures.



**CE 586. Analysis and Design of Deep Foundations. 4 units.**

Prerequisite: CE 481 or graduate standing.

Bearing capacity and settlement analysis of drilled shafts and driven piles. Analysis and design of single piles and pile groups for vertical, lateral, and combined loading. Construction procedures, field inspection, and load-testing. Computer-aided analysis and design. 4 lectures.

**CE 587. Geoenvironmental Engineering. 4 units.**

Prerequisite: CE 381.

Principles for containment applications. Engineering properties of soils and geosynthetics and their interaction with contaminants and wastes; analysis of geosynthetics used in containment facilities; liners; covers; leachate and gas collection systems; contaminant transport; and monitoring systems. 4 lectures.

**CE 588. Ground Improvement. 4 units.**

Prerequisite: CE 381, CE 382, and CE 481.

Ground improvement applications investigated for modification of geomechanical and hydraulic properties of soils. Engineering properties of soft ground and high water content materials; mechanical, chemical, and thermal stabilization investigated for foundation and environmental remediation applications. 4 lectures.

**CE 589. Geosynthetics Engineering. 4 units.**

Prerequisite: CE 481.

Geosynthetics applications within civil engineering. Design content for geotechnical, geoenvironmental, and transportation applications. Manufacturing processes, material properties, interaction with soils, and service conditions. 4 lectures.

**CE 591. Graduate Seminar I. 1 unit.**

Prerequisite: Graduate standing.

Current research activities and analysis/design philosophies in civil and environmental engineering practice. 1 seminar.

**CE 592. Graduate Seminar II. 1 unit.**

Prerequisite: CE 591 and graduate standing.

Current research activities and analysis/design philosophies in civil and environmental engineering practice. Development of oral and written presentation skills. 1 seminar.

**CE 593. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**CE 594. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**CE 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only.

**CE 596. Comprehensive Examination. 1 unit.**

CR/NC

Prerequisite: Graduate standing. Recommended: Student should be in the final quarter of completing graduate coursework (45 units of 400 and 500 level coursework) and prepared to take the MS exam.

Comprehensive exam for a non-thesis master's student. The comprehensive examination assesses the student's ability to integrate knowledge, show critical and independent thinking, and demonstrate mastery of the subject matter. Timing of the comprehensive exam shall be scheduled with the faculty advisor per department guidelines.

**CE 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing.

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis.

## **Science and Mathematics (SCM)**

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### **College of Science and Mathematics Courses**

**SCM 100. Orientation to the College Science and Mathematics. 2 units.**

CR/NC

Application of learning strategies, problem-solving methodologies, academic planning and career selection for students in the science and mathematics disciplines. Concurrent enrollment in specific orientation or content course is desirable. Credit-No Credit grading only. 1 lecture, 1 activity.

**SCM 101. Introduction to the Health Professions. 1 unit.**

CR/NC

Preparation for a health professions career and examination of various health professions. Emphasis on planning and developing an individual pre-health plan, including academic course selection, obtaining appropriate experiences/activities, and review of the elements of a strong application. Intended for freshmen and sophomores. Credit/No Credit grading only. 1 lecture.

**SCM 150. Supplemental Workshops in Science. 1 unit.**

CR/NC

Prerequisite: Concurrent enrollment in the designated section of the associated course.

Facilitated study and discussion of theory, concepts, and applications of content material from selected courses. Credit/No Credit grading only. Total credit limited to 8 units. 1 laboratory.



**SCM 201. Orientation to Biotechnology. 2 units.**

Prerequisite: Completion of a course with a BIO, BOT or MCRO prefix and a course with a CHEM prefix.

Introduction to the diversity of fields in biotechnology. Applications in agriculture, nutrition, medicine and environmental problems. 1 lecture, 1 activity.

**SCM 220. Seminar for Science and Math Tutors. 1 unit.**

CR/NC

Prerequisite: MATH 142, PHYS 132, PHYS 133, PHYS 122, PHYS 123, PSC 102, or PSC 103; and consent of instructor.

Concepts of teaching and learning as it relates to roles as K-12 grade science and math tutors and/or classroom assistants. Restricted to students who are Teaching Assistants in Math and Science (TeAMS) tutors or Volunteers in Out of School Time (VOST). Participation in public schools requires mandated fingerprint clearance. 1 activity.

**SCM 230. Seminar for Learning Assistants. 2 units.**

CR/NC

Prerequisite: BIO 160, BIO 161, CHEM 124, CHEM 127, MATH 141, PHYS 131, or PHYS 141.

Introduction to learning theory and teaching practices for mathematics and science learning assistants regarding conceptual development, questioning techniques, cooperative learning, nature of math and science, and argumentation in mathematics and science. Restricted to students admitted to the Learning Assistant program. 2 seminars.

**SCM 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**SCM 300. Early Field Experience. 4 units.**

CR/NC

Prerequisite: Sophomore standing; for Math majors or Science and Engineering majors only.

Historical, philosophical, and social foundations of public science and mathematics education. Public school curriculum and professional education dispositions. Structured observation and participation in K-12 public schools with attention to instructional practices for diverse learners. Credit/No Credit grading only. 2 lectures, 2 activities.

**SCM 302. The Learn By Doing Lab Teaching Practicum. 2 units.**

CR/NC

Prerequisite: Completion of GE Area B and consent of instructor.

Early teaching experience in an informal science/technology/engineering/ mathematics (STEM) teaching and learning environment. Principles of inquiry-driven STEM education, lesson design, implementation and assessment. Intended for undergraduates exploring STEM teaching as a career. Total credit limited to 4 units. Credit/No Credit grading only. 1 seminar, 1 laboratory. Crosslisted as ENGR 322/SCM 302/HNRS 302.

**SCM 320. Technology in London. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.  
Concurrent: Enrollment in London Study Program.

Impact of one or two technologies in modern London. How they developed from the scientific/industrial revolution, as seen through London museums and industries. How solutions to modern problems are dependent on available technology. Specific technology chosen by instructor. 2 lectures, 2 activities. Fulfills GE Area F.

**SCM 325. Genetic Engineering Technology. 4 units.**

GE Area F

Prerequisite: Completion of GE Area B2 and B3, including a chemistry course. Recommended: Junior standing.

Introduction to the methodology and techniques used in genetic engineering. Applications in agriculture, nutrition, medicine and environmental problems. Potential benefits and problems, including the underlying ethical questions. Not open to students with credit in CHEM 373. 4 lectures. Fulfills GE Area F.

**SCM 330. Ocean Discovery through Technology. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Introduction to marine science and current issues in marine science. Investigation of emerging technologies that provide new understanding of the ocean, including sensors and sensor platforms such as ships, satellites, and underwater vehicles. 3 lectures, 1 activity. Fulfills GE Area F.

**SCM 335. Nuclear Science and Society. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Impact of nuclear phenomena on energy production, warfare, health and medicine, and the environment. Scientific and public policy aspects of reactor design, nuclear accidents, disposal of radioactive waste, nuclear medicine, food irradiation, nuclear weapons, and fusion as potential energy source. 4 lectures. Fulfills GE Area F.

**SCM 350. The Global Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary investigation of how human activities impact the Earth's environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/ historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 4 lectures. Crosslisted as AG/ EDES/ENGR/ HUM/SCM/UNIV 350. Fulfills GE Area F.

**SCM 363. Health Professions Internships. 2 units.**

CR/NC

Prerequisite: Sophomore standing; must have been enrolled at Cal Poly for at least two quarters; consent of instructor.

Structured experiences for pre-health students, such as County Health Agency internships designed to promote understanding of social and public purpose of chosen professions, or internships designed to provide observational experiences in a modern clinical setting. The Schedule of Classes will list topic selected. Limited space availability. Application process for enrollment. Total credit limited to 12 units; a maximum of 6 units may be applied toward degree requirement. Credit/No Credit grading only.

**SCM 401. Advanced Undergraduate Research. 1-3 units.**

CR/NC

Prerequisite: Consent of instructor.

Laboratory research under faculty supervision. Credit/No Credit grading only. Total credit limited to 6 units. 4 units may be applied to approved chemistry electives. 1-3 laboratories. Crosslisted as CHEM/SCM 401.

**SCM 451. Ethics in the Sciences. 3 units.**

Prerequisite: Junior standing.

The practice, performance and application of science from the standpoint of ethics. Includes issues involving plagiarism, data handling, fraud, safety and selected applications in specific science careers. Models for the analysis and resolution of ethical dilemmas are presented. 3 seminars.

**SCM 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**SCM 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**SCM 491. Science Student Teaching Workshop. 1 unit.**

CR/NC

Corequisite: EDUC 469 or EDUC 479.

Facilitated discussions of successful pedagogical tools used in secondary science education, laboratory activities geared towards teaching California science standards, and issues facing students pursuing the public school teaching profession. Open to students in a secondary science credential program. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**SCM 593. Advanced Science Topics for Teachers. 1-4 units.**

CR/NC

Prerequisite: Multiple Subject or Single Subject teaching credential or consent of instructor.

Science topics for credentialed and pre-service teachers. Content, hands-on activities geared towards California science standards. Development of inquiry-based lessons and skills for integration of language, literacy and technology into the science curriculum. The Schedule of Classes will list topic selected. Total credit limited to 12 units; repeatable same term. 1-4 seminars.

## Communication Studies (COMS)

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### Communication Studies Courses

**COMS 101. Public Speaking. 4 units.**

GE Area A2

Introduction to the principles of public speaking. Practical experience in the development, presentation, and critical analysis of speeches to inform, to persuade, and to actuate. Not open to students with credit in COMS 102. 4 lectures. Crosslisted as COMS/HNRS 101. Fulfills GE A2.

**COMS 102. Principles of Oral Communication. 4 units.**

GE Area A2

Introduction to the fundamentals and principles which underlie effective oral communication. Practical experience in various types of speaking situations: informative speaking, persuasive speaking, and panel discussion. Not open to students with credit in COMS 101. 4 lectures. Crosslisted as COMS/HNRS 102. Fulfills GE A2.

**COMS 126. Argument and Advocacy. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor. Recommended: Completion of GE Area A2.

The nature of critical thinking as applied in written and oral argument. Analysis of inductive and deductive reasoning. Analysis of reasoning, argument, forms of support and fallacies of argument and language. Instruction in and practical experience in writing sound persuasive arguments and engaging in oral argumentation assignments. 4 lectures. Fulfills GE A3.

**COMS 145. Reasoning, Argumentation, and Writing. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor. Recommended: Completion of GE Area A2.

The principles of reasoning in argumentation. Examination of rhetorical principles and responsible rhetorical behavior. Application of these principles to written and oral communications. Effective use of research methods and sources. 4 lectures. Crosslisted as COMS/ENGL/HNRS 145. Fulfills GE A3.

**COMS 201. Advanced Public Speaking. 4 units.**

Prerequisite: COMS 101 or COMS 102.

Further consideration of the principles of public address. Advanced practice in manuscript, extemporaneous, and impromptu speaking. 4 lectures.

**COMS 208. Performance of Literature. 4 units.**

GE Area C3

Prerequisite: Completion of GE Areas A and C1.

Poetry, prose, nonfiction and dramatic literature performed to communicate the levels of meaning within each work to the audience. 4 lectures. Fulfills GE C3.

**COMS 212. Interpersonal Communication. 4 units.**

Introduction to the interaction process in two-person (dyadic) communication settings. Emphasis on the functions of varying messages in the initiation, development, maintenance and termination of personal and professional relationships. 4 lectures. Crosslisted as COMS/PSY 212.

**COMS 213. Organizational Communication. 4 units.**

Prerequisite: COMS 101 or COMS 102.

Introduction to communication within the organization and between the organization and its environment. Effects of networks, superior/subordinate message patterns, team building, climate, message flow patterns and distortion on organizational effectiveness. 4 lectures.

**COMS 217. Small Group Communication. 4 units.**

Prerequisite: COMS 101 or COMS 102.

Basic principles and techniques of small group communication. Survey of the importance of discussion in contemporary society, including study of and practice in informal group discussion, panel discussion, symposium, and forum. 4 lectures.

**COMS 226. Applied Argumentation. 4 units.**

Prerequisite: Completion of GE Area A.

Intermediate level course in the theory and practice of everyday argument. Select theories of argumentation, and practical experience arguing in a wide variety of contexts. 4 lectures.

**COMS 250. Forensic Activity. 2 units.**

Prerequisite: COMS 101 or COMS 102 or consent of instructor.

Introduction to competitive debate activities. Research, analysis, and debating about contemporary issues. Any student who wishes to receive academic credit for participation in such activities during the quarter should enroll. Total credit limited to 6 units. 2 laboratories.

**COMS 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**COMS 301. Business and Professional Communication. 4 units.**

Prerequisite: COMS 101 or COMS 102.

Communication skills and functions for all levels of organizational employees. Interviewing, oral briefings, motivational and conference speaking. 4 lectures.

**COMS 308. Group Performance of Literature. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and C3. Recommended: Junior standing.

Examination and experience in the various modes of group performance of literature: Readers Theatre, Chamber Theatre, Story Theatre. Scripting; directing; performing and critiquing of group performance of literature. 4 lectures. Fulfills GE C4 except for Communication Studies majors.

**COMS 311. Communication Theory. 4 units.**

Prerequisite: Completion of GE Area A.

Survey of human communication theories including interpersonal, small group, organizational, persuasion, nonverbal, intercultural, and media. Philosophical foundations for understanding communication from a social science perspective. 4 lectures.

**COMS 312. Communication Research Methods. 4 units.**

Prerequisite: COMS 311 and STAT 217, junior standing; for COMS majors only.

Exploration of communication research strategies and methodologies. Basic methods of designing research in empirical communication studies. 4 lectures.

**COMS 315. Intergroup Communication. 4 units.**

Prerequisite: Completion of GE Area A.

Survey of theory and research concerning language and communication between various social groups (e.g., age, sex, race, sexual orientation), with an emphasis on understanding the role verbal, nonverbal, and mass communication plays in identity formation and differentiating group members. 4 lectures.

**COMS 317. Technology and Human Communication. 4 units.**

Prerequisite: Completion of GE Area A.

Impact of technological change upon human communication. Past, present, and future technological developments that have affected how humans communicate. Emphasis on new communication technologies. 4 lectures.

**COMS 322. Persuasion. 4 units.**

Prerequisite: Completion of GE Area A.

Theory of persuasion with particular emphasis upon social psychological principles of influence. Analysis of various forms of persuasion, social influence and propaganda. 4 lectures.

**COMS 330. Classical Rhetorical Theory. 4 units.**

Prerequisite: Completion of GE Area A.

Early development of rhetorical theory in Greco-Roman civilization. Analysis of the canons of rhetoric. Rhetorical thought of Sophists, Isocrates, Plato, Aristotle, Cicero and Quintilian. 4 lectures.

**COMS 331. Contemporary Rhetorical Theory. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Rhetoric's role in contemporary culture. Issues: political advocacy; science, technology and mass persuasion; ethics and rhetoric. Representative theorists: Burke, Weaver, Richards, Toulmin and McLuhan. 4 lectures.

**COMS 332. Rhetorical Criticism. 4 units.**

Prerequisite: Junior standing, COMS 330.

Theory and method used in the analysis and evaluation of rhetorical discourse. Study of critical essays. Practice in interpreting and evaluating persuasive discourse. 4 lectures.

**COMS 350. Advanced Forensic Activity. 2 units.**

Prerequisite: COMS 250 or consent of instructor.

Advanced participation in intercollegiate speech activities. Intercollegiate tournament competition, judging speech competition and other communication-related public service on campus and in the community. Total credit limited to 6 units. 2 laboratories.

**COMS 385. Media Criticism. 4 units.**

Prerequisite: Completion of GE Area A, and junior standing.

Theory and method used in analyzing media from critical, rhetorical, and cultural perspectives. Practice in interpreting and evaluating news, advertising, prime-time television, the Internet, and other mass-mediated texts, with special attention to relationships among media, identity, and political action. 4 lectures.

**COMS 390. Environmental Communication. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Recommended: Completion of GE Area B2 or B3.

Recent developments in the field of environmental communication, including how and with what effect environmental messages are transmitted among scientists, policymakers, and the public. Critical/rhetorical and mediated perspectives that inform contemporary understandings of the human-nature relationship are addressed. 4 lectures.

**COMS 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor and junior standing.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**COMS 413. Advanced Organizational Communication. 4 units.**

Prerequisite: COMS 213 or COMS 301; junior standing.

Describing and measuring the organization's human message system. Planning and implementing communication training and development for the organization. New functions, careers and opportunities for the communication professional. 4 lectures.

**COMS 416. Intercultural Communication. 4 units.**

USCP

Prerequisite: Completion of GE Area A.

Examination and clarification of cultural aspects of communication within and among ethnic groups. 4 lectures. Fulfills USCP.

**COMS 418. Health Communication. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Communication in health contexts. Topics include interpersonal communication (e.g., health professional/patient), group and organizational communication (e.g., health-related groups), and mass communication (e.g., persuasive health campaigns). Open to all majors and valuable to laypersons who are consumers of health care, and pre-health professionals. 4 lectures.

**COMS 419. Media Effects. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Effects of media on the individual. Influence of mediated message producers, production technologies, and message content. Empirical approaches to data collection using experimental and survey techniques. 4 lectures.

**COMS 420. Nonverbal Communication. 4 units.**

Prerequisite: Completion of GE Area A.

Influence of kinesic, proxemic, artifactual, olfactory, paralinguistic and environmental factors in human communication. Theory, research and practice in nonverbal communication. 4 lectures.

**COMS 421. Gender and Communication. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Examination of gender in a variety of communication contexts. Concepts presented will help students understand the theory and practice of communication with members of the same and opposite sex. 4 lectures.

**COMS 424. Classroom Communication. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Exploration of classroom communication development. Student-teacher-parent interaction. Communication style, environmental stimuli, dialectal differences and bilingualism, measurement of communication competence. 4 lectures.

**COMS 435. American Political Rhetoric. 4 units.**

Prerequisite: Junior standing.

Role of oratory in American political and social history since Lincoln. Historical and rhetorical analyses of important political speeches delivered by presidents, activists, demagogues, and leaders of social movements. 4 lectures.

**COMS 450. Internship: Communication Studies. 2-4 units.**

CR/NC

Prerequisite: Junior standing, 2.5 GPA, and consent of instructor.

Supervised practicum and application of principles and theories of communication in organizational settings. Total credit limited to 8 units. Credit/No Credit grading only.

**COMS 460. Undergraduate Seminar. 1 unit.**

Prerequisite: Completion of COMS 311, COMS 312, COMS 330 and COMS 332, and junior standing; for COMS majors only.

Discussion and design of individual projects, oral reports on material in current professional writings. 1 seminar.

**COMS 461. Senior Project. 3 units.**

Prerequisite: COMS 460; for COMS majors only.

Completion of approved project under faculty supervision. Project results are presented in a formal written report. Minimum 90 hours total time.

**COMS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**COMS 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: 2.5 GPA and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.

## Computer Engineering (CPE)

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## Computer Engineering Courses

### **CPE 100. Computer Engineering Orientation. 1 unit.** CR/NC

Introduction to the computer engineering discipline. Success skills and curricular information. Career paths and opportunities. Professional aspects of engineering and computer science. Interaction with upper division students, alumni, faculty and staff. Introduction to computer software and hardware. Credit/No Credit grading only. 1 lecture.

### **CPE 101. Fundamentals of Computer Science I. 4 units.**

Prerequisite: Completion of ELM requirement, and passing score on MAPE or MATH 117 with a grade of C- or better or MATH 118 with a grade of C- or better, or consent of instructor.

Basic principles of algorithmic problem solving and programming using methods of top-down design, stepwise refinement and procedural abstraction. Basic control structures, data types, and input/output. Introduction to the software development process: design, implementation, testing and documentation. The syntax and semantics of a modern programming language. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 101.

### **CPE 102. Fundamentals of Computer Science II. 4 units.**

Prerequisite: CSC/CPE 101 with a grade of C- or better or either MATH 141 or MATH 221 with a grade of C- or better, or consent of instructor.

Basic design, implementation, testing, and documentation of object-oriented software. Introduction to classes, interfaces, inheritance, algorithms (sort, search, recursion), abstract data types, data structures (lists, stacks, queues), file I/O, and exceptions. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 102.

### **CPE 103. Fundamentals of Computer Science III. 4 units.**

Prerequisite: CPE/CSC 102 with a grade of C- or better or CPE/CSC 108 with a grade of C- or better, CSC 141 with a grade of C- or better, and MATH 141 with a grade of C- or better, or consent of instructor.

Introduction to data structures and analysis of algorithms. Abstract data types. Specification and implementation of advanced data structures. Theoretical and empirical analysis and proofs of properties of recursive and iterative algorithms. Software performance evaluation and testing techniques. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 103.

### **CPE 105. Fundamentals of Computer Science I Supplemental Instruction. 1 unit.**

CR/NC

Concurrent: CPE/CSC 101.

Facilitated study and discussion of fundamental concepts of computer science and familiarization with programming environments. Credit/No Credit grading only. 1 laboratory. Crosslisted as CPE/CSC 105.

### **CPE 108. Accelerated Introduction to Computer Science. 4 units.**

Prerequisite: Math 118 (or equivalent) with a grade of C- or better, significant experience in computer programming, and consent of instructor. Corequisite: CSC 141.

Accelerated introduction to basic principles of algorithmic and object-oriented problem solving and programming. Introduction to programming language concepts including control structures, data types, classes, and inheritance. Program design principles. Use and implementation of algorithms (searching, sorting, recursion) and data structures (lists, stacks, and queues). Intended for students with experience in algorithmic problem solving and using basic control structures and data types in a modern programming language (CSC/CPE 101), but who are not ready for CSC/CPE 102. Credit not available for students who have taken CSC/CPE 102. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 108.

### **CPE 123. Introduction to Computing. 4 units.**

Prerequisite: Basic computer literacy.

Use of a supportive software development environment to design, develop, and test applications in a selected topic domain that demonstrates the potential of careers in computing. An introduction to computing and to the selected topic domain. The Schedule of Classes will list topic selected. No programming experience required. Not for students with credit in CPE/CSC 103. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 123.

### **CPE 129. Digital Design. 3 units.**

Prerequisite: An orientation course in student's major (EE 111 & EE 151 for EE students, CPE 100 for CPE students), CPE/CSC 101. Concurrent: CPE/EE 169.

Number systems, Boolean algebra, Boolean functions, and minimization. Analysis and design of combinational logic circuits. Feedback circuits. Analysis and design of sequential logic circuits. Applying Hardware Description Language (HDL) to synthesize digital logic circuits in Programmable Logic Devices (PLDs). Not open to students with credit in CPE/EE 133. 3 lectures. Crosslisted as CPE/EE 129.

### **CPE 133. Digital Design. 4 units.**

Prerequisite: An orientation course in student's major (EE 111 & EE 151 for EE students, CPE 100 for CPE students), CPE/CSC 101.

Number systems, Boolean algebra, Boolean functions, and function minimization. Analysis and design of combinational and sequential logic circuits. Hardware Description Language (HDL) concepts and applications digital design and synthesis in Programmable Logic Devices (PLDs). Not open to students with credit in CPE/EE 129. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 133.

### **CPE 169. Digital Design Laboratory. 1 unit.**

Prerequisite: An orientation course in student's major (EE 111 & EE 151 for EE students, CPE 100 for CPE students), CPE/CSC 101. Concurrent: CPE/EE 129.

Experiments to analyze and design combinational and sequential logic circuits with discrete ICs and PLDs. Introduction to laboratory equipment such as the logic state analyzer for testing circuits. Introduction to a hardware description language for logic simulation and design. Not open to students with credit in CPE/EE 133. 1 laboratory. Crosslisted as CPE/EE 169.



**CPE 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**CPE 209. Problem Solving with Computers. 1 unit.**

CR/NC

Prerequisite: CSC/CPE 101 or CSC/CPE 108 with a grade of C- or better, or consent of instructor.

Reinforcement of computer science fundamentals. Review of important algorithms, language features, design, syntax, and testing techniques. Repeated application of techniques to solve problems in a constrained amount of time. Primarily intended to support students preparing for the Association for Computing Machinery's International Collegiate Programming Contest. Credit/No Credit grading only. Total credit limited to 15 units. 1 laboratory. Crosslisted as CPE/CSC 209.

**CPE 225. Introduction to Computer Organization. 4 units.**

Prerequisite: CSC/CPE 102.

Introduction to computer systems. Simple instruction set architecture and the computer hardware needed to implement that architecture. Machine and assembly language programming. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 225.

**CPE 229. Computer Design and Assembly Language Programming. 3 units.**

Prerequisite: CPE/EE 129&169 or CPE/EE 133. Concurrent: CPE/EE 269.

Design and implementation of digital computer circuits via CAD tools for programmable logic devices (PLDs). Computer design including datapath components and control unit. Assembly language programming. Instruction set architecture, hardware/software interface, performance evaluation of computer processors. Not open to students with credit in CPE/EE 233. 3 lectures. Crosslisted as CPE/EE 229.

**CPE 233. Computer Design and Assembly Language Programming. 4 units.**

Prerequisite: CPE/EE 129 and CPE/EE 169, or CPE/EE 133.

Design and implementation of digital computer circuits via CAD tools for programmable logic devices (PLDs). Basic computer design with its datapath components and control unit. Introduction to assembly language programming of an off-the-shelf RISC-based microcontroller. Not open to students with credit in CPE/EE 229. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 233.

**CPE 235. Fundamentals of Computer Science for Scientists and Engineers I. 4 units.**

Prerequisite: MATH 141 or MATH 161 with a grade of C- or better, or consent of instructor.

Introduction to the fundamentals of computer programming with an emphasis on mathematical, scientific and engineering applications: principles of algorithmic problem solving and procedural programming using a modern programming language, data types, elementary data structures, input/output and control structures. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 235.

**CPE 236. Fundamentals of Computer Science for Scientists and Engineers II. 4 units.**

Prerequisite: CSC/CPE 235 with a grade of C- or better, or consent of instructor.

Further study of computer program development with an emphasis on mathematical, scientific and engineering applications. Introduction to more complicated data types and structures. Practice of more complicated techniques of procedural programming. Introduction to the principles of object-oriented programming using a modern programming language. Detailed discussion of lists and classic list algorithms, algorithm analysis, multidimensional arrays, records, dynamic data structures, file input/output, classes. Not a substitute for CSC/CPE 102 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 236.

**CPE 269. Computer Design and Assembly Language Programming Laboratory. 1 unit.**

Prerequisite: CPE/EE 129&169 or CPE/EE 133. Concurrent: CPE/EE 229.

Experiments to design and test digital computer circuits and systems with programmable logic devices (PLDs). Design projects to implement a basic computer with data path components and control. Assembly language programming projects for an off-the-shelf RISC-based microcontroller. Not open to students with credit in CPE/EE 233. 1 laboratory. Crosslisted as CPE/EE 269.

**CPE 290. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CPE 300. Professional Responsibilities. 4 units.**

Prerequisite: CSC/CPE 357 and junior standing.

The responsibilities of the computer science professional. The ethics of science and the IEEE/ACM Software Engineering Code of Ethics. Quality tradeoffs, software system safety, intellectual property, history of computing and the social implications of computers in the modern world. Applications to ethical dilemmas in computing. Technical presentation methods and practice. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 300.

**CPE 301. Personal Software Process. 4 units.**

Prerequisite: CSC/CPE 103.

Principles and practices for defining and applying software processes to individual software development tasks. Quantitative methods for the measurement and analysis of software development cost and quality. Interpretation and evaluation of process metrics for creation of improvement plans. Adaptation of processes to individual styles. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 301.

**CPE 305. Individual Software Design and Development. 4 units.**

Prerequisite: CSC/CPE 357.

Practical software development skills needed for construction of mid-sized production-quality software modules, using the CSC upper division programming language. Topics include inheritance, exceptions, and memory and disk-based dynamic data structures. Students must complete an individual programming project of mid-level complexity. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 305.

**CPE 307. Introduction to Software Engineering. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357.

Requirements, specification, design, implementation, testing and verification of large software systems. Study and use of the software process and software engineering methodologies; working in project teams. 3 lectures, 1 laboratory. Not open to students with credit in CSC/CPE 308. Crosslisted as CPE/CSC 307.

**CPE 308. Software Engineering I. 4 units.**

Prerequisite: CSC/CPE 357.

Principles for engineering requirements analysis and design of large complex software systems. Software process models. Methods of project planning, tracking, documentation, communication, and quality assurance. Analysis of engineering tradeoffs. Group laboratory project. Technical oral and written presentations. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 308.

**CPE 309. Software Engineering II. 4 units.**

Prerequisite: CSC/CPE 308.

Continuation of the software lifecycle. Methods and tools for the implementation, integration, testing and maintenance of large software systems. Software development and test environments. Software quality assurance. Group laboratory project. Technical presentation methods and practice. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 309.

**CPE 315. Computer Architecture. 4 units.**

Prerequisite: CSC/CPE 103, and CPE/EE 229 or CSC 225 or CPE/EE 233.

In-depth study of the instruction set architecture and hardware design of a specific CPU. Introduction to pipelines, input/output and multi-processors. Computer abstractions and performance measurement. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 315.

**CPE 316. Micro Controllers and Embedded Applications. 4 units.**

Prerequisite: CPE/CSC 315 or CPE/EE 329.

Introduction to micro controllers and their applications as embedded devices. Hardware/software tradeoffs, micro controller selection, use of on-chip peripherals, interrupt driven real-time operation, A/D conversion, serial and parallel communications, watch-dog timers, low power operation and assembly language programming techniques. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 316.

**CPE 328. Discrete Time Signals and Systems. 3 units.**

Prerequisite: EE 228. Concurrent: EE/CPE 368.

Discrete-time systems and analysis, with emphasis on linear time-invariant (LTI) systems. Sampling theorem. Classification of discrete-time systems. Convolution and its application to LTI systems. The z transform, discrete-time Fourier transform, and discrete Fourier transform. Introduction to digital filters. 3 lectures. Crosslisted as CPE/EE 328.

**CPE 329. Programmable Logic and Microprocessor-Based Systems Design. 4 units.**

Prerequisite: EE 307&347, EE 229&269 or CPE/EE 233.

Design, implementation and testing of programmable logic microprocessor-based systems. Hardware/software tradeoffs (such as timing analysis and power considerations), system economics of programmable logic and microprocessor-based system design. Interfacing hardware components (such as ADCs/DACs, sensors, transducers). 3 lectures, 1 laboratory. Not open to students with credit in CPE/EE 336. Crosslisted as CPE/EE 329.

**CPE 336. Microprocessor System Design. 4 units.**

Prerequisite: CPE/EE 229 & CPE/EE 269 or CPE/EE 233.

Introduction to microcontrollers and integrated microprocessor systems. Hardware/software trade-offs, system economics, and functional configurations. Interface design, real-time clocks, interrupts, A/D conversion, serial and parallel communications, watch-dog timers, low power operation, event-based inter-peripheral communication, and assembly and higher-level language programming techniques. Architecture and design of sampled data and low-power systems. Not open to students with credit in CPE/EE 329. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 336.

**CPE 344. Music Programming. 4 units.**

Prerequisite: CSC/CPE 357.

Music-producing programs. Software synthesizers: oscillators, coupled oscillators, wavetable synthesis. Sound processing units/filters: LTI, FIR, IIR, nonlinear. Physics of sound, mathematical foundations of sound synthesis and filtering, existing sound formats (both sampled and MIDI). 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 344.

**CPE 349. Design and Analysis of Algorithms. 4 units.**

Prerequisite: CSC/CPE 103, with a grade of C- or better, and MATH 142; and STAT 312 or STAT 321 or STAT 350.

Intermediate and advanced algorithms and their analysis. Mathematical, geometrical, and graph algorithms. NP-complete problems. Additional topics will be chosen from pattern matching, file compression, cryptology, dynamic and linear programming, and exhaustive search. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 349.

**CPE 350. Capstone I. 4 units.**

Prerequisite: CPE 329, may be concurrent.

Definition and specification of a system to be constructed in CPE 450; requirements elicitation techniques, research and data gathering methods; project planning, time and budget estimating; project team organization. Ethics and professionalism. 3 lectures, 1 laboratory.

**CPE 357. Systems Programming. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better, or consent of instructor, and CSC 225 or CPE/EE 229 or CPE/EE 233.

C programming language from a system programming perspective. Standard C language including operators, I/O functions, and data types in the context of system functions. Unix commands, shell scripting, file system, editors. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 357.

**CPE 365. Introduction to Database Systems. 4 units.**

Prerequisite: CSC/CPE 103.

Basic principles of database management systems (DBMS) and of DBMS application development. DBMS objectives, systems architecture, database models with emphasis on Entity-Relationship and Relational models, data definition and manipulation languages, the Structured Query Language (SQL), database design, application development tools. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 365.

**CPE 366. Database Modeling, Design and Implementation. 4 units.**

Prerequisite: CSC/CPE 365.

The database modeling problem. Database modeling levels: external, conceptual, logical and physical. Database models: entity-relationship, relational, object-oriented, semantic, and object-relational. Normal forms. Distributed database design. Functional analysis of database applications and transaction specification, design, and implementation. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 366.

**CPE 368. Signals and Systems Laboratory. 1 unit.**

Prerequisite: EE 228. Concurrent: EE/CPE 328.

Laboratory work pertaining to linear systems, including Fourier analysis, time and frequency responses, and system transfer function. 1 laboratory. Crosslisted as CPE/EE 368.

**CPE 369. Distributed Computing I. 4 units.**

Prerequisite: CSC/CPE 357.

Introduction to distributed computing paradigms and protocols: interprocess communications, group communications, the client-server model, distributed objects, and Internet protocols. Emphasis on distributed software above the operating system and network layers. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 369.

**CPE 378. Interactive Entertainment Engineering. 4 units.**

Prerequisite: CPE/CSC 103.

Project-based, software oriented, design of interactive entertainment applications. Topics may include interactive storytelling, game physics, game AI, scripting, and development of virtual worlds using modeling and rendering tools. Projects require significant programming. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 378.

**CPE 400. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**CPE 402. Software Requirements Engineering. 4 units.**

Prerequisite: CSC/CPE 307 or CSC/CPE 309; CSC/CPE 305.

Software requirements elicitation, analysis and documentation. Team process infrastructure and resource estimation to support appropriate levels of quality. Software architectural design. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 402.

**CPE 405. Software Construction. 4 units.**

Prerequisite: CPE/CSC 402.

Design and construction of sizeable software products. Technical management of software development teams. Software development process models, software design, documentation, quality assurance during development, software unit and integration testing; CASE tools, development environments, test tools, configuration management. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 405.

**CPE 406. Software Deployment. 4 units.**

Prerequisite: CPE/CSC 405.

Deployment of a sizeable software product by a student team. Software maintenance and deployment economic issues. Management of deployed software: version control, defect tracking and technical support. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 406.

**CPE 409. Current Topics in Software Engineering. 4 units.**

Prerequisite: CSC/CPE 309 or CSC/CPE 307.

Selected topics in software engineering. Topics may include program generation, quality assurance, formal methods, software metrics, design methods, testing, or software development processes. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 409.

**CPE 415. Microcomputer Systems. 4 units.**

Prerequisite: CSC/CPE 315.

Recent advances in microcomputer architectures. RISC, parallel processing advances, and component communication. 3 lectures, 1 laboratory.

**CPE 416. Autonomous Mobile Robotics. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336 or both CSC/CPE 315 and CSC/CPE 357.

Theory and application of concepts relevant to autonomous mobile robots. Sensor and actuator interfacing, programming mobile robots, mobile robot configurations, software architectures and algorithms. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 416.

**CPE 419. Applied Parallel Computing. 4 units.**

Prerequisite: CSC/CPE 357. Recommended: CSC/CPE 315.

Introduction to applied parallel computing paradigms: software models, resource allocation, performance measurement, and data sharing. Emphasis on massively parallel computation and performance improvement for a real-world application of significant scope. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 419.

**CPE 427. Digital Computer Subsystems. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336.

Design of components and subsystems in digital computers. Use of modern techniques and devices (CPLDs and FPGAs) in implementation. Consideration given to cost/speed tradeoffs. Implementation of a basic digital computer using pre-designed subsystems. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 427.

**CPE 428. Computer Vision. 4 units.**

Prerequisite: EE 328 or CPE/CSC 357 or ME 305 or consent of instructor.

Introduction to the concepts of 2D and 3D computer vision: low-level image processing methods such as filtering and edge detection; feature extraction; segmentation and clustering; stereo vision; appearance-based and model-based algorithms. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 428.

**CPE 430. Programming Languages I. 4 units.**

Prerequisite: CSC 349 and CSC/CPE 357.

Construction of the front end of a compiler including lexical analysis, syntactic analysis, type checking, and formal semantics. Introduction to regular languages, finite automata, and context-free grammars. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 430.

**CPE 431. Programming Languages II. 4 units.**

Prerequisite: CSC/CPE 430.

Language principles and design issues: bindings, conversion, parameter passing, and dynamic semantics. Language implementation: intermediate code representation, memory management, code optimization, and code generation. Functional programming languages. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 431.

**CPE 432. Digital Control Systems. 3 units.**

Prerequisite: EE 302 &amp; EE 342. Concurrent: CPE/EE 472.

Recommended: Prior background in discrete time systems, for example EE 328, EE 368.

Theory and applications of digital computers in linear control systems. Discrete time methods are used in analysis and design studies. Digital control systems are synthesized. 3 lectures. Crosslisted as CPE/EE 432.

**CPE 435. Introduction to Object Oriented Design Using Graphical User Interfaces. 4 units.**

Prerequisite: CPE/CSC 305.

Principles of object-oriented design, with emphasis on use of these principles in the design of graphical interfaces. Comparison and contrasting of two major object-oriented languages and their corresponding GUI class libraries. Language-independent object-oriented design methods, and application of these methods in the construction of a GUI-based project. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 435.

**CPE 436. Mobile Application Development. 4 units.**

Prerequisite: CSC/CPE 357.

Inception, development, testing, and deployment of mobile applications. Introduction to tools, libraries, and frameworks for one or more mobile platforms and devices. Emphasis on software engineering best practices for developing entrepreneurial or humanitarian mobile-centric applications. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 436.

**CPE 437. Dynamic Web Development. 4 units.**

Prerequisite: CSC/CPE 357 (C- or better), CSC/CPE 365 or consent of instructor.

Project-based study of web-based three-tiered applications, including current best practices and tools for design, implementation and testing of browser interface, serverside business logic, object-relational mapping, databases, and web services. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 437.

**CPE 438. Digital Computer Systems. 3 units.**

Prerequisite: CPE 427 or consent of instructor.

Design of computer ALU's, microprogram controllers, memory systems, and I/O controllers. Use of LSI components in CPU design. Microprogram and nanoprogram development. 3 lectures. Crosslisted as CPE/EE 438.

**CPE 439. Real-Time Embedded Systems. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336.

Introduction to operating systems as they apply to real-time embedded applications. Use of standard and/or softcore microcontroller platforms with communications to discrete peripherals through common bus interfaces. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 439.

**CPE 441. Computer-Aided Design of VLSI Devices. 4 units.**

Prerequisite: EE 307 &amp; EE 347, EE 308 &amp; EE 348 or consent of instructor.

Design of VLSI circuits, design of subsystems using static CMOS, transmission gates, and other methods. Variety of CAD tools for design, verification, test, and simulation. Several design projects. 3 lectures, 1 laboratory. Crosslisted as CPE 441/EE 431.

**CPE 448. Bioinformatics Algorithms. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better, or BIO/CHEM 441 and senior standing, or consent of instructor.

Introduction to the use of computers to solve problems in molecular biology. The algorithms, languages, and databases important in determining and analyzing nucleic and protein sequences and their structure. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 448.

**CPE 449. Current Topics in Algorithms. 4 units.**

Prerequisite: CSC 349.

Selected aspects of the verification, analysis and design of algorithms. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 449.

**CPE 450. Capstone II. 4 units.**

Prerequisite: CPE 350.

Team-based design, construction and deployment of an embedded system that includes a custom-built computer. Technical management of product development teams. Technical documentation, configuration management, quality assurance, integration and systems testing. Professionalism. 3 lectures, 1 laboratory.

**CPE 453. Introduction to Operating Systems. 4 units.**

Prerequisite: CSC/CPE 357, and CSC/CPE 225 or CPE/EE 229 or CPE/EE 233.

Introduction to sequential and multiprogramming operating systems; kernel calls, interrupt service mechanisms, scheduling, files and protection mechanisms, conventional machine attributes that apply to operating system implementation, virtual memory management, and I/O control systems. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 453.

**CPE 454. Implementation of Operating Systems. 4 units.**

Prerequisite: CSC/CPE 453.

Design and implementation of multiprogramming kernels, systems programming methodology, interprocess communications, synchronization, device drivers and network access methods. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 454.

**CPE 456. Introduction to Computer Security. 4 units.**

Prerequisite: CSC/CPE 453 and either CSC/CPE 300 or CPE 350.

Survey of topics in computer system and network security, including protection, access control, distributed access control, operating system security, applied cryptography, network security, firewalls, secure coding practices, and case studies from real-world systems. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 456.



**CPE 458. Current Topics in Computer Systems. 4 units.**

Prerequisite: CSC/CPE 357.

Selected aspects of design, implementation and analysis of networks, advanced operating and distributed systems. Topics may include process management, virtual memory, process communication, context switching, file system designs, persistent objects, process and data migration, load balancing, security and networks. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 458.

**CPE 461. Senior Project I. 3 units.**

Prerequisite: CPE 350.

Selection and completion of an individual or team project in laboratory environment. Project results are presented in a formal report. 3 laboratories.

**CPE 462. Senior Project II. 2 units.**

Prerequisite: CPE 450.

Selection and completion of an individual or team project in laboratory environment. Project results are presented in a formal report. 2 laboratories.

**CPE 464. Introduction to Computer Networks. 4 units.**

Prerequisite: CSC/CPE 357. Recommended: STAT 312 or STAT 321 or STAT 350.

Computer network architectures; communications protocol standards; services provided by the network; historical and current examples presented. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 464.

**CPE 465. Advanced Computer Networks. 4 units.**

Prerequisite: CSC/CPE 464 and CSC/CPE 453.

Advanced topics in computer networks; greater detail of protocol standards and services provided by the network; focus on current industry and research topics. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 465.

**CPE 466. Knowledge Discovery from Data. 4 units.**

Prerequisite: CSC/CPE 365 and one of STAT 312, STAT 321 or STAT 350.

Overview of modern knowledge discovery from data (KDD) methods and technologies. Topics in On-line Analytic Transaction Processing (OLAP), data mining (association rules mining, classification, clustering), information retrieval. Emphasis on use of KDD techniques in modern software applications. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 466.

**CPE 468. Database Management Systems Implementation. 4 units.**

Prerequisite: CSC/CPE 365.

Data structures and algorithms used in the implementation of database systems. Implementation of data and transaction managers: access methods interfaces, concurrency control and recovery, query processors and optimizers. Introduction to implementation of distributed database systems. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 468.

**CPE 469. Distributed Computing II. 4 units.**

Prerequisite: CSC/CPE 369.

Continued exploration of topics in distributed computing in greater depth, with emphasis on design patterns and team projects. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 469.

**CPE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**CPE 471. Introduction to Computer Graphics. 4 units.**

Prerequisite: CSC/CPE 357.

Graphics software development and use of APIs for 3D graphics. The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 471.

**CPE 472. Digital Control Systems Laboratory. 1 unit.**

Concurrent: CPE/EE 432.

Design and programming of microprocessor-based digital controls for electro-mechanical plants. Topics include digital control laws, translation of transfer functions into algorithms, assembly language programming, real-time software design, sample rate selection, finite word-length considerations. 1 laboratory. Crosslisted as CPE/EE 472.

**CPE 473. Advanced Rendering Techniques. 4 units.**

Prerequisite: CSC/CPE 471.

Illumination models, reflectance, absorption, emittance, Gouraud shading, Phong shading, raytracing polyhedra and other modeling primitives, coherence, acceleration methods, radiosity, form factors, advanced algorithms. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 473.

**CPE 474. Computer Animation. 4 units.**

Prerequisite: CSC/CPE 471.

Basic and advanced algorithms for generating sequences of synthetic images. Interpolation in time and space, procedural and keyframe animation, particle systems, dynamics and inverse kinematics, morphing and video. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 474.

**CPE 476. Real-Time 3D Computer Graphics Software. 4 units.**

Prerequisite: CSC/CPE 471.

Basic and advanced algorithms for real-time, interactive, 3D graphics software. Modeling (polygon mesh, height field, scene graph), real-time rendering and shading (visibility processing, LOD, texture and light maps), collision detection (bounding volumes, complexity management), interactive controls, multi-player game technology, game engine architecture. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 476.

**CPE 478. Current Topics in Computer Graphics. 4 units.**

Prerequisite: CSC/CPE 471.

Selected aspects of the design, implementation and analysis of computer graphics. Topics may include rendering, modeling, visualization, animation, virtual reality, computer vision, multimedia, and perception issues. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 478.



**CPE 479. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**CPE 480. Artificial Intelligence. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better.

Programs and techniques that characterize artificial intelligence. Programming in a high level language. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 480.

**CPE 481. Knowledge Based Systems. 4 units.**

Prerequisite: CSC/CPE 480.

In-depth treatment of knowledge representation, utilization and acquisition in a programming environment. Emphasis on the use of domain-specific knowledge to obtain expert performance in programs. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 481.

**CPE 482. Advanced Topics in Systems for Computer Engineering. 4 units.**

Corequisite: CPE 350, or consent of instructor.

Selected aspects of design, implementation, verification and analysis of advanced computer systems. Topics may include computer systems, embedded systems, robotics, mechatronics, haptics, human computer interfaces, digital control, digital signal processing, wireless computing, real time operating systems, and networks. Class Schedule will list topic selected. Total credit limited to 8 units, repeatable in same term. 3 lectures, 1 laboratory.

**CPE 483. Current Topics in Human-Computer Interaction. 4 units.**

Prerequisite: CSC/CPE 484.

Selected aspects of the field of human-computer interaction. Topics may include dynamic information visualization, universal access, social impact of technology usage, educational technology, human cognition and performance studies, and extended usability evaluation techniques. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 483.

**CPE 484. User-Centered Interface Design and Development. 4 units.**

Prerequisite: Junior standing and CSC/CPE 307 or CSC/CPE 308.

Introduction to the importance of user-centered principles in the design of good interfaces and effective human-computer interaction. Topics include: study of human characteristics affected by interface design, effective requirements data collection and analysis, user-centered approaches to software engineering, and evaluation of interface and interaction quality. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 484.

**CPE 485. Autonomous Robot Navigation. 4 units.**

Prerequisite: CSC/CPE 357 or consent of instructor.

Overview of existing autonomous mobile robot systems, basic kinematic modeling, control structures, sensing and sensor modeling, localization, and motion planning algorithms. Implementation of autonomous navigation capabilities. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 485.

**CPE 486. Human-Computer Interaction Theory and Design. 4 units.**

Corequisite: CSC/CPE 484.

Application of the theories of human-computer interaction to the task of user-centered design. Survey of techniques for studying and involving users in different aspects of the design process, and demonstration of where and when applicable. Combining of theoretical understanding with practical experience to design solutions to problems facing interactive systems designers. 3 lectures, 1 laboratory. Crosslisted as CSC/CPE 486.

**CPE 488. Microelectronics and Electronics Packaging. 4 units.**

Prerequisite: EE 112 or EE 201. Recommended: MATE 210.

Materials, processes, and reliability of microelectronics and electronics packaging, surface mount assembly and printed circuit board fabrication. Organic substrates and ceramic substrates. Mechanical design, thermal, and electrical considerations in electronic packaging. Design for manufacturability. Overview of optoelectronics packaging and other emerging technologies in microelectronics and electronic packaging. Project on design and manufacture of an electronic device. 3 lectures, 1 laboratory. Crosslisted as CPE 488/IME 458/MATE 458.

**CPE 489. Current Topics in Artificial Intelligence. 4 units.**

Prerequisite: CSC/CPE 480.

Selected aspects of the design, implementation and analysis of advanced systems and concepts in the area of artificial intelligence. Topics may include knowledge representation, reasoning, learning, or planning, and specific techniques like intelligent agents, genetic algorithms, semantic web, or robotics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 489.

**CPE 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**CPE 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**CPE 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**CPE 520. Computer Architecture. 4 units.**

Prerequisite: CPE 315 and graduate standing, or consent of instructor.

Comparative study and design of multiprocessor, dataflow, RISC, high level language and other new computer architectures. VLSI processor design techniques. 3 seminars, 1 laboratory. Crosslisted as CPE/CSC 520.

**CPE 521. Computer Systems. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336, or equivalent, and graduate standing or consent of instructor.

Organization of modern general purpose, high speed digital computer systems. Design of arithmetic units, control units, memories and memory subsystems. Cost, power and speed trade-offs in the design of such systems. 3 seminars, 1 laboratory. Crosslisted as CPE/EE 521.

**CPE 522. Advanced Real-Time Embedded Systems Design. 4 units.**

Prerequisite: Advanced C programming skills, CPE/EE 329 or CPE/EE 336 or equivalent, or consent of instructor.

Theory, design and implementation of real-time operating system-based embedded systems. Scheduling algorithms, operating system resources, peripheral device interfacing and embedded system architecture. Resource management issues in a resource-limited (microcontroller-based) environment. 3 seminars, 1 laboratory. Crosslisted as CPE/EE 522.

**CPE 523. Digital Systems Design. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336 or equivalent, and graduate standing or consent of instructor.

Full-custom design and analysis of digital circuits using full CMOS, pass-transistor and dynamic circuit topologies. Transistor sizing for minimizing power consumption, delay and other design criteria. 3 seminars, 1 laboratory. Crosslisted as CPE/EE 523.

**CPE 556. Computer Security. 4 units.**

Prerequisite: CSC/CPE 456 and graduate standing, or consent of instructor.

Exploration of advanced topics in computer security with an emphasis on research topics. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 556.

**CPE 564. Computer Networks: Research Topics. 4 units.**

Prerequisite: CSC/CPE 464 and graduate standing, or consent of instructor.

Exploration of advanced topics in emerging computer networking technologies; focus on leading edge computer network research topics. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 564.

**CPE 569. Distributed Computing. 4 units.**

Prerequisite: CSC/CPE 357 and graduate standing, or consent of instructor.

Principles and practices in distributed computing: interprocess communications, group communications, client-server model, distributed objects, message queue system, distributed services, mobile agents, object space, Internet protocols. Distributed algorithms: consensus protocols, global state protocols. Fault tolerance: classification of faults, replication. Not open to students with credit in CSC/ CPE 369 or CSC/CPE 469. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 569.

**CPE 580. Artificial Intelligence. 4 units.**

Prerequisite: CPE/CSC 480 and graduate standing, or consent of instructor.

Current research in the field of artificial intelligence with emphasis on cooperative agents, distributed agents, and decision making in complex, concurrent environments. AI programming in a distributed environment. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 580.

**CPE 581. Computer Support for Knowledge Management. 4 units.**

Prerequisite: CSC/CPE 480 or CSC/CPE 484 or consent of instructor.

Methods and techniques that computer-based systems can provide to make the management of knowledge and information in digital form easier for the user. Emphasis on support for knowledge-intensive activities performed by users. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 581.

**CPE 582. Introduction to Natural Language Processing. 4 units.**

Prerequisite: CPE/CSC 480 or CPE/CSC 466 or graduate standing. Recommended: CSC/CPE 580.

Classic Natural Language Processing systems and techniques; review of recent advancements in the subject. Topics selected from: parsing, tagging, word-sense disambiguation, natural language generation, data mining, voice recognition, vocalization, knowledge management, semantic networks, stylistics and machine learning. 3 lectures, 1 laboratory.

## Computer Science (CSC)

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### Computer Science Courses

**CSC 100. Computer Science Orientation. 2 units.**

Prerequisite: Computer science major or minor or software engineering major.

Introduction to the computer science discipline for majors. Computer problem solving and the use of computers. Success skills for computer science majors. Career paths and opportunities. Interaction with upper division students and faculty. 2 seminars.

**CSC 101. Fundamentals of Computer Science I. 4 units.**

Prerequisite: Completion of ELM requirement, and passing score on MAPE or MATH 117 with a grade of C- or better or MATH 118 with a grade of C- or better, or consent of instructor.

Basic principles of algorithmic problem solving and programming using methods of top-down design, stepwise refinement and procedural abstraction. Basic control structures, data types, and input/output. Introduction to the software development process: design, implementation, testing and documentation. The syntax and semantics of a modern programming language. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 101.

**CSC 102. Fundamentals of Computer Science II. 4 units.**

Prerequisite: CSC/CPE 101 with a grade of C- or better and either MATH 141 or MATH 221 with a grade of C- or better, or consent of instructor.

Basic design, implementation, testing, and documentation of object-oriented software. Introduction to classes, interfaces, inheritance, algorithms (sort, search, recursion), abstract data types, data structures (lists, stacks, queues), file I/O, and exceptions. Credit not available for students who have taken CSC/CPE 108. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 102.

**CSC 103. Fundamentals of Computer Science III. 4 units.**

Prerequisite: CPE/CSC 102 with a grade of C- or better or CPE/CSC 108 with a grade of C- or better, CSC 141 with a grade of C- or better, and MATH 141 with a grade of C- or better, or consent of instructor.

Introduction to data structures and analysis of algorithms. Abstract data types. Specification and implementation of advanced data structures. Theoretical and empirical analysis and proofs of properties of recursive and iterative algorithms. Software performance evaluation and testing techniques. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 103.

**CSC 105. Fundamentals of Computer Science I Supplemental Instruction. 1 unit.**

CR/NC

Concurrent: CPE/CSC 101.

Facilitated study and discussion of fundamental concepts of computer science and familiarization with programming environments. Credit/No Credit grading only. 1 laboratory. Crosslisted as CPE/CSC 105.

**CSC 108. Accelerated Introduction to Computer Science. 4 units.**

Prerequisite: Math 118 (or equivalent) with a grade of C- or better, significant experience in computer programming, and consent of instructor. Corequisite: CSC 141.

Accelerated introduction to basic principles of algorithmic and object-oriented problem solving and programming. Introduction to programming language concepts including control structures, data types, classes, and inheritance. Program design principles. Use and implementation of algorithms (searching, sorting, recursion) and data structures (lists, stacks, and queues). Intended for students with experience in algorithmic problem solving and using basic control structures and data types in a modern programming language (CSC/CPE 101), but who are not ready for CSC/CPE 102. Credit not available for students who have taken CSC/CPE 102. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 108.

**CSC 123. Introduction to Computing. 4 units.**

Prerequisite: Basic computer literacy.

Use of a supportive software development environment to design, develop, and test applications in a selected topic domain that demonstrates the potential of careers in computing. An introduction to computing and to the selected topic domain. The Schedule of Classes will list topic selected. No programming experience required. Not for students with credit in CPE/CSC 103. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 123.

**CSC 141. Discrete Structures I. 4 units.**

Prerequisite: MATH 118 and MATH 119, or high school equivalent.

Recommended: Prior programming experience.

Introduction to structures of computer science: logic, sets, relations, functions, graphs and trees. Propositional and predicate logic. Applications of predicate logic to preconditions, postconditions, and proof techniques. Introduction to complexity of algorithms. 4 lectures.

**CSC 171. Introduction to Interactive Entertainment. 4 units.**

Use of click-and-drag software application to create an entertaining or informative, socially responsible application, such as a game.

Team collaboration to design, develop, and test applications. Focus on design, teamwork, and using an iterative development process.

An enjoyable introduction to both computer science and interactive entertainment. No computer science experience required. 3 lectures, 1 laboratory.

**CSC 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**CSC 209. Problem Solving with Computers. 1 unit.**

CR/NC

Prerequisite: CSC/CPE 101 or CSC/CPE 108 with a grade of C- or better, or consent of instructor.

Reinforcement of computer science fundamentals. Review of important algorithms, language features, design, syntax, and testing techniques. Repeated application of techniques to solve problems in a constrained amount of time. Primarily intended to support students preparing for the Association for Computing Machinery's International Collegiate Programming Contest. Credit/No Credit grading only. Total credit limited to 15 units. 1 laboratory. Crosslisted as CPE/CSC 209.

**CSC 225. Introduction to Computer Organization. 4 units.**

Prerequisite: CSC/CPE 102.

Introduction to computer systems. Simple instruction set architecture and the computer hardware needed to implement that architecture. Machine and assembly language programming. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 225.

**CSC 231. Programming for Engineering Students. 2 units.**

Prerequisite: MATH 142; PHYS 121 or PHYS 131 or PHYS 141.

Programming techniques and procedures with applications to engineering problems. Introduction to numerical methods and simulation. Credit not allowed for CSC, Software Engineering or CPE majors. 2 activities.

**CSC 232. Computer Programming for Scientists and Engineers. 3 units.**

Prerequisite: MATH 118 or equivalent.

Computer programming, with an emphasis on procedural programming, taught using a language hosted by applications commonly used in science and engineering. Credit not allowed for CSC, CPE or Software Engineering majors. 2 lectures, 1 activity.

**CSC 234. C and Unix. 3 units.**

Prerequisite: MATH 142.

The C programming language and the UNIX programming environment. Operators, standard I/O functions, strings, pointers and arrays, data types and storage classes. Unix shell programming and basic I/O system calls. Credit not allowed for CSC, Software Engineering or CPE majors. 3 lectures.

**CSC 235. Fundamentals of Computer Science for Scientists and Engineers I. 4 units.**

Prerequisite: MATH 141 or MATH 161 with a grade of C- or better, or consent of instructor.

Introduction to the fundamentals of computer programming with an emphasis on mathematical, scientific and engineering applications: principles of algorithmic problem solving and procedural programming using a modern programming language, data types, elementary data structures, input/output and control structures. Not a substitute for CSC/CPE 101 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 235.

**CSC 236. Fundamentals of Computer Science for Scientists and Engineers II. 4 units.**

Prerequisite: CSC/CPE 235 with a grade of C- or better, or consent of instructor.

Further study of computer program development with an emphasis on mathematical, scientific and engineering applications. Introduction to more complicated data types and structures. Practice of more complicated techniques of procedural programming. Introduction to the principles of object-oriented programming using a modern programming language. Detailed discussion of lists and classic list algorithms, algorithm analysis, multidimensional arrays, records, dynamic data structures, file input/output, classes. Not a substitute for CSC/CPE 102 for CSC/CPE majors or minors. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 236.

**CSC 239. Selected Programming Languages. 4 units.**

Prerequisite: Knowledge of a programming language.

A programming language selected from languages of current interest. Intended for students who want to learn another programming language. Class Schedule will list selected language. 3 lectures, 1 laboratory.

**CSC 290. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CSC 300. Professional Responsibilities. 4 units.**

Prerequisite: CSC/CPE 357 and junior standing.

The responsibilities of the computer science professional. The ethics of science and the IEEE/ACM Software Engineering Code of Ethics. Quality tradeoffs, software system safety, intellectual property, history of computing and the social implications of computers in the modern world. Applications to ethical dilemmas in computing. Technical presentation methods and practice. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 300.

**CSC 301. Personal Software Process. 4 units.**

Prerequisite: CSC/CPE 103.

Principles and practices for defining and applying software processes to individual software development tasks. Quantitative methods for the measurement and analysis of software development cost and quality. Interpretation and evaluation of process metrics for creation of improvement plans. Adaptation of processes to individual styles. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 301.

**CSC 302. Computers and Society. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Social, ethical, political and technological implications and effects of computers in the modern world. Examination of the benefits and side-effects of computer applications and automation. Case study review and analysis. 4 lectures. Fulfills GE Area F.

**CSC 303. Teaching Computer Science. 2 units.**

Prerequisite: CSC/CPE 103, with a grade of C- or better, or equivalent.

Practical coverage of educational techniques appropriate for tutoring in CSC/CPE undergraduate courses, including Socratic methods for tutoring of technical topics, design of test questions and grading rubrics, and lecture presentation. Intended for CSC/CPE/SE students interested in tutoring, grading, or a career in teaching computer science. 1 lecture, 1 laboratory. Not available for technical elective credit.

**CSC 305. Individual Software Design and Development. 4 units.**

Prerequisite: CSC/CPE 357.

Practical software development skills needed for construction of mid-sized production-quality software modules, using the CSC upper division programming language. Topics include inheritance, exceptions, and memory and disk-based dynamic data structures. Students must complete an individual programming project of mid-level complexity. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 305.

**CSC 307. Introduction to Software Engineering. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better, and CSC/CPE 357.

Requirements, specification, design, implementation, testing and verification of large software systems. Study and use of the software process and software engineering methodologies; working in project teams. 3 lectures, 1 laboratory. Not open to students with credit in CSC/CPE 308. Crosslisted as CPE/CSC 307.

**CSC 308. Software Engineering I. 4 units.**

Prerequisite: CSC/CPE 357.

Principles for engineering requirements analysis and design of large complex software systems. Software process models. Methods of project planning, tracking, documentation, communication, and quality assurance. Analysis of engineering tradeoffs. Group laboratory project. Technical oral and written presentations. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 308.



**CSC 309. Software Engineering II. 4 units.**

Prerequisite: CSC/CPE 308.

Continuation of the software lifecycle. Methods and tools for the implementation, integration, testing and maintenance of large software systems. Software development and test environments. Software quality assurance. Group laboratory project. Technical presentation methods and practice. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 309.

**CSC 310. Computers for Poets. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

How computers and computer devices work. Introduction to software systems and applications. How computers connect with various media including images, speech and data. How information is encoded and transmitted across networks. Relationship between the computer and human information processing. 4 lectures. Crosslisted as CSC 310/HNRS 311. Fulfills GE Area F.

**CSC 315. Computer Architecture. 4 units.**

Prerequisite: CSC/CPE 103, and CPE/EE 229 or CSC 225 or CPE/EE 233.

In-depth study of the instruction set architecture and hardware design of a specific CPU. Introduction to pipelines, input/output and multi-processors. Computer abstractions and performance measurement. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 315.

**CSC 316. Micro Controllers and Embedded Applications. 4 units.**

Prerequisite: CPE/CSC 315 or CPE/EE 329.

Introduction to micro controllers and their applications as embedded devices. Hardware/software tradeoffs, micro controller selection, use of on-chip peripherals, interrupt driven real-time operation, A/D conversion, serial and parallel communications, watch-dog timers, low power operation and assembly language programming techniques. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 316.

**CSC 341. Numerical Engineering Analysis. 4 units.**

GE Area B6

Prerequisite: MATH 244 and one of the following courses: CSC 101, CSC 231, CSC 232, CSC 234, CSC 235, or consent of instructor.

An intensive survey of numerical analysis techniques used for solving engineering problems. Topics include solution of nonlinear equations, solution of linear systems, interpolation, numerical quadrature, ordinary differential equations and boundary value problems. Not open to students who have completed CSC 342. 4 lectures. Fulfills GE B6.

**CSC 342. Numerical Analysis I. 3 units.**

Prerequisite: MATH 143 and knowledge of a high level programming language, or ability to use one of the following systems: Maple, MatLab, Mathematica, or Mathcad.

Computer solutions of nonlinear equations and systems of linear equations. Polynomial interpolation. Numerical quadrature. Introduction to the solution of ordinary differential equations. 3 lectures.

**CSC 344. Music Programming. 4 units.**

Prerequisite: CSC/CPE 357.

Music-producing programs. Software synthesizers: oscillators, coupled oscillators, wavetable synthesis. Sound processing units/filters: LTI, FIR, IIR, nonlinear. Physics of sound, mathematical foundations of sound synthesis and filtering, existing sound formats (both sampled and MIDI). 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 344.

**CSC 349. Design and Analysis of Algorithms. 4 units.**

Prerequisite: CSC/CPE 103, with a grade of C- or better, and MATH 142; and STAT 312 or STAT 321 or STAT 350.

Intermediate and advanced algorithms and their analysis. Mathematical, geometrical, and graph algorithms. NP-complete problems. Additional topics will be chosen from pattern matching, file compression, cryptology, dynamic and linear programming, and exhaustive search. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 349.

**CSC 357. Systems Programming. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better, or consent of instructor, and CSC 225 or CPE/EE 229 or CPE/EE 233.

C programming language from a system programming perspective. Standard C language including operators, I/O functions, and data types in the context of system functions. Unix commands, shell scripting, file system, editors. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 357.

**CSC 358. Computer System Administration. 2 units.**

Prerequisite: CSC/CPE 103 or permission of instructor.

Fundamental concepts of Unix system administration. Use of shell scripts and utilities. Techniques of networks and data communications. Methods of system maintenance and accounting. 2 seminars.

**CSC 365. Introduction to Database Systems. 4 units.**

Prerequisite: CSC/CPE 103.

Basic principles of database management systems (DBMS) and of DBMS application development. DBMS objectives, systems architecture, database models with emphasis on Entity-Relationship and Relational models, data definition and manipulation languages, the Structured Query Language (SQL), database design, application development tools. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 365.

**CSC 366. Database Modeling, Design and Implementation. 4 units.**

Prerequisite: CSC/CPE 365.

The database modeling problem. Database modeling levels: external, conceptual, logical and physical. Database models: entity-relationship, relational, object-oriented, semantic, and object-relational. Normal forms. Distributed database design. Functional analysis of database applications and transaction specification, design, and implementation. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 366.

**CSC 369. Distributed Computing I. 4 units.**

Prerequisite: CSC/CPE 357.

Introduction to distributed computing paradigms and protocols: interprocess communications, group communications, the client-server model, distributed objects, and Internet protocols. Emphasis on distributed software above the operating system and network layers. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 369.

**CSC 378. Interactive Entertainment Engineering. 4 units.**

Prerequisite: CPE/CSC 103.

Project-based, software oriented, design of interactive entertainment applications. Topics may include interactive storytelling, game physics, game AI, scripting, and development of virtual worlds using modeling and rendering tools. Projects require significant programming. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 378.



**CSC 400. Special Problems. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units.

**CSC 402. Software Requirements Engineering. 4 units.**

Prerequisite: CSC/CPE 307 or CSC/CPE 309; CSC/CPE 305.

Software requirements elicitation, analysis and documentation. Team process infrastructure and resource estimation to support appropriate levels of quality. Software architectural design. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 402.

**CSC 405. Software Construction. 4 units.**

Prerequisite: CPE/CSC 402.

Design and construction of sizeable software products. Technical management of software development teams. Software development process models, software design, documentation, quality assurance during development, software unit and integration testing; CASE tools, development environments, test tools, configuration management. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 405.

**CSC 406. Software Deployment. 4 units.**

Prerequisite: CPE/CSC 405.

Deployment of a sizeable software product by a student team. Software maintenance and deployment economic issues. Management of deployed software: version control, defect tracking and technical support. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 406.

**CSC 409. Current Topics in Software Engineering. 4 units.**

Prerequisite: CSC/CPE 309 or CSC/CPE 307.

Selected topics in software engineering. Topics may include program generation, quality assurance, formal methods, software metrics, design methods, testing, or software development processes. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 409.

**CSC 416. Autonomous Mobile Robotics. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336 or both CSC/CPE 315 and CSC/CPE 357.

Theory and application of concepts relevant to autonomous mobile robots. Sensor and actuator interfacing, programming mobile robots, mobile robot configurations, software architectures and algorithms. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 416.

**CSC 419. Applied Parallel Computing. 4 units.**

Prerequisite: CSC/CPE 357. Recommended: CSC/CPE 315.

Introduction to applied parallel computing paradigms: software models, resource allocation, performance measurement, and data sharing. Emphasis on massively parallel computation and performance improvement for a real-world application of significant scope. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 419.

**CSC 430. Programming Languages I. 4 units.**

Prerequisite: CSC 349 and CSC/CPE 357.

Construction of the front end of a compiler including lexical analysis, syntactic analysis, type checking, and formal semantics. Introduction to regular languages, finite automata, and context-free grammars. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 430.

**CSC 431. Programming Languages II. 4 units.**

Prerequisite: CSC/CPE 430.

Language principles and design issues: bindings, conversion, parameter passing, and dynamic semantics. Language implementation: intermediate code representation, memory management, code optimization, and code generation. Functional programming languages. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 431.

**CSC 435. Introduction to Object Oriented Design Using Graphical User Interfaces. 4 units.**

Prerequisite: CPE/CSC 305.

Principles of object-oriented design, with emphasis on use of these principles in the design of graphical interfaces. Comparison and contrasting of two major object-oriented languages and their corresponding GUI class libraries. Language-independent object-oriented design methods, and application of these methods in the construction of a GUI-based project. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 435.

**CSC 436. Mobile Application Development. 4 units.**

Prerequisite: CSC/CPE 357.

Inception, development, testing, and deployment of mobile applications. Introduction to tools, libraries, and frameworks for one or more mobile platforms and devices. Emphasis on software engineering best practices for developing entrepreneurial or humanitarian mobile-centric applications. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 436.

**CSC 437. Dynamic Web Development. 4 units.**

Prerequisite: CSC/CPE 357 (C- or better), CSC/CPE 365 or consent of instructor.

Project-based study of web-based three-tiered applications, including current best practices and tools for design, implementation and testing of browser interface, serverside business logic, object-relational mapping, databases, and web services. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 437.

**CSC 445. Theory of Computation I. 4 units.**

Prerequisite: CSC 141 and CSC 349 or consent of instructor.

Theory of formal languages and automata. Turing machines. Chomsky hierarchy. Theory of decidability and computability. 4 lectures.

**CSC 448. Bioinformatics Algorithms. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better, or BIO/CHEM 441 and senior standing, or consent of instructor.

Introduction to the use of computers to solve problems in molecular biology. The algorithms, languages, and databases important in determining and analyzing nucleic and protein sequences and their structure. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 448.

**CSC 449. Current Topics in Algorithms. 4 units.**

Prerequisite: CSC 349.

Selected aspects of the verification, analysis and design of algorithms. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 449.

**CSC 453. Introduction to Operating Systems. 4 units.**

Prerequisite: CSC/CPE 357, and CSC/CPE 225 or CPE/EE 229 or CPE/EE 233.

Introduction to sequential and multiprogramming operating systems; kernel calls, interrupt service mechanisms, scheduling, files and protection mechanisms, conventional machine attributes that apply to operating system implementation, virtual memory management, and I/O control systems. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 453.

**CSC 454. Implementation of Operating Systems. 4 units.**

Prerequisite: CSC/CPE 453.

Design and implementation of multiprogramming kernels, systems programming methodology, interprocess communications, synchronization, device drivers and network access methods. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 454.

**CSC 456. Introduction to Computer Security. 4 units.**

Prerequisite: CSC/CPE 453 and either CSC/CPE 300 or CPE 350.

Survey of topics in computer system and network security, including protection, access control, distributed access control, operating system security, applied cryptography, network security, firewalls, secure coding practices, and case studies from real-world systems. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 456.

**CSC 458. Current Topics in Computer Systems. 4 units.**

Prerequisite: CSC/CPE 357.

Selected aspects of design, implementation and analysis of networks, advanced operating and distributed systems. Topics may include process management, virtual memory, process communication, context switching, file system designs, persistent objects, process and data migration, load balancing, security and networks. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 458.

**CSC 464. Introduction to Computer Networks. 4 units.**

Prerequisite: CSC/CPE 357. Recommended: STAT 312 or STAT 321 or STAT 350.

Computer network architectures; communications protocol standards; services provided by the network; historical and current examples presented. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 464.

**CSC 465. Advanced Computer Networks. 4 units.**

Prerequisite: CSC/CPE 464 and CSC/CPE 453.

Advanced topics in computer networks; greater detail of protocol standards and services provided by the network; focus on current industry and research topics. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 465.

**CSC 466. Knowledge Discovery from Data. 4 units.**

Prerequisite: CSC/CPE 365 and one of STAT 312, STAT 321 or STAT 350.

Overview of modern knowledge discovery from data (KDD) methods and technologies. Topics in On-line Analytic Transaction Processing (OLAP), data mining (association rules mining, classification, clustering), information retrieval. Emphasis on use of KDD techniques in modern software applications. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 466.

**CSC 468. Database Management Systems Implementation. 4 units.**

Prerequisite: CSC/CPE 365.

Data structures and algorithms used in the implementation of database systems. Implementation of data and transaction managers: access methods interfaces, concurrency control and recovery, query processors and optimizers. Introduction to implementation of distributed database systems. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 468.

**CSC 469. Distributed Computing II. 4 units.**

Prerequisite: CSC/CPE 369.

Continued exploration of topics in distributed computing in greater depth, with emphasis on design patterns and team projects. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 469.

**CSC 471. Introduction to Computer Graphics. 4 units.**

Prerequisite: CSC/CPE 357.

Graphics software development and use of APIs for 3D graphics. The graphics pipeline, modeling, geometric and viewing transforms, lighting and shading, rendering, interaction techniques and graphics hardware. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 471.

**CSC 473. Advanced Rendering Techniques. 4 units.**

Prerequisite: CSC/CPE 471.

Illumination models, reflectance, absorption, emittance, Gouraud shading, Phong shading, raytracing polyhedra and other modeling primitives, coherence, acceleration methods, radiosity, form factors, advanced algorithms. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 473.

**CSC 474. Computer Animation. 4 units.**

Prerequisite: CSC/CPE 471.

Basic and advanced algorithms for generating sequences of synthetic images. Interpolation in time and space, procedural and keyframe animation, particle systems, dynamics and inverse kinematics, morphing and video. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 474.

**CSC 476. Real-Time 3D Computer Graphics Software. 4 units.**

Prerequisite: CSC/CPE 471.

Basic and advanced algorithms for real-time, interactive, 3D graphics software. Modeling (polygon mesh, height field, scene graph), real-time rendering and shading (visibility processing, LOD, texture and light maps), collision detection (bounding volumes, complexity management), interactive controls, multi-player game technology, game engine architecture. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 476.

**CSC 478. Current Topics in Computer Graphics. 4 units.**

Prerequisite: CSC/CPE 471.

Selected aspects of the design, implementation and analysis of computer graphics. Topics may include rendering, modeling, visualization, animation, virtual reality, computer vision, multimedia, and perception issues. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 478.

**CSC 479. Computer Graphics Seminar. 2 units.**

Prerequisite: CSC/CPE 471.

Current topics in computer graphics. Total credit limited to 4 units. 2 seminars.

**CSC 480. Artificial Intelligence. 4 units.**

Prerequisite: CSC/CPE 103 with a grade of C- or better.

Programs and techniques that characterize artificial intelligence. Programming in a high level language. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 480.

**CSC 481. Knowledge Based Systems. 4 units.**

Prerequisite: CSC/CPE 480.

In-depth treatment of knowledge representation, utilization and acquisition in a programming environment. Emphasis on the use of domain-specific knowledge to obtain expert performance in programs. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 481.

**CSC 483. Current Topics in Human-Computer Interaction. 4 units.**

Prerequisite: CSC/CPE 484.

Selected aspects of the field of human-computer interaction. Topics may include dynamic information visualization, universal access, social impact of technology usage, educational technology, human cognition and performance studies, and extended usability evaluation techniques. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 483.

**CSC 484. User-Centered Interface Design and Development. 4 units.**

Prerequisite: Junior standing and CSC/CPE 307 or CSC/CPE 308.

Introduction to the importance of user-centered principles in the design of good interfaces and effective human-computer interaction. Topics include: study of human characteristics affected by interface design, effective requirements data collection and analysis, user-centered approaches to software engineering, and evaluation of interface and interaction quality. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 484.

**CSC 485. Autonomous Robot Navigation. 4 units.**

Prerequisite: CSC/CPE 357 or consent of instructor.

Overview of existing autonomous mobile robot systems, basic kinematic modeling, control structures, sensing and sensor modeling, localization, and motion planning algorithms. Implementation of autonomous navigation capabilities. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 485.

**CSC 486. Human-Computer Interaction Theory and Design. 4 units.**

Corequisite: CSC/CPE 484.

Application of the theories of human-computer interaction to the task of user-centered design. Survey of techniques for studying and involving users in different aspects of the design process, and demonstration of where and when applicable. Combining of theoretical understanding with practical experience to design solutions to problems facing interactive systems designers. 3 lectures, 1 laboratory. Crosslisted as CSC/CPE 486.

**CSC 489. Current Topics in Artificial Intelligence. 4 units.**

Prerequisite: CSC/CPE 480.

Selected aspects of the design, implementation and analysis of advanced systems and concepts in the area of artificial intelligence. Topics may include knowledge representation, reasoning, learning, or planning, and specific techniques like intelligent agents, genetic algorithms, semantic web, or robotics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 489.

**CSC 490. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**CSC 491. Senior Project Lab I. 2 units.**

Prerequisite: CSC/CPE 307 or CSC/CPE 309 and consent of instructor.

Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project may include students from other disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories.

**CSC 492. Senior Project Lab II. 3 units.**

Prerequisite: CSC 491 and consent of instructor.

Selection and completion of a project by individuals or team which is typical of problems which graduates must solve in their fields of employment. Project may include students from other disciplines. Project results are presented in a formal report. 3 laboratories.

**CSC 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**CSC 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**CSC 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**CSC 496. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**CSC 500. Directed Study. 2-3 units.**

CR/NC

Prerequisite: Fully classified graduate standing and consent of instructor.

Individual directed study of advanced topics. Total credit limited to 4 units. Credit/No Credit grading only.

**CSC 508. Software Engineering I. 4 units.**

Prerequisite: CSC/CPE 307 or CSC/CPE 308 and graduate standing, or consent of instructor.

In-depth study of requirements engineering, software project management, formal specifications and object-oriented analysis. 4 seminars.

**CSC 509. Software Engineering II. 4 units.**

Prerequisite: CSC 508 and graduate standing, or consent of instructor.

In-depth study of software modeling and design. Formal design methodologies. Design patterns. Detailed case studies of existing projects. Tools and methods for designing large software systems. 4 seminars.

**CSC 520. Computer Architecture. 4 units.**

Prerequisite: CPE 315 and graduate standing, or consent of instructor.

Comparative study and design of multiprocessor, dataflow, RISC, high level language and other new computer architectures. VLSI processor design techniques. 3 seminars, 1 laboratory. Crosslisted as CPE/CSC 520.

**CSC 530. Languages and Translators. 4 units.**

Prerequisite: CSC 430 and graduate standing, or consent of instructor.

Advanced programming language and translator concepts. Language concepts to be covered will be selected from current state-of-the-art languages and current issues in language design. Compiler concepts will include retargetable code generation, use of translator-writing systems, and error recovery. 4 seminars.

**CSC 540. Theory of Computation II. 4 units.**

Prerequisite: CSC 445 and graduate standing, or consent of instructor.

Advanced topics in theoretical computer science from such areas as automata theory, cellular automata theory, computational complexity, and program verification. 4 seminars.

**CSC 541. Numerical Methods. 4 units.**

Prerequisite: CSC 342 and graduate standing, or consent of instructor.

Introduction to advanced methods used in numerical analysis. Finite element methods for one and two-dimensional problems. Study of transforms including the Fast Fourier Transform and the Fast Hartley Transform. Review of the software supporting these methods. 4 seminars.

**CSC 550. Operating Systems. 4 units.**

Prerequisite: CSC/CPE 453 and graduate standing, or consent of instructor.

General concepts of computer architecture and operating systems. Design features of advanced computers, general time-sharing systems and schemes for dynamic memory allocation, scheduling and protection. Dynamic linkage between subroutines. Intercommunication between input/output and processors. 4 seminars.

**CSC 556. Computer Security. 4 units.**

Prerequisite: CSC/CPE 456 and graduate standing, or consent of instructor.

Exploration of advanced topics in computer security with an emphasis on research topics. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 556.

**CSC 560. Database Systems. 4 units.**

Prerequisite: CSC/CPE 365 and graduate standing, or consent of instructor.

Current topics in database systems: distributed databases and transactions, nested and long-running transactions, distributed concurrency control, semantic and object-oriented data models, database systems for non-traditional applications: engineering design databases, active, logic, temporal, multimedia, and real-time databases. 4 seminars.

**CSC 564. Computer Networks: Research Topics. 4 units.**

Prerequisite: CSC/CPE 464 and graduate standing, or consent of instructor.

Exploration of advanced topics in emerging computer networking technologies; focus on leading edge computer network research topics. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 564.

**CSC 568. Distributed Systems. 4 units.**

Prerequisite: CSC/CPE 369 or CSC/CPE 569 and graduate standing, or consent of instructor.

Advanced topics in distributed systems with emphasis on recent and emerging distributed computing paradigms, fault tolerance, and distributed algorithms. 4 seminars.

**CSC 569. Distributed Computing. 4 units.**

Prerequisite: CSC/CPE 357 and graduate standing, or consent of instructor.

Principles and practices in distributed computing: interprocess communications, group communications, client-server model, distributed objects, message queue system, distributed services, mobile agents, object space, Internet protocols. Distributed algorithms: consensus protocols, global state protocols. Fault tolerance: classification of faults, replication. Not open to students with credit in CSC/ CPE 369 or CSC/CPE 469. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 569.

**CSC 570. Current Topics in Computer Science. 2-4 units.**

Prerequisite: Graduate standing and evidence of satisfactory preparation in computer science.

Directed group study of selected topics for graduate students. Topics will normally consist of continuations of those in CSC 520, CSC 530, CSC 540, CSC 550, CSC 560 and CSC 580, and other topics as needed. Class Schedule will list topic selected. Topic credit limited to 12 units. 2 to 4 seminars.



**CSC 572. Computer Graphics. 4 units.**

Prerequisite: Successful completion of CSC/CPE 471 and graduate standing, or consent of instructor.

Advanced topics in computer graphics with emphasis on leading edge computer graphics technologies and advanced topics in graphics fundamentals. 3 lectures, 1 laboratory.

**CSC 580. Artificial Intelligence. 4 units.**

Prerequisite: CPE/CSC 480 and graduate standing, or consent of instructor.

Current research in the field of artificial intelligence with emphasis on cooperative agents, distributed agents, and decision making in complex, concurrent environments. AI programming in a distributed environment. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 580.

**CSC 581. Computer Support for Knowledge Management. 4 units.**

Prerequisite: CSC/CPE 480 or CSC/CPE 484 or consent of instructor.

Methods and techniques that computer-based systems can provide to make the management of knowledge and information in digital form easier for the user. Emphasis on support for knowledge-intensive activities performed by users. 3 lectures, 1 laboratory. Crosslisted as CPE/CSC 581.

**CSC 582. Introduction to Natural Language Processing. 4 units.**

Prerequisite: CPE/CSC 480 or CPE/CSC 466 or graduate standing. Recommended: CSC/CPE 580.

Classic Natural Language Processing systems and techniques; review of recent advancements in the subject. Topics selected from: parsing, tagging, word-sense disambiguation, natural language generation, data mining, voice recognition, vocalization, knowledge management, semantic networks, stylistics and machine learning. 3 lectures, 1 laboratory.

**CSC 590. Thesis Seminar. 1 unit.**

Prerequisite: Graduate standing or consent of instructor.

Preparation for conducting research in the field of computer science, through discussions, selected readings, and student presentations. 1 seminar.

**CSC 593. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**CSC 594. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**CSC 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only.

**CSC 596. Thesis I. 2 units.**

Prerequisite: Graduate standing and consent of instructor. Corequisite: CSC 590.

Individual research or activity under faculty supervision, beginning work on the master's thesis.

**CSC 597. Thesis II. 3 units.**

Prerequisite: CSC 596 and consent of instructor.

Individual research or activity under faculty supervision, continuing work on the master's thesis.

**CSC 599. Thesis III. 3 units.**

Prerequisite: CSC 597, selection of thesis committee, graduate standing, and consent of instructor.

Individual research or activity under faculty supervision leading to an acceptable thesis.

## Construction Management (CM)

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### Construction Management Courses

**CM 102. Introduction to Construction Management. 2 units.**

Introduction to the fundamental concepts and overview of the essential elements associated with the construction profession, to include: construction trends, ethics, safety and health issues, and professional practice methods. 2 lectures.

**CM 113. Construction Materials and Assemblies. 2 units.**

Prerequisite: EDES 101. Concurrent: CM 114 for CM majors. Recommended: CM 102.

Exploration of the various materials, assemblies, and processes used and applied in the building construction process. Includes presentation, discussion, analysis, study and research of construction materials and assemblies. 2 lectures.

**CM 114. Construction Materials and Assemblies Lab. 2 units.**

Prerequisite: EDES 101. Concurrent: CM 113. Recommended: CM 102.

Exploration of the various materials, assemblies, and processes used and applied in the building construction process. Includes presentation, discussion, analysis, study and research of construction materials and assemblies. 2 laboratories.



**CM 115. Fundamentals of Construction Management. 6 units.**

Prerequisite: ARCE 106 or CM 113; MATH 141; and PHYS 141.

Production of drawings and specifications for residential and light commercial construction. Integration of scheduling, estimating, codes, and contracts with a project based approach. Manual drawing techniques and computer aided drafting with building information modeling develop visualization skills for architectural systems. 4 laboratories, 2 activities.

**CM 212. Construction Management Principles. 3 units.**

Prerequisite: Consent of instructor.

Introduction to the fundamental concepts of construction management. Primary areas of focus are quantity surveying and basic scheduling techniques. Additional topics of study to include work activity durations and sequencing, and computer applications in scheduling. Course does not satisfy approved technical elective requirement for CM majors. 3 laboratories.

**CM 214. Residential Construction Management. 5 units.**

Prerequisite: CM 115, PHYS 132 or CHEM 124. Corequisite: CM 232.

Materials, methods, and techniques associated with residential and light commercial construction operations. Topics include shallow foundations, timber and masonry framing, roofing, and exterior and interior finishes. Scheduling, estimating, and construction contracts are integrated into a project based approach. 3 laboratories, 2 activities. Formerly CM 311.

**CM 221. Concrete and Formwork Technology. 3 units.**

Prerequisite: ARCH 106.

Modern concepts of concrete and formwork construction. Significant developments in concrete chemistry and strength theory. Formwork systems, concrete mix design, admixtures, batching, finishing, curing and testing. Includes physically building basic forms, finishing and curing concrete, and testing of designed mixes. 2 lectures, 1 laboratory.

**CM 232. Evaluation of Cost Alternatives. 3 units.**

Prerequisite: MATH 142 or MATH 182.

Basic principles of economic evaluations using fundamental concepts of time value of money to compare cost alternatives related to construction, design, and real property development. 3 lectures. Formerly CM 332.

**CM 239. Construction Surveying. 4 units.**

Prerequisite: MATH 119 or equivalent.

Theory and practice of plane surveying with an emphasis on construction applications. Topics include property use and care of survey equipment and instruments, distance measurement, leveling, angular measurement, construction layout, basic roadwork, and as-built surveys. 3 lectures, 1 laboratory.

**CM 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**CM 313. Commercial Construction Management. 5 units.**

Prerequisite: CM 214 and ARCE 212.

Materials, methods, and techniques associated with large commercial and institutional construction operations. Topics include building systems analysis of foundations, waterproofing, structural framing, exterior cladding, and finishes. Scheduling, estimating, and construction contracts are integrated into a project based approach. 3 laboratories, 2 activities.

**CM 314. Heavy Civil Construction Management. 5 units.**

Prerequisite: CM 313.

Materials, methods, and techniques associated with civil engineering projects and heavy construction operations. Topics include tunnel, bridge, dam, and road construction; equipment selection; and temporary structures. Scheduling, estimating, and construction contracts are integrated into a project based approach. 3 laboratories, 2 activities. Formerly CM 213.

**CM 317. Sustainability and the Built Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Interdisciplinary analysis of sustainable strategies and technologies to enhance the built environment. A systems approach to green building science that includes sustainable site development, water use efficiency, renewable energy, improving material use, indoor environmental quality, and design innovation. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE Area F.

**CM 334. Construction Law. 2 units.**

Prerequisite: CM 115.

The intersection of law and the construction industry. Topics of study include a survey of most major legal issues potentially encountered during construction activity. 2 activities. Formerly CM 333.

**CM 335. Construction Accounting. 2 units.**

Prerequisite: CM 115, CM 232, and BUS 215.

Fundamentals of construction accounting principles to include income recognition, job cost control, cash flow analysis and associated cost reports. 2 activities. Formerly CM 331.

**CM 371. Construction Management and Project Planning. 4 units.**

Prerequisite: ARCE 106, CE 259 or CM 113.

Theory and practice of planning, scheduling, estimating, and reporting for construction projects. Fundamentals of scheduling logic including critical path, deterministic, and probabilistic scheduling; including the impact of constraints. Identifying resources and estimating time requirements for design activities and project operations. Not open to Architectural Engineering or Construction Management majors. 3 lectures, 1 activity. Crosslisted as CE/CM 371.

**CM 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 6 units, with a maximum of 4 units per quarter.

**CM 411. Specialty Contracting Construction Management. 5 units.**

Prerequisite: CM 313.

Materials, methods, and techniques associated with mechanical, electrical, and plumbing systems. Topics include heating, ventilating, air conditioning, power distribution, grounding, lighting, communication, fire detection/protection, and plumbing. Integration of scheduling, estimating, and construction subcontracts with a project based approach. 3 laboratories, 2 activities.

**CM 413. Jobsite Construction Management. 5 units.**

Prerequisite: CM 115, CM 214, CM 232, CM 313, CM 314, CM 334, CM 335, ARCE 212, and BUS 207.

Management activities applicable to the construction process involving techniques, applications, and theory needed in a jobsite environment. Addresses the relationships, roles, and perspectives of all stakeholders. Integrated utilization of temporary structures associated with field construction. 3 laboratories, 2 activities.

**CM 415. Integrated Project Delivery. 4 units.**

Prerequisite: CM 413 and CM 480.

Team based collaborative effort to analyze and evaluate the unique interdisciplinary challenges associated with coordinating and integrating the design and construction processes to deliver a project with respect to the design, budget, schedule, quality, and performance expectations of a client. 4 laboratories.

**CM 420. Service / Experiential Learning. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Service and project-based learning and teaching techniques as applied to a variety of construction management concepts. Goals and objectives achieved through service-learning, project-based, and/or experiential pedagogical approaches. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 421. Emerging Trends. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Emerging trends related to construction management concepts and practices. Goals and objectives achieved through analysis, study, and research of a particular construction emerging trend. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 422. Professional Preparation. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Professional practice related to the construction management industry. Goals and objectives achieved through analysis, study, and preparation for a particular professional practice. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 423. Construction Materials / Assemblies. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Various materials and assemblies related to construction process. Goals and objectives achieved through analysis, study, and research of a particular construction material and/or assembly. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 424. Construction Technology. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Technology related to construction management education and the construction industry. Goals and objectives achieved through analysis, study, and research of a particular construction technology. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 425. Sustainability and Environment. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Sustainable and environmental issues related to the construction industry. Goals and objectives achieved through analysis of a particular construction related sustainable and/or environmental issue. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 426. International Construction Studies. 1-6 units.**

Prerequisite: Third-year standing, or consent of instructor.

Exploration of international construction studies through several potential teaching techniques, including field trips to countries overseas, research and case studies of companies and projects, and management skills and leadership as they relate to international construction. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-6 activities.

**CM 430. Collaborative Process. 3 units.**

Prerequisite: Minimum junior standing or consent of instructor.

A comprehensive set of tools and practices that allow for high performance, interdisciplinary collaborative teams to focus on extraordinary outcomes at each step of project development, including planning, design, bidding, permitting, construction and management phases. 3 activities. Crosslisted as CM/EDES 430.

**CM 432. Design-Build Project Management. 3 units.**

Prerequisite: Minimum junior standing.

Management issues applicable to the design and construction integration method of project delivery. Project sponsor/project advocate techniques, monitoring the evolving design, detecting and controlling change, early warning systems, cost trending, schedule impacts, cost impacts, systems integration, contract/scope modifications, procurement, contingencies, quality, and overall process control. 3 activities.

**CM 433. Integrated Project Delivery. 2 units.**

Prerequisite: CM 214.

Investigation and analysis of special advanced topics in Integrated Project Delivery including Design-Build, CM-at-Risk, Alliance Contracting and other alternative delivery models and application across a wide range of project types. Topics include source selection, acquisitions, contracting, performance criteria, design management, and others. 2 activities.

**CM 443. Management of the Construction Firm. 3 units.**

Prerequisite: CM 413.

Applications of strategic management techniques and business strategy for managing and long-range planning of the construction firm. 3 activities.

**CM 460. Senior Project Methodology. 2 units.**

Prerequisite: CM 313; junior standing; Construction Management majors only.

Introduction to senior project processes, timelines, requirements, and best practices including topic selection, literature review, methodology, and paper formatting. 2 lectures.

**CM 461. Senior Project I. 2 units.**

Prerequisite: Consent of project advisor and department head. See department for additional guidelines and requirements.

Selection and completion of a comprehensive project under faculty supervision. Problems to involve the student's technical and creative skills. Student proposal must be submitted and approved by project advisor and department head prior to registration for course. Construction and team projects encouraged.

**CM 462. Senior Project II. 1-2 units.**

Prerequisite: Consent of project advisor and department head. See department for additional guidelines and requirements.

Selection and completion of a comprehensive project under faculty supervision. Problems to involve the student's technical and creative skills. Student proposal must be submitted and approved by project advisor and department head prior to registration for course. Construction and team projects encouraged.

**CM 463. Senior Project: Professional Practice for Constructors. 3 units.**

Prerequisite: CM 413. Corequisite: CM 443.

Practical application of construction management theory and practice solving problems related to the built environment. 3 laboratories.

**CM 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**CM 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**CM 475. Real Property Development Principles. 4 units.**

Prerequisite: Minimum junior standing.

Development process and its major actors: investors, developers, government agencies, environmental and local stakeholders; their development roles, objectives, approaches. Basics of urban markets and economics, financing, regulation, public planning; value added, contractual, environmental and community context factors. 4 lectures.

**CM 480. Preconstruction Integration and Planning. 2 units.**

Prerequisite: CM 313.

Examination of the role of preconstruction services, team integration, and joint design planning in several Integrated Project Delivery (IPD) approaches. Various tools and techniques associated with preconstruction services and design planning from the proposal stage through the design stages of a project. 2 activities.

**CM 485. Cooperative Education Experience. 3-6 units.**

CR/NC

Prerequisite: Consent of instructor.

Full-time work experience in an area directly related to the construction industry for 3 months. Positions are paid and usually require relocation and registration in course for one quarter. Registration in course is required at start of work experience. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. May be repeated for credit. Major credit limited to 6 units; total credit limited to 12 units. See department for additional requirements.

**CM 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Consent of instructor.

Full-time work experience in an area directly related to the construction industry for 6 months. Positions are paid and usually require relocation for two consecutive quarters. Registration in course is required at start of work experience. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. May be repeated for credit. Major credit limited to 6 units; total credit limited to 24 units. See department for additional requirements.

**CM 510. Principles of Integrated Facility Management. 4 units.**

Prerequisite: Consent of instructor.

Examination of the facility management profession and all functions associated with it, including strategic planning, financial planning, budgeting, project management, operations and maintenance, sustainability, and emergency preparedness, and how those functions interface with the overall goals of the business enterprise. Course offered online only. 4 lectures.

**CM 511. Facility Risk Analysis and Project Management. 4 units.**

Prerequisite: CM 510 or IFMA's CFM certification.

Examination of the full range of financial risks and management strategies associated with facilities including asset management, real estate options, budget development, analysis and cost control, project management, contracting methods for design and construction, and procurement approaches. 4 lectures.

**CM 512. Facility Maintenance and Operation Strategies. 4 units.**

Prerequisite: CM 510 or IFMA's CFM certification.

Examination of the various strategies associated with the oversight and management of operations and maintenance of the internal and external systems, equipment, and building functions associated with the physical plant of real estate assets. 4 lectures.

**CM 513. Facility Systems Assessment and Integration. 4 units.**

Prerequisite: CM 510 or IFMA's CFM certification.

Examination of how facility conditions assessments and the integration of systems through computerized, intelligent networks of electronic devices designed to monitor and control the mechanical electronics, lighting systems, access, and security systems enhance building performance and ease of operation over its life-cycle. 4 lectures.

**CM 514. Sustainable Facility Management. 4 units.**

Prerequisite: CM 510 or IFMA's CFM certification.

Examination of the basics of environmental sustainability as applied to new or existing facilities and the identification of skills, tools, and techniques necessary to make effective and sustainable facility management and operations decisions that align with the organization's sustainability goals and objectives. 4 lectures.

**CM 515. Environmental Health and Safety Management for Facilities. 4 units.**

Prerequisite: CM 510 or IFMA's CFM certification.

Examination of major safety and environmental regulations, regulatory implications, and how best to minimize associated risk. Examination of emergency preparedness at both a macro and micro level, from planning for an emergency through recovering from disasters. 4 lectures.

**CM 521. Construction Cost Estimating and Work Procurement. 4 units.**

Prerequisite: Consent of program coordinator.

Examination of the construction discipline of cost estimating and pre-construction activities, emphasizing both the core and higher functions associated with types of estimates, measuring and pricing, bidding procedures and strategies, procurement, pre-construction services, budget, and cost control analysis. 4 lectures.

**CM 522. Construction Planning, Scheduling, and Impact Analysis. 4 units.**

Prerequisite: Consent of program coordinator.

Examination of the construction discipline of planning, scheduling, management, and control relating to both core and higher functions associated with network diagram analysis, CPM scheduling, project diagnostics, short interval, resource loaded, pull scheduling, forecasting, and earned value management techniques. 4 lectures.

**CM 523. Construction Contracts and Law. 4 units.**

Prerequisite: Consent of program coordinator.

Examination of the discipline of law and contracts as they relate to the construction industry, including both the core and higher functions associated with the construction process, business organization, employment responsibilities, liability, damages, claims, dispute resolution, and risk management. 4 lectures.

**CM 524. Construction Project Management and Control. 4 units.**

Prerequisite: Consent of program coordinator.

Examination of the discipline of construction project management and control relating to both the core and higher functions associated with the construction process, pre-construction services, and management in the areas of safety, quality, resource, risk, schedule, budget, changes, and value. 4 lectures.

**CM 525. Construction Workforce, Productivity, and Safety. 4 units.**

Prerequisites: Consent of program coordinator.

Examination of the disciplines of workforce productivity and safety as they relate to the construction industry, including both the core and higher functions associated with field personnel management, construction operations, lean construction techniques, equipment utilization, productivity, and OSHA regulations. 4 lectures.

**CM 531. Construction Cost and Material Control. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Advanced theory and practice of cost and material control for construction projects. Emphasis on computer applications. 2 lectures, 1 activity.

**CM 533. Case Histories in Contract Administration. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Common points of disputes between design professional, owner, and contractor. Methods of avoidance and dispute resolution. 3 activities.

**CM 542. Advanced Construction Estimating. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Advanced theory and practice of cost estimating techniques. Includes standard, conceptual and parameter estimating; bidding strategies, value engineering concepts, and risk analysis. Emphasis on computer applications. 2 lectures, 1 activity.

**CM 552. Construction Project Scheduling. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Basic and advanced network scheduling techniques as applied to architectural building projects. Emphasis on computer applications. 2 lectures, 1 activity.

**CM 570. Selected Advanced Topics in Construction Management. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed study of selected topics in Construction Management. Class Schedule will list topic selected. Total credit limited to 12 units. 4 seminars.

**CM 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

## Crop Science (CRSC)

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### Crop Science Courses

**CRSC 123. Forage Crops. 4 units.**

Forages as a world resource in food and animal production, soil and water conservation and sustainable agricultural systems. Forage use systems: pasture and range, green chop, silage, hay and cubes. Identification and management of limiting factors of forage plant growth. Botany of legumes and grasses. Grass, legume and weed identification. Forage crop improvement. Forage composition and quality. Antiquity factors. 3 lectures, 1 laboratory.

**CRSC 203. Organic Farming Enterprise Project. 2-4 units.**

CR/NC

Beginning field experience in production and marketing of organic vegetable and fruit crops, under faculty supervision. Project participation subject to approval by department head and Cal Poly Corporation. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture, 1-3 units of independent study.

**CRSC 244. Precision Farming. 4 units.**

Prerequisite: FRSC 133 or VGSC 190 or VGSC 230.

Precision agriculture applications. Integrating GIS, GPS, and remote sensing technologies with site-specific farming practices to optimize agricultural productivity. Field trip required. 3 lectures, 1 laboratory.

**CRSC 333. Greenhouse Vegetable Production. 2 units.**

Prerequisite: CHEM 111 and HCS 120 and SS 221.

Development, practices, history, and future of crop production in greenhouses. Research applications, commercial applications, production problems, marketing, and economics. Special emphasis on growing transplants in greenhouses and use of nutrient solutions. Field trips to a commercial greenhouse operation and/or analysis lab required. 2 activities.

**CRSC 402. Enterprise Project Management. 2-4 units.**

CR/NC

Prerequisite: CRSC 202, and consent of instructor.

Advanced experience in production of an agronomic crop. Development of a plan for field operations, a marketing plan, and a budget. Management decision-making. Project participation is subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture, variable practicum.

**CRSC 411. Experimental Techniques and Analysis. 4 units.**

Prerequisite: Junior standing and MATH 118 or equivalent, and STAT 218 or consent of instructor.

Principal experimental designs used in agriculture and methods of statistical analysis of data collected from each. Statistical software. Field practice in planning and layout of typical experiments. 3 lectures, 1 laboratory.

**CRSC 445. Cropping Systems. 4 units.**

Prerequisite: BOT 121 and SS 121, or HCS 120.

Classification and description of agricultural systems of the world. Cropping systems as land management plans. Systems approaches to improvement of agricultural situations. Consideration of human factors and the agroecosystem in efforts to create a more sustainable agriculture. Field trip required. 3 lectures, 1 activity.

**CRSC 581. Graduate Seminar in Crop/Fruit Production. 3 units.**

Prerequisite: Graduate standing.

Group study of current problems, trends and research results pertaining to production or marketing of field, vegetable or fruit crops. 3 seminars.

**CRSC 599. Thesis in Crop Science. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem in Crop Science. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Dairy Science (DSCI)

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### Dairy Science Courses

**DSCI 100. Enterprise Project. 1-4 units.**

CR/NC

Selection and completion of a management/production project under faculty supervision. Project participation is subject to approval by the project supervisor and the Cal Poly Corporation. Degree credit limited to 12 units. Credit/No Credit grading only.

**DSCI 121. Elements of Dairying. 4 units.**

General information on statistics and opportunities in the dairy industry. Dairy cattle record keeping systems and their use in dairy herds. Principles of reproduction management, milking and milking machine function. Principles and practices of the feeding and management of dairy cattle. 3 lectures, 1 laboratory.

**DSCI 123. Dairy Science Orientation. 1 unit.**

CR/NC

Curricula, career paths, and opportunities for involvement in the dairy industry. Campus resources and tips for academic success. Student and professional organizations and affiliations. Meet and interact with each member of the faculty, Dairy Club officers, and industry guests. Credit/No Credit grading only. 1 lecture.

**DSCI 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**DSCI 201. Introduction to Dairy Nutrition and Feed Ingredients. 4 units.**

Prerequisite: DSCI 121 or DSCI 230; CHEM 111, BIO 111.

Introduction to dairy cattle/ruminant nutrition. Classification and metabolism of nutrients. Nutrient content and identification of feeds common to dairy cattle. Nutrient analysis procedures and requirements. Ration formulation, feeding practices for maximizing growth and milk production. 3 lectures, 1 laboratory. Formerly DSCI 101.

**DSCI 202. Dairy Promotion and Marketing. 4 units.**

Recommended: DSCI 231.

National and state dairy promotional programs, advertising and merchandising. Marketing and pricing of milk and dairy products at the state and national level. 4 lectures.

**DSCI 223. Frozen Dairy Foods. 4 units.**

Prerequisite: DSCI 231 and DSCI 232, or FSN 125, or FSN 230.

Technology, equipment, mix calculations and preparation required to process, freeze, package, harden and distribute ice cream and related products. 3 lectures, 1 laboratory.

**DSCI 230. General Dairy Husbandry. 4 units.**

Selection, breeding, feeding, and management of dairy cattle. Composition and food value of dairy products. Milk pricing, political influences, dairy industry statistics and opportunities. Producing and handling products. Intended as introductory course for non-dairy science majors. 3 lectures, 1 laboratory.

**DSCI 231. General Dairy Manufacturing. 4 units.**

Composition and properties of fluid milk and manufactured milk products. Chemistry and microbiology of dairy products. Processes and equipment involved in the manufacture of butter, cheeses, and other fermented dairy products, frozen, condensed, and dried dairy foods. 3 lectures, 1 activity.



**DSCI 233. Milk Processing and Inspection. 4 units.**

Prerequisite: DSCI 231, FSN 125, or FSN 230; and MCRO 221.

Composition and properties of fluid milk and its constituents. Equipment used to handle, process, and distribute fluid milk and related products. California dairy codes used for dairy farms and plants, with practice inspections of dairy farms and factories. 3 lectures, 1 laboratory.

**DSCI 234. Dairy Foods Evaluation. 2 units.**

Prerequisite: DSCI 231, or FSN 125, or FSN 230.

Basic principles of sensory evaluation of dairy foods, physiology of various senses and their relationship to distinguishing the quality of dairy products by sight, flavor, body and texture. Product defects, causes, and methods of prevention. 1 lecture, 1 laboratory.

**DSCI 241. Dairy Cattle Selection, Breeds, Fitting and Showing. 4 units.**

Prerequisite: DSCI 121 or DSCI 230.

Selection of dairy cattle on type conformation and the correlation between type and production. Dairy cattle breeds and breed comparisons. Techniques to properly condition, groom and present dairy cattle for evaluation and merchandising. 2 lectures, 2 activities.

**DSCI 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**DSCI 301. Dairy Cattle Nutrition. 4 units.**

Prerequisite: DSCI 201.

Nutrition principles to maximize milk production. Ruminant and post ruminal digestion, post absorptive metabolism, nutrient interactions and microbiology. Modern techniques to manipulate and increase animal efficiency. Use of computer models to evaluate and precisely formulate diets. 3 lectures, 1 activity.

**DSCI 321. Lactation Physiology. 4 units.**

Prerequisite: DSCI 201, DSCI 121/DSCI 230, BIO 111.

Mechanisms of milk component secretion, including protein, lactose and fat metabolism. Disorders of the mammary gland (mastitis) and control strategies. Endocrine aspects of mammary gland development and lactogenesis. 4 lectures.

**DSCI 330. Artificial Insemination and Embryo Biotechnology. 4 units.**

Prerequisite: DSCI 121 or DSCI 230 or ASCI 229 or consent of instructor.

Techniques in the collection, evaluation and processing of semen, along with embryo culturing and manipulation. Insemination procedures, fertility problems, record keeping, estrous synchronization, endocrine control of reproduction, treating reproductive disorders and embryo transfer. 3 lectures, 1 laboratory.

**DSCI 333. Dairy Animal Health, Safety and Applied Technology. 4 units.**

Prerequisite: DSCI 121 or DSCI 230; DSCI 321; DSCI 330.

Application of principles of herd health, biosecurity, lactation physiology, cattle management and reproductive physiology to successful dairy operations. Assessment of animal comfort and general healthy and well-being. Practical techniques in safe animal handling. 3 lectures, 1 activity.

**DSCI 339. Internship in Dairy Science. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected Dairy Science students will spend up to 12 weeks with an approved agricultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 12 units. Credit/No Credit grading only.

**DSCI 340. Dairy Waste Management and Resource Recovery. 3 units.**

Prerequisite: MCRO 221.

Management of dairy wastes to protect the environment while providing a return on investment. Selection of waste management systems, considering capital and operating costs and benefits from nutrient, biogas, and heat recovery. Best practices that meet current regulatory requirements. 3 lectures.

**DSCI 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**DSCI 401. Physical and Chemical Properties of Dairy Products. 4 units.**

Prerequisite: CHEM 212 or CHEM 312.

Composition, structure and properties of milk and milk products. Physical and chemical changes that occur during processing and storage of dairy products. Objective measurement of chemical and physical properties. 3 lectures, 1 laboratory.

**DSCI 402. Quality Assurance and Control of Dairy Products. 4 units.**

Prerequisite: DSCI 444.

Current methods used to evaluate dairy products with respect to plant economics and consumer safety. Accurate procedures for chemical and biological testing, statistical approach to sampling and design and interpretation of HACCP programs for assuring product quality and safety. 3 lectures, 1 laboratory.

**DSCI 411. Integrative Dairy Cattle Management. 4 units.**

Prerequisite: DSCI 301.

Integration of dairy cattle nutritional concepts applied to on farm management practices. Practical and case study evaluation of nutritional management. Analysis of current approaches, advanced techniques and strategies to increase productivity and sustainability in dairy production. 3 lectures, 1 laboratory.

**DSCI 412. Dairy Farm Consultation. 4 units.**

Prerequisite: DSCI 333.

Student consultation teams of three or four students visit dairies and/or attend management training seminars followed by presenting management recommendations to the dairy owners, consultants, and other industry leaders. 1 seminar and supervised work.

**DSCI 422. Breeding and Genetics of Dairy Cattle. 4 units.**

Prerequisite: DSCI 241, BIO 111 or higher, STAT 130 or higher.

Evaluation of inherited characteristics in dairy cattle, including principles of inheritance and genomic evaluations. Proving and selecting sires and dams, dairy genetic evaluations. 4 lectures.

**DSCI 432. Advanced Dairy Herd Management. 4 units.**

Prerequisite: DSCI 333.

Dairy herd management skills needed in dairy operations. Instruction and lab experience in management, records, labor, waste management, and milking management. 4 lectures.

**DSCI 433. Dairy Plant Management and Equipment. 4 units.**

Prerequisite: DSCI 233 and DSCI 434, or FSN 204 and FSN 474.

Basic management principles applied to the dairy industry. Industrial organization and control. Dairy plant design, facilities, layout. Inventory control and records. Milk pooling and stabilization records. Maintenance and operation of equipment. 3 lectures, 1 laboratory.

**DSCI 434. Cheese and Fermented Dairy Foods. 4 units.**

Prerequisite: DSCI 231 and DSCI 232 and MCRO 221 or MICRO 224, or consent of instructor.

Scientific methods, ingredients, and equipment used in the manufacture of various fermented dairy products, including cheeses, buttermilk, sour cream, and yogurt. 3 lectures, 1 laboratory.

**DSCI 435. Concentration/Fractionation and Butter Technology. 4 units.**

Prerequisite: DSCI 233 or FSN 204.

Technology of evaporation, drying and membrane separation processes applied to dairy fluids. Design and performance of evaporators, driers, and membrane processing systems. Equipment, ingredients, and methods needed to manufacture butter and dairy spreads. 3 lectures, 1 laboratory.

**DSCI 444. Dairy Microbiology. 4 units.**

Prerequisite: DSCI 233, and MCRO 221 or MCRO 224, and STAT 130 or STAT 218, or consent of instructor.

Microorganisms involved in the fermentation and ripening processes in the dairy industry, as well as those involved in spoilage of milk and dairy products, in the transmission of disease through these products, and indicator systems used to determine sanitary quality of these products. 3 lectures, 1 laboratory.

**DSCI 461. Senior Project. 3 units.**

Prerequisite: Junior standing.

Selection and completion of a project under faculty supervision. Projects are typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal written report. 2 lectures and supervised work.

**DSCI 463. Undergraduate Seminar. 2 units.**

Reports on student papers, bulletins, periodical articles, and dairy research experiments. Sources of dairy husbandry information. Practice in oral reporting. Recent developments and research work in the dairy industry. 2 seminars.

**DSCI 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**DSCI 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**DSCI 500. Individual Study in Dairy Science. 1-6 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced independent study planned and completed under the direction of a member of the Dairy Science faculty. Total credit limited to 6 units.

**DSCI 501. Dairy Chemistry. 3 units.**

Prerequisite: CHEM 212 or CHEM 312; admission to Master of Professional Studies program in Dairy Products Technology. Recommended: Differential and Integral Calculus.

Composition, structure/functional relationships and properties of milk, milk components and products. Physical, chemical and biochemical changes that occur during processing, storage and use of milk and milk components. Chemical, physical, functional and nutritional properties of milk components. 3 lectures.

**DSCI 502. Dairy Chemistry Laboratory. 2 units.**

Prerequisite: DSCI 501; admission to Master of Professional Studies program in Dairy Products Technology.

Objective measurements, analysis and isolation of milk components. Experimental demonstration of chemical and physical reactions of milk components during typical processing conditions. 2 laboratories.

**DSCI 510. Dairy Foods: Issues and Practices. 2 units.**

Prerequisite: Admission to Master of Professional Studies program in Dairy Products Technology.

Contemporary issues in the dairy foods and allied industries. Consumer, political, environmental, regulatory, producer, technological, scientific, and economic considerations critical to future industry leaders. Required field trips to the dairy foods processing industry in California. 1 lecture, 1 activity.

**DSCI 520. Dairy Processing and Manufacturing I. 3 units.**

Prerequisite: Admission to Master of Professional Studies program in Dairy Products Technology. Concurrent: DSCI 540.

Principles of unit operations involving heat and mass transfer including pasteurization and related thermal processes, centrifugal separation, concentration processes, churning and related high shear extrusion, fractionation processes, freezing, and drying technologies. Pneumatic and mechanical devices and systems. 2 lectures, 1 laboratory.

**DSCI 521. Dairy Processing and Manufacturing II. 4 units.**

Prerequisite: DSCI 520; admission to Master of Professional Studies program in Dairy Products Technology.

Unit operations in process systems for the efficient manufacture of fluid milk products, cream, butter, and concentrated milk. Process variables and their control, system integration. Use of processes to manipulate physical and chemical properties to influence product quality. 3 lectures, 1 laboratory.

**DSCI 522. Bioseparation Processes. 4 units.**

Prerequisite: DSCI 401, FSN 444.

Physical and chemical principles governing bioseparation processes in dairy product technology. Factors influencing mass transport phenomena as it relates to filtration, chromatography, ion exchange, dialysis, centrifugation, adsorption, crystallization and other unit operations. Laboratories to emphasize application of bioseparations of commercial importance. Field trips to be required. 3 lectures, 1 laboratory.

**DSCI 524. Dairy Processing and Manufacturing III. 4 units.**

Prerequisite: DSCI 520.

Unit operations in process systems for the efficient manufacture of fermented milks, cheese, frozen desserts, and dried milk and whey products. Process variables and their control, system integration for these products. 3 lectures, 1 laboratory.

**DSCI 535. Dairy Foods Ingredient Functionality. 4 units.**

Prerequisite: DSCI 501.

Identification and industrial use of functional milk fractions. Physical, chemical, and sensory properties of milk fractions. Objective and sensory measurements of milk ingredients as used in food and beverage products. 3 lectures, 1 laboratory.

**DSCI 539. Graduate Internship in Dairy Science. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of agricultural production or related business in the field of Dairy Science. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**DSCI 540. Graduate Dairy Microbiology. 4 units.**

Prerequisite: Admission to Master of Professional Studies program in Dairy Products Technology. Concurrent: DSCI 520. Recommended: MCRO 221 or equivalent.

Raw milk microbiological principles, pasteurization and microorganisms in dairy foods safety, microbiological analysis of dairy products, fermented milks and cheese, starters and probiotics, commercial practices and sources of information for regulation on microbial aspects of dairy foods. 2 lectures, 2 laboratories.

**DSCI 541. Quality Assurance, Quality Control and Food Safety. 4 units.**

Prerequisite: Admission to Master of Professional Studies program in Dairy Products Technology.

Concepts and methodologies used in dairy industry and dairy food plants for assurance and control of the quality of finished product. Basis for understanding physical, chemical and microbiological methods as they apply to quality evaluation of dairy foods. 3 lectures, 1 laboratory.

**DSCI 560. Recent Developments in Dairy Science and Technology. 1-3 units.**

Prerequisite: Senior or graduate standing and approval of instructor.

Presentation and critical review of current research publications. Methodological advances and applications in dairy food systems. Class Schedule will list topic selected. Total credit limited to 6 units. 1-3 seminars.

**DSCI 565. Industrial Plant Considerations for Sustainable Operation. 4 units.**

Prerequisite: DSCI 520; admission to Master of Professional Studies program in Dairy Science Technology.

Plant site selection considerations, project management, plant design and layout, management of productivity maintenance, plant improvement project selection criteria, working with regulatory environment, community relations, and personal safety for overall industrial plant sustainability. 3 lectures, 1 activity.

**DSCI 570. Selected Topics in Dairy Science. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**DSCI 571. Selected Advanced Laboratory in Dairy Science. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**DSCI 581. Graduate Seminar in Dairy Science. 1-3 units.**

CR/NC

Prerequisite: Graduate standing or consent of instructor.

Current findings and research problems in the field and their application to industry. Group study of current problems of industry. Current experimental and research findings as applied to production and marketing. Repeatable for up to 3 units. Credit/No Credit grading only. 1-3 seminars. Credit/ no credit grading only.

**DSCI 582. Dairy Processing and Plant Management. 2 units.**

Prerequisite: Admission to Master of Professional Studies program in Dairy Products Technology.

Dairy plant operation, processing experience and production team dynamics. Practical training and experience in dairy plant operations to allow efficient, safe and sanitary processing of dairy products manufacture in a team environment. Total credit limited to 4 units. 2 laboratories.

**DSCI 585. Cooperative Education Experience in Dairy Science. 1-6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study, analysis and part-time work experience in the field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only.

**DSCI 599. Thesis in Dairy Science. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem in Dairy Science. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Dance (DANC)

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### Dance Courses

**DANC 130. Pilates/Physicalmind Conditioning Methods. 2 units.**

Introduction to Joseph Pilates Physicalmind conditioning method, providing the ideal physical fitness for the attainment and maintenance of a uniformly developed body and sound mind. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 131. Beginning Ballet. 2 units.**

Fundamentals of ballet technique stressing alignment, turn-out, five basic positions, seven movements of dance, and terminology. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 132. Beginning Modern Dance. 2 units.**

Fundamentals of modern technique stressing alignment, off-centered use of torso, floorwork, movement phrases, and improvisation exercises. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 133. Beginning Jazz Dance. 2 units.**

Introduction of jazz dance techniques stressing a variety of styles, alignment, isolation, polyrhythms, syncopation, improvisation, and phrasing. Performance technique and presentation of simple dance phrases. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 134. Beginning Ballroom Dance. 2 units.**

Selected ballroom dances including the cha-cha-cha, foxtrot, merengue, rumba, samba, swing, tango, waltz, and line dance hustle. Emphasis on alignment, etiquette, leading and following, performance techniques, and presentation of simple dance phrases. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 135. International Folk Dance. 2 units.**

Introduction to international folk dances including round, longway, and square sets. Study of various dance steps, formation, positions, historical and cultural background. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 139. Beginning Tap. 2 units.**

Introduction to tap dance technique stressing rhythms and breaks, syncopation, and improvisation. Different tap styles and related cultural influences. Performance of beginning tap dance phrases. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 221. Dance Appreciation. 4 units.**

GE Area C3

Diverse dance forms. Focus on major western dance artists and their works from the 19th century to the present. Cultural context, style and forms in dance. Introductory survey of major experiments in dance. Purchase of concert ticket(s) may be required. 4 lectures. Fulfills GE C3.

**DANC 231. Intermediate Ballet. 2 units.**

Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

Continuation of training in basic technical skills in ballet stressing phrasing, performance, and more complex step patterns. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 232. Intermediate Modern Dance. 2 units.**

Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

Continuing study of DANC 132 with emphasis on various movement styles, phrasing, more complex step patterns, and performance. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 233. Intermediate Jazz Dance. 2 units.**

Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

Continuation of DANC 133 with emphasis on more extensive movement vocabulary. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 234. Intermediate Ballroom Dance. 2 units.**

Prerequisite: DANC 134 or intermediate level experience as determined by instructor at first class meeting.

Continuation of DANC 134. Selected ballroom dances: cha cha, foxtrot, merengue, rumba, swing, tango, hustle, paso doble, polka and samba. Emphasis on variations, styles, and performance skill. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**DANC 280. Body Awareness and Expression. 4 units.**

Directed group study of movement techniques and exercises to facilitate expressive physical performance for the actor. Body effectiveness, alignment and conditioning practice integrated with creative exploration and movement analysis of effort, spatial awareness and detailed body usage. 4 lectures. Crosslisted as TH/ DANC 280.

**DANC 311. Dance in American Musical Theatre. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C3. Recommended: Junior standing.

Cultural norms portrayed through dance and musical production. Major works with multicultural, racial, class, and gender issues associated with American themes. Artists, role of dance in musical theatre, and significance of dance in human society. Purchase of concert ticket(s) may be required. 4 lectures. Fulfills GE C4 except for Theatre Arts majors.

**DANC 321. Cultural Influence on Dance in America. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C3. Recommended: Junior standing.

Multicultural approach to history of dance in America, with emphasis on American Indian, West African, Caribbean, Mexican, European, and Asian contributions and influences. Explores culture through dance. Purchase of concert ticket(s) required. 4 lectures. Fulfills GE C4 except for Theatre Arts majors. Fulfills USCP.

**DANC 331. Advanced Ballet and Repertory. 2 units.**

Prerequisite: DANC 231 or intermediate level experience as determined by instructor at first class meeting.

Advanced ballet technique and reconstruction of historical ballet repertoires from the romantic, classical, neoclassical, and modern periods. Participation in dance performance of selected repertory. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 332. Modern Dance Repertory. 2 units.**

Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

Intermediate to advanced dance skills learned through the study and performance of selected modern dance repertory. Addresses problems in advanced performance technique. Informal presentation in performance situation. Purchase of concert ticket(s) may be required. Total credit limited to 6 units. 2 activities.

**DANC 340. Dance Composition. 4 units.**

Prerequisite: Intermediate level experience as determined by instructor at first class meeting.

Principles of dance composition. Exploration of creative potential and development of movement motifs through choreographic studies. Preparation for informal public presentation of student generated choreographic works. Purchase of concert ticket(s) may be required. Total credit limited to 8 units. 1 lecture, 1 laboratory, 2 activities.

**DANC 345. Choreography/Workshop in Dance Concert Preparation. 4 units.**

Prerequisite: By audition only.

Workshop in concert preparation for major public dance production. Exploration and process of concert dance choreography. Purchase of concert ticket(s) may be required. Total credit limited to 16 units. 2 activities, 2 laboratories.

**DANC 346. Dance Production. 4 units.**

Prerequisite: DANC 345.

Directed production of annual Orchesis Dance Company Concert and other public performances. Attendance of professional dance concert(s) required. Purchase of concert ticket(s) may be required. Total credit limited to 16 units. 1 activity, 3 laboratories.

**DANC 381. Dance for KINE/Dance Minors. 4 units.**

Prerequisite: KINE 419 or KINE 310, Dance Minor or consent of instructor.

Dance skills and techniques. Experience in selected dance forms. Rhythmic structure and analysis of dance steps. Includes introduction to dance pedagogy, curricular materials and evaluative procedures. Purchase of concert ticket(s) may be required. 2 lectures, 2 activities.

**DANC 400. Special Problems. 1-4 units.**

Prerequisite: Consent of instructor and department head.

Individual investigation, research and studies or survey of selected problems in dance and related areas. Total credit limited to 8 units with a maximum of 4 units per quarter.

**DANC 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed study of selected topics for advanced dance students. Class Schedule will list topics selected. Total credit limited to 8 units. 1-4 lectures.

**DANC 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for dance students. Class Schedule will list topics selected. Total credit limited to 8 units. 1-4 laboratories.

## Disaster Management and Homeland Security (DMHS)

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### Disaster Management and Homeland Security Courses

**DMHS 351. Introduction to Emergency Management in California. 3 units.**

Prerequisite: Completion of GE Area B3 or D.

Emergency management emphasizing the Standardized Emergency Management System (SEMS) and Emergency Operations Center (EOC) operations. Earthquake hazard used as the case to explore potential wide geographic impacts, multiple secondary hazards, and multidisciplinary problem-solving methods in natural disasters faced by local governments and communities. 2 lectures, 1 activity. Crosslisted as CRP/DMHS/NR 351.

**DMHS 352. Terrorism: Understanding the Threat. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Theories, procedures, and practices to prepare field responders, first level governmental supervisors and managers in appropriate local emergency operations centers' response to a terrorist incident. 2 lectures, 1 activity. Crosslisted as DMHS/NR 352.



**DMHS 353. Introduction to Crisis Communications and the Media. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Theories, practices and procedures to educate public and private officials on methods and practices used to communicate with the media in time of local or national disasters or crises. 2 lectures, 1 activity. Crosslisted as DMHS/NR 353.

**DMHS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor and department head.

Individual investigation, research and studies or survey of selected problems in dance and related areas. Total credit limited to 8 units with a maximum of 4 units per quarter.

**DMHS 401. Disaster Recovery. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Strategies and procedures for public sector management of recovery from disasters. Understanding the role of, and relationship between, federal, state and local agencies to provide assistance to individuals and communities in the post-disaster environment. Issues in the recovery process. 2 lectures, 1 activity. Crosslisted as CRP/DMHS/NR 401.

**DMHS 405. Managing Sustained Operations. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Methods and techniques for managing Emergency Management Operations Centers in order to ensure support to local government efforts in rebuilding after a disaster. 2 lectures, 1 activity. Crosslisted as DMHS/NR 405.

**DMHS 432. Disaster Operations Planning. 3 units.**

Prerequisite: NR/CRP/DMHS 351.

Developing emergency operations plans in support of the local, state and federal emergency management community needs. Major aspects and necessary elements of emergency planning required in a multi-hazard emergency operations plan. 3 lectures. Crosslisted as DMHS/NR 432.

**DMHS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed study of selected topics for advanced dance students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**DMHS 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for dance students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

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**Early Start English (ESE)**

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**Early Start English Courses****ESE 100. Early Start Program: English. 1.5 unit.**

Prerequisite: Appropriate score on EPT.

Review of fundamental writing and rhetoric skills intended for students who need to meet the CSU Early Start Program (ESP) requirement. Not for baccalaureate credit. Credit/No Credit grading only.

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**Early Start Math (ESM)**

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**Early Start Math Courses****ESM 100. Early Start Program: Mathematics. 1.5 unit.**

Prerequisite: Appropriate score on the ELM examination.

Review of basic algebra skills intended for students who need to meet the CSU Early Start Program (ESP) requirement. Not for baccalaureate credit. Credit/No Credit grading only.

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**Earth Science (ERSC)**

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**Earth Science Courses****ERSC 110. Orientation in Earth and Soil Sciences. 1 unit.**

CR/NC

Understanding the depth and breadth of earth and soil sciences. Examine potential career opportunities. Introduction to both student and professional organizations. Credit/No Credit grading only. 1 activity. Crosslisted as ERSC/SS 110.

**ERSC 144. Introduction to Earth Science. 4 units.**

Survey of fundamental processes of Earth science. Application of systems thinking to understanding the dynamic interactions among geological, geographic, soils and human factors in shaping the Earth. 3 lectures, 1 activity.

**ERSC 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 12 units, with a maximum of 2 units per quarter. Crosslisted as ERSC/SS 200.

**ERSC 202. Soil Erosion and Water Conservation. 4 units.**

Prerequisite: SS 121 or consent of instructor.

Development of an erosion and sediment control plan using climate, topography, soils and land use in relation to soil and water quality. Evaluation of soil and water conservation plans and best management practices for agriculture, urban, riparian, and rangelands. 3 lectures, 1 activity.

**ERSC 223. Rocks and Minerals. 4 units.**

Prerequisite: SS 121, CHEM 111 or CHEM 127.

Origin, composition, identification and weathering of rocks, minerals, and clays important in the development of soils. Parent materials as related to the nature and properties of soils. 3 lectures, 1 laboratory.

**ERSC 250. Physical Geography. 4 units.**

Addresses the origins and patterns of the earth's diverse assemblage of climates, landforms, biota and soils. A major focus on relationship between human cultures and these earthly environments. 4 lectures. Crosslisted as ERSC/GEOG 250.

**ERSC 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 lectures. Crosslisted as ERSC/SS 270.

**ERSC 301. Earth Sciences/Soils Science Practicum. 1-2 units.**

CR/NC

Prerequisite: SS 110 or SS 121.

Supervised practice in technical, educational, professional, and operational applications related to earth sciences or soil science. Students participate in faculty-supervised group or individual activities that support educational and professional goals. Credit/No Credit grading only. Total credit limited to 12 units. 1-2 activities. Crosslisted as ERSC/SS 301.

**ERSC 323. Geomorphology. 4 units.**

Prerequisite: SS 121 and GEOL 201.

Recognizing and identifying major landforms and their components by interpretation of aerial photographs and topographic maps, and observations. Emphasis on analyzing common landforms in the western United States for application in soil science, physical geography, hydrology, and geology. 2 lectures, 1 laboratory, 1 activity.

**ERSC 325. Climate and Humanity. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Geographic perspective on the interrelationships between climate and human cultures. Effects of people on climate and the influence of climate and weather upon human activities and behavior. Focus on global human conditions which are responsible for the alteration of climate and in turn are vulnerable to climate change. 4 lectures. Crosslisted as ERSC/GEOG 325.

**ERSC 333. Human Impact on the Earth. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Global assessment of the impact of humans on the earth's vegetation, animals, soil, water and atmosphere. Emphasis on problems stemming from the interactions of human attitudes, technologies, and population with natural resources. 4 lectures. Crosslisted as ERSC/GEOG 333.

**ERSC 339. Soil Science Internship. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected students will spend up to 12 weeks with an approved firm or agency engaged in work and study related to their major. A detailed written proposal and written interim and final reports required. One unit of credit may be allowed for each full week of internship. Credit/No Credit grading. Crosslisted as ERSC/SS 339.

**ERSC 400. Special Problems for Advanced Undergraduates. 2-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 12 units, with a maximum of 2 units per quarter. Crosslisted as ERSC/SS 400.

**ERSC 401. Field-Geology Methods. 4 units.**

Prerequisite: GEOL 102 or GEOL 201, GEOL 241, GEOL 415, ERSC 223, ERSC 323.

Collecting and interpreting field-geologic data. Description of sedimentary rocks and construction of stratigraphic columns. Mapping geologic structures in the field. Surficial geologic stratigraphy and surficial geologic mapping. Understanding geologic processes through field study. Communicating results of field study. 1 lecture, 3 activities. Crosslisted as ERSC/GEOL 401.

**ERSC 402. Geologic Mapping. 4 units.**

Prerequisite: ERSC/GEOL 401.

Bedrock geologic mapping on topographic maps and aerial photos. Surficial geologic mapping on topographic maps and aerial photos. Correlating and defining surficial geologic map units on the basis of soil development. Understanding landscape evolution using soil development 4 activities. Crosslisted as ERSC/GEOL 402.

**ERSC 414. Global and Regional Climatology. 4 units.**

Prerequisite: Junior standing.

The earth's pattern of climates and the physical processes that account for them. Focus on interrelationships between climate and the physical/biological and cultural environments. Special emphasis on modern climate changes and their consequences. 3 lectures, 1 laboratory. Crosslisted as ERSC/GEOG 414.

**ERSC 415. Applied Meteorology and Climatology. 4 units.**

Prerequisite: GEOG/ERSC 250 or consent of instructor.

Physical processes in the atmosphere that determine regional weather, climate and climate variability. Surface and satellite systems for weather observation, and weather/climate modeling. Dynamics of weather systems, including thunderstorms and hurricanes. Emphases on weather/climate affecting agriculture and other human activities. 3 lectures, 1 activity. Crosslisted as ERSC/GEOG 415.

**ERSC 461. Senior Project I. 1 unit.**

Prerequisite: MATH 118 or MATH 141, STAT 218 or CRSC 411.

Senior project topic selection and contract development with project advisor. Statement of problems, subproblems, assumptions, objectives, hypothesis, methods of analysis and statistical design. Development of literature review and budget of time and finances. Proper format and presentation of tabular and graphic information. 1 activity.

**ERSC 462. Senior Project II. 3 units.**

Prerequisite: ERSC 461.

Implementation of materials and methods. Collection, analysis and interpretation of data. Completion of formal written report under advisor supervision. Minimum 90 hours.

**ERSC 463. Undergraduate Seminar. 2 units.**

Prerequisite: ERSC 461.

Review of current research, experiments, and problems related to the student's major field of interest. Preparation and presentation of reports on problems or research activities. 2 seminars.

**ERSC 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 lectures. Crosslisted as ERSC/SS 470.

**ERSC 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories. Crosslisted as ERSC/SS 471.

**ERSC 544. Earth Sciences for Educators. 3 units.**

Prerequisite: Graduate standing and consent of instructor.

An interdisciplinary earth sciences course which emphasizes the interactions of multiple systems of air, water, land, life, and human society. Designed for teachers and students seeking teaching credential. Incorporates scientific theory, learning resources, and applications in the field. 3 lectures. Not open to students in Soil Science specialization under MS Agriculture.

**ERSC 570. Selected Topics in Earth Science. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**ERSC 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

## Economics (ECON)

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### Economics Courses

**ECON 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Sophomore standing and consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**ECON 201. Survey of Economics. 4 units.**

GE Area D2

Basic principles of microeconomics and macroeconomics. Emphasis on applications to current national and global economic issues. For majors requiring one quarter of economics. Not open to students having previous credit in ECON 222 or equivalent. 4 lectures. Crosslisted as ECON/HNRS 201. Fulfills GE D2.

**ECON 221. Microeconomics. 4 units.**

Microeconomic principles. Marginal and equilibrium analysis of commodity and factor markets in determination of price and output. Normative issues of efficiency and equity. 4 lectures.

**ECON 222. Macroeconomics. 4 units.**

GE Area D2

Introduction to economic problems. Macroeconomic analysis and principles. Aggregate output, employment, prices, and economic policies for changing these variables. International trade and finance. Issues of economic growth and development. Comparative economic systems and economies in transition. 4 lectures. Fulfills GE D2.

**ECON 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ECON 303. Economics of Poverty, Discrimination and Immigration. 4 units.**

GE Area D5; USCP

Prerequisite: Junior standing; completion of GE Areas A, D1, and either ECON 221 and ECON 222, or ECON 201.

Economic analysis of the cause, extent and impact of poverty, discrimination and immigration and of the policies designed to address these socioeconomic issues. Emphasis on the experience of African-Americans, Latinos, and women in the United States. 4 lectures. Crosslisted as ECON/HNRS 303. Fulfills GE D5 except for Economics majors. Fulfills USCP.

**ECON 304. Comparative Economic Systems. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Areas A, D3, and either ECON 221 and ECON 222, or ECON 201.

Analysis of economic systems as a set of mechanisms and institutions for decision making, and the implementation of decisions regarding income distribution, the levels of consumption and production, and the level of economic welfare. 4 lectures. Fulfills GE D5 except for Economics majors.

**ECON 311. Intermediate Microeconomics I. 4 units.**

Prerequisite: MATH 142 or MATH 221, and STAT 252 or STAT 302, and either ECON 221 and ECON 222, or ECON 201.

Consumer behavior and the theory of demand; production, cost, supply functions; perfect competition; monopoly and oligopoly; the economics of information technology. 4 lectures.

**ECON 312. Intermediate Microeconomics II. 4 units.**

Prerequisite: ECON 311.

Game theory; risk, uncertainty and information; choice over time; asset markets; general equilibrium; welfare economics, externalities and public goods. 4 lectures.

**ECON 313. Intermediate Macroeconomics. 4 units.**

Prerequisite: ECON 312.

Analysis of national income, price level, employment, international trade and economic growth. Development of the theory of national income determination. Evaluation of roles of monetary and fiscal policy. 4 lectures.

**ECON 322. Economic History of the Advanced World. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Areas A, D3, and either ECON 221 and ECON 222, or ECON 201.

Analysis of the growth of economic institutions from about 600. Includes the spread of economic structures and institutions to colonies. Analyzes the internal development of the industrial economy in Europe and its expansion to other parts of the globe. 4 lectures. Fulfills GE D5 except for Economics majors.

**ECON 325. Economics of Development and Growth. 4 units.**

Prerequisite: Completion of GE Areas A, D3, and either ECON 221 and ECON 222, or ECON 201.

Analysis of the economy of less developed countries, and a survey of public policies designed to stimulate economic growth and reduce poverty. Topics include financing development, technology, population problems, human capital, rural and urban development, trade policy and the economic relationships between developed and developing nations. 4 lectures.

**ECON 330. International Trade Theory. 4 units.**

Prerequisite: Either ECON 221 and ECON 222, or ECON 201.

Theory of comparative advantage, gains from trade, and recent developments in trade theory; examination of tariffs, quotas, exchange controls, other trade barriers and underlying policy issues; review of U.S. commercial policy, GATT, the common market, regional and world economic organizations. 4 lectures. Not open to students with credit in ECON 404 or equivalent.

**ECON 337. Money, Banking and Credit. 4 units.**

Prerequisite: Either ECON 221 and ECON 222, or ECON 201.

Financial markets and institutions. Structure of the banking industry and impacts of technological change in banking. Structure and operations of the Federal Reserve. Impacts of monetary policy on the economy. 4 lectures.

**ECON 339. Econometrics. 4 units.**

Prerequisite: MATH 142 or MATH 221, and STAT 252 or STAT 302, and either ECON 221 and ECON 222, or ECON 201, or consent of instructor.

Application of statistical methods useful in economics. General linear regression model. Specific issues and problems related to economic models: multicollinearity, autocorrelation, heteroscedasticity, dummy variables, lagged variables, and simultaneous equation estimation. Application and evaluation of selected examples of empirical economic research. Microcomputer applications. 3 lectures, 1 activity.

**ECON 340. Advanced Econometrics. 4 units.**

Prerequisite: ECON 339, and either ECON 221 and ECON 222, or ECON 201, or consent of instructor.

Advanced topics in undergraduate econometrics. Single equation estimation topics including: distributed lag models, causality, cointegration and error correction models and nonlinear estimation. Forecasting with a single equation model. Simultaneous equation estimation, including instrumental variables, two stage least squares and seemingly unrelated regression. 3 lectures, 1 activity.

**ECON 400. Special Problems. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**ECON 403. Industrial Organization. 4 units.**

Prerequisite: ECON 311 or consent of instructor.

Application of basic tools of economics to American Industry. Case studies of individual firms and industries. Performance of various business structures, such as monopoly and oligopoly. Effects of government regulation and antitrust policy. 4 lectures.

**ECON 404. International Trade Theory. 4 units.**

Prerequisite: ECON 311 or consent of instructor.

Theory of comparative advantage, neoclassical model of trade, offer curves and terms of trade, edgeworth boxes, valuation of factor inputs, effects of migration and mobility of funds, emerging growth and trade distortions, welfare effects of trade, and recent developments in trade theory. 4 lectures.

**ECON 405. International Monetary Economics. 4 units.**

Prerequisite: ECON 311 or consent of instructor.

Nature of international payments, U.S. balance of payments. Theory and practice of foreign exchange rate determination under the gold standard, paper standard, and IMF system; international money and capital markets; problems of international liquidity and monetary stability. 4 lectures.

**ECON 406. Applied Forecasting. 4 units.**

Prerequisite: ECON 311 and ECON 339, or consent of instructor.

Causes and measurement of business fluctuations. Techniques of forecasting with microcomputer applications. 3 lectures, 1 activity.

**ECON 408. Mathematical Economics. 4 units.**

Prerequisite: ECON 313, or consent of instructor.

Applications of quantitative techniques to topics in microeconomic and macroeconomic theory. Use of multivariate calculus and linear algebra in formulating static economic models. Applications of statistical inference, estimation and forecasting in economic models. 4 lectures.

**ECON 409. Probability Models for Economic Decisions. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Decision making in complex, realistic situations. Simulation of random variables in Excel. Risk aversion. Subjective assessment of probabilities and correlations. Decision trees. Optimal bidding in auctions. The winner's curse. Moral hazard and risk sharing. Repeated investment decisions under risk. 4 lectures.

**ECON 410. Public Finance and Cost-Benefit Analysis. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Principles of rational decision making with respect to government revenues and spending. Measurement of costs and benefits, and criterion selection. Taxation, user fees, deficit financing, public goods, neighborhood effects and zoning. Microcomputer applications. 4 lectures.

**ECON 413. Labor Economics. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Wage determination theory, basic economic factors that affect the labor movement, economic impact of union activities on employment, output, income, wages, prices, and national economic policy. 4 lectures.

**ECON 417. Development of Economic Analysis. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Analysis of ideas related to the development of economic theory in the Western civilization from the Greeks through the classical, neoclassical, and Keynesian to the current post-Keynesian concepts. 4 lectures.

**ECON 420. Advanced Macroeconomics. 4 units.**

Prerequisite: ECON 313, or consent of instructor.

Macroeconomics for advanced students. Inflation, unemployment, interest rates, real output, exchange rates, business cycles and macroeconomic policy. Analysis of current data on the macro-economy within the scope of competing views on the macro-economy. 4 lectures.

**ECON 424. Monetary Economics. 4 units.**

Prerequisite: ECON 311 or consent of instructor. Recommended: ECON 313.

The role of money in our economy. Focus on the links between monetary policy, interest rates, prices, housing markets, mortgage lending and overall economic activity. Public policy issues relating to real estate markets. 4 lectures.

**ECON 431. Environmental Economics. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Economic dimensions of environmental abuse and protection. Use of simple economic models in developing and evaluating environmental policies. Overview of current environmental problems. Issues related to the sustainability of economic growth at the national and international levels. 4 lectures.

**ECON 432. Economics of Energy and Resources. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Economic theory and public policies as applied to problems of natural resources and energy. Dynamic resource and energy models developed with reference to public and private sector growth. Application of the principles of capital theory emphasized. Case studies. Computer software applications in the study of natural resources and energy under uncertainty. 4 lectures.

**ECON 434. Urban Economics. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Application of basic tools of economic analysis to problems of urban regions. Causes and possible cures for inadequate growth rate, income levels, and the quality of life in urban regions. 4 lectures.

**ECON 435. Economics of Land and Water. 4 units.**

Prerequisite: ECON 311, or consent of instructor.

Economic analysis of natural resource issues, policies and management with an emphasis on land and water use decisions in the western U.S. Urban demand for water; water supply and economic growth; economic impacts of surface water law and institutions; economics of land management. 4 lectures.

**ECON 461. Senior Project I. 2 units.**

Prerequisite: ECON 313 and senior standing.

Selection and analysis of a problem under faculty supervision. Problems typical of those which graduates must solve in their fields of employment. Formal report is required. Minimum 120 hours total time.

**ECON 462. Senior Project II. 2 units.**

Prerequisite: ECON 313 and senior standing.

Selection and analysis of a problem under faculty supervision. Problems typical of those which graduates must solve in their fields of employment. Formal report is required. Minimum 120 hours total time.

**ECON 464. Applied Senior Project. 4 units.**

Prerequisite: ECON 313 and senior standing.

Analysis of selected economic topics and problems in directed individual or group-based projects, which require application of economic models, principles and theory to investigate important business, economic or social issues. Formal report required. 4 seminars.

**ECON 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**ECON 500. Independent Study. 1-4 units.**

Prerequisite: Consent of department head.

Advanced study planned and completed under the direction of a departmental faculty member. Open only to graduate students demonstrating ability to do independent work. Enrollment by petition.

**ECON 510. Quantitative Methods I. 4 units.**

Prerequisite: ECON 408 or MATH 244 or equivalent, and graduate standing, or consent of instructor.

Review and discussion of the basic math tools needed for graduate work in economics, including set theory, linear algebra, properties of functions, static and dynamic optimization. 4 lectures.

**ECON 511. Microeconomic Analysis. 4 units.**

Prerequisite: Concurrent with ECON 510 and graduate standing, or consent of instructor.

Basic microeconomic theory including theory of the firm, consumer theory, general equilibrium, capital theory, and welfare economics. 4 lectures.

**ECON 512. Macroeconomic Analysis. 4 units.**

Prerequisite: ECON 511 and graduate standing, or consent of instructor.

Basic macroeconomic theory including markets for commodities and credit, the demand for money, market-clearing and the labor market, inflation and interest rates, investment, real business cycles and unemployment, economic growth, government consumption and the role of public services, and taxes, transfers, and the public debt. 4 lectures.

**ECON 518. Quantitative Methods II. 4 units.**

Corequisite: ECON 510 and graduate standing, or consent of instructor.

Statistical concepts for use in theoretical and applied econometric applications including random variables, independence, expectations, probability, distributions, covariance and correlation, large sample theory, and properties of estimators. 4 lectures.



**ECON 520. Advanced Econometrics I. 4 units.**

Prerequisite: ECON 339; ECON 518; and graduate standing or consent of instructor. Corequisite: ECON 511.

The use of statistical procedures to measure theoretical economic relationships and to verify and reject theories. Advanced coverage of regression analysis and hypothesis testing. 4 lectures.

**ECON 522. Advanced Econometrics II. 4 units.**

Prerequisite: ECON 520 and graduate standing, or consent of instructor.

The use of statistical procedures to deal with simultaneous equations, limited dependent variables and time-series data. Includes methods of instrumental variables, generalized method of moments and maximum likelihood. 4 lectures.

**ECON 524. Computational Methods in Economics. 4 units.**

Corequisite: ECON 510 and graduate standing, or consent of instructor.

Use of computers to solve economic problems. Topics include computer programming using econometric software, data gathering and organization, and numerical solution methods for economic problems. 4 lectures.

**ECON 526. Microeconometrics. 4 units.**

Prerequisite: ECON 520 and graduate standing, or consent of instructor. Recommended: ECON 524.

Variety of standard and advanced econometric techniques employed in applied microeconomics. Emphasis on when and how to apply appropriate techniques. 4 lectures.

**ECON 532. Environmental and Natural Resource Economics. 4 units.**

Prerequisite: ECON 511 and graduate standing, or consent of instructor.

Economic analysis of pollution, congestion, public good provision, and natural resource conservation. Static and dynamic efficiency, economic growth and sustainability, pollution taxes, marketable permits, and the design of market-based regulations. 4 lectures.

**ECON 534. International Economics. 4 units.**

Prerequisite: ECON 511 and graduate standing, or consent of instructor.

Analysis of the international movement of goods, services, capital and payments. The role of exchange rates, tariffs, quotas, and transport costs. Relationship between international trade and economic growth. 4 lectures.

**ECON 536. Public Economics. 4 units.**

Prerequisite: ECON 511 and graduate standing, or consent of instructor.

Economic analysis of the rationale for public expenditure and taxation. Externalities, pollution and public policy, income redistribution and public welfare, public goods, collective choice and political institutions, public budgeting techniques and cost-benefit analysis, taxation and tax policy, state-local finance and fiscal federalism. 4 lectures.

**ECON 538. Industrial Economics. 4 units.**

Prerequisite: ECON 511 and graduate standing, or consent of instructor.

Economic theories of industrial organization with specific reference to such topics as cartels, market concentration and performance, vertical integration, franchise contracts, ownership and control of firms, multipart and discriminatory pricing, and tie-in sales. Economic aspects of antitrust law and government regulation of industry. 4 lectures.

**ECON 542. Advanced Labor Economics. 4 units.**

Prerequisite: ECON 522 and graduate standing, or consent of instructor. Recommended: ECON 526.

Research methods in labor economics and application of modern empirical techniques to the analysis of labor markets. Topics include labor supply and demand, discrimination, migration, and human capital accumulation. 4 lectures.

**ECON 544. Evidence-Based Decision Analysis. 4 units.**

Prerequisite: ECON 520 and graduate standing, or consent of instructor. Recommended: ECON 524 and ECON 526.

Representing uncertainty using discrete and continuous conditional probabilities. Monte Carlo simulation of independent and correlated random variables. Optimization of decision variables. Randomization in program evaluation. Model mis-specification. Visualization and representation of the results of a decision analysis. Case studies. 4 lectures.

**ECON 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**ECON 580. Seminar in Economics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Advanced topics in economics chosen according to the common interests and needs of the students enrolled. Schedule of Classes will list topic selected. 1-4 seminars. Total credit limited to 5 units.

**ECON 599. Thesis. 4 units.**

Prerequisite: Graduate standing and consent of thesis committee.

Individual research under the general supervision of the faculty, leading to a graduate thesis of suitable quality. Minimum of 8 units required for degree.

## Education (EDUC)

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### Education Courses

**EDUC 125. First Year Seminar. 2 units.**

CR/NC

Issues associated with the successful transition from high school or community college to Cal Poly. Links fostered between student needs and campus resources. Coverage of academic policies and procedures, university study skills, goal setting, career planning, wellness and other topics relevant to student success. Credit/No Credit grading only. 1 lecture, 1 activity.

**EDUC 207. The Learner's Development, Culture and Identity in Educational Settings. 4 units.**

Prerequisite: PSY 201 or PSY 202, or admission to the Multiple Subject Credential Program.

Theoretical background of child and early adolescent development within diverse cultural settings and implications for the teaching-learning process. Observations of children in everyday settings. 3 lectures, 1 activity. Participation in public schools requires mandated fingerprint clearance. Crosslisted as CD/EDUC 207.

**EDUC 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**EDUC 300. Historical, Philosophical, and Social Foundations of Public Education. 3 units.**

Prerequisite: Junior standing.

Historical, philosophical, and social foundations of public education in relation to school curriculum, instruction and dispositions of effective teachers. Structured observation and participation in K-12 public schools with attention to instructional practices for diverse learners. 2 lectures, 1 activity. Participation in public schools requires mandated fingerprint clearance.

**EDUC 310. Effective Teaching and Classroom Management with a Multicultural Perspective in K-3 and 4-8 Settings. 4 units.**

Prerequisite: Junior standing, and either LS 230 and LS 250 or EDUC 300 (may be taken concurrently), or consent of instructor.

Knowledge, theory, fieldwork and research related to effectively managing, planning, and teaching in K-3 and 4-8 classrooms; connections between preventing discipline problems and choices about curriculum, instruction, and management; creating a positive learning environment for all students. Participation in public schools requires mandated fingerprint clearance. 3 seminars, 1 activity.

**EDUC 400. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Junior standing and consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**EDUC 405. Social, Historical and Cultural Influences on Latino/a Students in Education. 4 units.**

Prerequisite: Admission to the Bilingual Authorization Program.

Social, cultural, historical, political, economic, and educational factors and systems in Latin America and the United States that have contributed to and shaped Latino/a individual and group identity. How factors affect individual acculturation in California and the United States and influence how Latino/as experience and participate with schooling in the United States. 3 seminars, 1 activity. Participation in public schools requires mandated fingerprint clearance.

**EDUC 410. Social, Historical and Ethical Perspectives on Teaching and Learning. 4 units.**

Prerequisite: AGED 330 or EDUC 300 or SCM 300; admission to the Single Subject Credential Program or consent of instructor. Concurrent: EDUC 412 and EDUC 414.

Inquiry into the social, historical, philosophical and psychological foundations of education with an emphasis on applying theory to practice. Prepares single subject credential students for teaching. 2 lectures, 2 activities.

**EDUC 412. Access to Learning in a Pluralistic Society. 4 units.**

Prerequisite: AGED 330 or EDUC 300 or SCM 300; admission to the Single Subject Credential Program. Concurrent: EDUC 410 and EDUC 414.

The role of culture, status, identity, and development in public school experiences for diverse learners. Organization and management of secondary classrooms as related to adolescent development and access to learning. PACT assessments embedded in course prepare credential candidates for the teaching event. 2 lectures, 2 activities.

**EDUC 414. Curriculum and Inquiry in Public Schools. 4 units.**

Prerequisite: AGED 330 or EDUC 300 or SCM 300; admission to the Single Subject Credential Program or consent of instructor. Concurrent: EDUC 410 and EDUC 412.

Principles, methods and practices of organizing curriculum, instruction, and assessment for secondary subject area content, with an emphasis on backward design in curriculum development and assessment. Site visits to local schools to allow analysis of planning, instruction, and assessment in secondary classrooms. PACT assessments embedded in course prepare credential candidates for the teaching event. 2 lectures, 2 activities.

**EDUC 416. Literacy, Language, and Culture in Content Area Classrooms. 3 units.**

Prerequisite: Admission to the Single Subject Credential Program or senior standing for Agricultural Education candidates. Concurrent: EDUC 418 and EDUC 469 (except students enrolled in Agricultural Education Credential Program).

Theories and application of literacy learning, assessment and second language acquisition in content classrooms. Observation of classrooms, tutoring English language learners, designing and teaching literacy lessons, planning and implementing assessments across content areas. Recognition of the role of culture in language acquisition. 3 lectures.

**EDUC 417. Literacy, Language, and Culture in the Content Area Classroom Fieldwork. 1 unit.**

CR/NC

Concurrent: EDUC 416.

Fieldwork in the secondary classroom related to literacy, language and culture for Agriculture Education candidates. Includes 1-3 hours of observation each week. Participation in public schools requires mandated fingerprint clearance. Credit/No Credit grading. 1 activity.

**EDUC 418. Culturally Responsive Teaching in Diverse Classrooms. 3 units.**

Prerequisite: EDUC 412, EDUC 414, and content methods course.  
 Concurrent: EDUC 416 and EDUC 469, or AGED 438 for students enrolled in Agricultural Education Credential Program.

Differentiated instruction and further theoretical knowledge and skills needed for successful teaching of linguistically and culturally diverse learners, as well as students with special learning needs. PACT assessments embedded in course prepare credential candidates for the teaching event. 3 lectures.

**EDUC 419. Culturally Responsive Fieldwork in Diverse Classrooms. 1 unit.**

CR/NC

Concurrent: EDUC 418.

Fieldwork in the secondary classroom related culturally responsive teaching in diverse classrooms for Agriculture Education candidates. Includes 1-3 hours of observation each week. Participation in public schools requires mandated fingerprint clearance. Credit/No Credit grading. 1 activity.

**EDUC 423. Bilingual Literacy. 4 units.**

Prerequisite: Junior status, Spanish proficiency and/or consent of instructor.

Patterns of classroom organization, application of reading programs, approaches, methods in English and Spanish, and supervised field experiences in elementary classrooms with bilingual students. 3 seminars, 1 activity. Limited to students seeking BCLAD certification.

**EDUC 427. Theories, Methods, and Assessment of First and Second Language Acquisition in Schools. 4 units.**

Prerequisite: Senior standing.

Theories, methods, materials and assessment involved in the instruction of limited English proficient (L.E.P.) students. Bilingual, transitional, and English only programs compared across a historical framework. Emphasis on an integrated language arts approach; theories of language acquisition. 3 seminars, 1 activity. Participation in public schools requires mandated fingerprint clearance.

**EDUC 428. Foundations of K-8 Literacy Teaching and Learning in Schools with Diverse Populations. 4 units.**

Prerequisite: Senior or Graduate standing.

Introduction of foundational topics in literacy teaching and learning in K-8 schools with diverse populations. Examination of concepts and theories underlying literacy learning and instruction, and relating research-based patterns of reading and writing development to features of the learner and learning environments. Participation in public schools requires mandated fingerprint clearance. 3 seminars, 1 activity.

**EDUC 429. Learning to Teach K-8 Literacy in Schools with Diverse Populations. 3 units.**

Prerequisite: Admission to the Multiple Subject Teacher Preparation Program; EDUC 310 or EDUC 427; and EDUC 428. Concurrent: EDUC 431, EDUC 435, EDUC 436, and EDUC 438.

Integration of theory and practice for planning, instruction and assessment in a balanced, comprehensive, research-based K-8 literacy and language arts program to enable children of all abilities and background to read, write, speak, listen and think effectively. 3 seminars.

**EDUC 430. Teaching Reading and Language Arts with a Multicultural Perspective. 6 units.**

Prerequisite: Admission into the Multiple Subject Credential Program.

Development of knowledge and skills for planning, teaching, and assessing a balanced, comprehensive, research-based K-8 reading and language arts program. State/national standards and trends. Attention to children of all abilities and backgrounds. PACT assessment task and RICA preparation. 4 seminars, 2 activities.

**EDUC 431. Learning to Teach K-8 Social Studies with Diverse Populations. 3 units.**

Prerequisite: Admission to the Multiple Subject Teacher Preparation Program; EDUC 427 and EDUC 428. Concurrent: EDUC 429, EDUC 435, EDUC 436 and EDUC 438.

Curriculum instruction and assessment concepts regarding teaching social studies to culturally diverse students in grades K-8, to promote civic competence and the development of elementary students' knowledge and reasoning in the social sciences. 3 seminars.

**EDUC 433. Foundations of Bilingual Education. 4 units.**

Prerequisite: Spanish proficiency demonstrated by passing SPAN 202 or equivalent with a grade of B or better, or consent of instructor.

History, theories, and practices associated with contemporary bilingual education in California and the U.S. Observation and limited teaching in bilingual classrooms. Approximately one-half of the class taught in Spanish. 3 seminars, 1 activity.

**EDUC 435. Learning to Teach K-8 Mathematics with Diverse Populations. 3 units.**

Prerequisite: Admissions to the Multiple Subject Teacher Preparation Program; EDUC 427 and EDUC 428. Prerequisite for LS majors: MATH 227, MATH 328, MATH 329 with a C- or better. Concurrent: EDUC 429, EDUC 431, EDUC 436 and EDUC 438.

Curriculum, instruction, and assessment concepts regarding teaching mathematics for understanding to culturally diverse students in grades K-8, with emphasis on using manipulatives to promote elementary students' development of mathematical knowledge and reasoning. 3 seminars.

**EDUC 436. Learning to Teach K-8 Science with Diverse Populations. 3 units.**

Prerequisite: Admission to the Multiple Subject Teacher Preparation Program; EDUC 427 and EDUC 428. Prerequisite for LS majors: PSC 103 and BIO 211. Concurrent: EDUC 429, EDUC 431, EDUC 435 and EDUC 438.

Curriculum, instruction, and assessment concepts regarding teaching science for understanding to culturally diverse students in grades K-8, with emphasis on teaching via inquiry to promote the development of scientific knowledge and reasoning. 3 seminars.

**EDUC 438. Clinical Practice I. 4 units.**

CR/NC

Prerequisite: Admission to the Multiple Subject Teacher Preparation (MSTEP) Program; EDUC 427 and EDUC 428. Concurrent: EDUC 429, EDUC 431, EDUC 435, and EDUC 436. Recommended: KINE 250 or KINE 443.

Clinical experiences involving observation; limited planning instruction, assessment and reflection; growth as a professional, and participation in other school-related activities in K-8 public school classrooms. Credit/No Credit grading only. Participation in public schools requires mandated fingerprint clearance.

**EDUC 439. Multiple Subject Clinical Practice Seminar I. 2 units.**

Prerequisite: Admission to the Multiple Subject Teacher Preparation (MSTEP) Program; EDUC 300; EDUC 427; and EDUC 428.

Discussion of contemporary educational issues and classroom practice; reflection on beginning clinical experiences in elementary education and their connection with educational theory and research. 2 seminars.

**EDUC 440. Educating Individuals with Exceptional Needs. 4 units.**

Corequisite: EDUC 430, EDUC 431, EDUC 435, EDUC 436, graduate standing or consent of instructor.

Characteristics, incidence, and etiology of individuals with exceptional needs. Problems, assessment, and approaches toward accommodating students with exceptional needs in the regular classroom. 3 seminars, 1 activity.

**EDUC 442. Elementary Field Experience in General and Special Education. 2-4 units.**

CR/NC

Prerequisite: Acceptance into the Preliminary Special Education Credential Program.

Public school classroom experiences in both general education classrooms and special education classrooms at the elementary level. Teaching individuals and small groups, emphasis on reading skills. Minimum 6 hours per week. Total credit limited to 4 units. Credit/No Credit grading only.

**EDUC 443. Assessment of Level II Education Specialists. 2 units.**

CR/NC

Prerequisite: Admission into the Professional Level II Special Education Credential Program and completion of all Level II coursework and related activities.

Use of multifaceted assessment process to verify that candidates have met the Level II Performance standards, including portfolio review, coursework competency review, and oral presentation before an assessor panel composed of trained professional practitioners. Credit/No Credit grading only. 1 seminar, 1 activity.

**EDUC 446. Adapting Instruction for Students with Disabilities in General Education Programs. 4 units.**

Prerequisite: Acceptance into Level I Special Education Credential Program, EDUC 440.

For Level I Special Education Credential candidates. Curriculum and method in teaching science, social science, mathematics, reading and the arts at the elementary schools including scope and sequence and appropriate methods for English language learners. The learning environment in the middle, junior high school, and secondary school with emphasis on specific single subject teaching area. 3 seminars, 1 activity.

**EDUC 447. Secondary Field Experience in General and Special Education. 2-4 units.**

CR/NC

Prerequisite: Acceptance into the Preliminary Special Education Credential Program.

Public school classroom experiences in both general education classrooms and special education classrooms at the secondary level. Teaching individuals and small groups, emphasis on behavior management. Minimum 6 hours per week. Total credit limited to 4 units. Credit/No Credit grading only.

**EDUC 449. Special Education Student Teaching. 8 units.**

CR/NC

Prerequisite: Acceptance into Level I Special Education Credential Program, and completion of all program requirements. Concurrent: EDUC 451.

Participation in public schools as a student teacher in activities representing different roles of special education teachers. Assumption of a teacher's responsibility for individual and small groups. Minimum 4 days per week. Credit/No Credit grading only.

**EDUC 450. Teaching Performance Assessment Seminar. 1 unit.**

CR/NC

Corequisite: EDUC 454 or EDUC 456.

Tasks, timelines, evaluation rubrics, and academic writing for the Performance Assessment for California Teachers (PACT) Teaching Event, which is the performance assessment at Cal Poly that is required for state certification. Credit/No Credit grading. 1 seminar.

**EDUC 451. Special Education Student Teaching Seminar. 4 units.**

CR/NC

Prerequisite: Acceptance into Level I Special Education Credential Program; completion of program requirements for the Level I Special Education Program. Concurrent: EDUC 449.

Educational issues and research, development and assessment of teaching portfolio, completion of materials for a job search, and beginning the first year as a special educator. 3 seminars, 1 activity.

**EDUC 454. Multiple Subject Clinical Practice II. 8 units.**

CR/NC

Prerequisite: Acceptance in STEP II or STEP B of the Multiple Subject Credential Program. Concurrent: EDUC 455.

Clinical experiences involving planning, instruction, assessment and reflection; growth as a professional and related activities in K-8 public school classrooms. Participation in public schools requires mandated fingerprint clearance. Credit/No Credit grading only.

**EDUC 455. Multiple Subject Clinical Practice Seminar II. 3 units.**

CR/NC

Prerequisite: Acceptance into STEP II or STEP B of the Multiple Subject Teacher Preparation Program. Concurrent: EDUC 454.

Discussion of contemporary educational issues, state education policies and expectations for effective classroom practice; reflection on clinical experiences in elementary education and their connection with educational theory research. Participation in public schools requires mandated fingerprint clearance. Credit/No Credit grading. 3 seminars.

**EDUC 456. Multiple Subject Clinical Practice III. 12 units.**

CR/NC

Prerequisite: EDUC 454 and EDUC 455. Concurrent: EDUC 457.

Advanced clinical experiences involving planning, instruction, assessment and reflection; growth as a professional and related activities in K-8 public school classrooms. Credit/No Credit grading only.

**EDUC 457. Multiple Subject Clinical Practice Seminar III. 3 units.**  
CR/NC

Prerequisite: EDUC 454 and EDUC 455. Concurrent: EDUC 456.

Discussion of contemporary educational issues, national education policies and expectations for effective classroom practice; reflection on advanced clinical experiences in elementary education and their connection with educational theory and research. Credit/No Credit grading. 3 seminars.

**EDUC 458. Summer Quarter Field Experiences: General and Special Education. 4 units.**  
CR/NC

Prerequisite: EDUC 304 and acceptance into Education Specialist Credential program. Concurrent: EDUC 459.

Participation in public schools in activities representing different teaching roles in general and special education. Assumption of a teacher's responsibility for individual and small groups. May include student teaching in special education. Minimum 20 hours per week. Total credit limited to 12 units. Credit/No Credit grading only.

**EDUC 469. Part-Time Student Teaching. 8 units.**

CR/NC

Prerequisite: Completion of courses and requirements to begin student teaching and approval of campus screening committee for credential candidates. Concurrent: EDUC 416, EDUC 418, content seminar (except AGED).

Part-time assignment in a classroom (Single Subject only). Includes teaching activities under the direction of a selected cooperating teacher in consultation with a university supervisor. Assignment consists of an entire morning in the classroom (or the equivalent) for one quarter. Credit/No Credit grading only.

**EDUC 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**EDUC 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**EDUC 479. Student Teaching. 12 units.**

CR/NC

Prerequisite: Completion of all courses and requirements prerequisite to full-time student teaching and approval by campus screening committee for credential candidates.

Full-time assignment in a classroom (Single Subject only). Includes teaching activities under the direction of a selected cooperating teacher in consultation with a university supervisor. Assignment consists of an entire teaching day in the school for one quarter. Credit/No Credit grading only.

**EDUC 480. Computer Based Curriculum. 2 units.**

Prerequisite: Junior standing.

Computer assisted instruction and computer based technology. Lesson planning and integration of technology into the K-12 curriculum. Familiarization with available educational courseware and software. Emphasis on classroom application. 1 seminar, 1 activity.

**EDUC 481. Advanced Educational Technology Methods and Integration. 4 units.**

Prerequisite: EDUC 480 or test equivalent.

Exploration of advanced educational technology methods and review of constructivist approaches to lesson design. Designing and running technology-based lessons in local K-12 classrooms, and preparing portfolio to meet Level II technology requirements as defined by CCTC. 3 seminars, 1 activity.

**EDUC 500. Individual Study. 1-4 units.**

Prerequisite: Consent of department head, graduate major advisor, and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 8 units.

**EDUC 501. Applied Practices in Curriculum Development. 4 units.**

Prerequisite: Graduate standing.

Overview of major curriculum trends; planning and development of a comprehensive curriculum project geared toward use of technology in teaching. Emphasis on practicality. 3 seminars, 1 activity.

**EDUC 507. Instructional Materials and Technology. 4 units.**

Prerequisite: Graduate standing.

Examination of technology-supported instruction with special focus on the use of technology to enable constructivist learning experiences for K-12 students. A survey of advanced technologies including electronic media, digital geography, digital story telling, probeware, simulation, and blogging. 3 seminars, 1 activity.

**EDUC 508. Digital Moviemaking for K-12 Educators. 4 units.**

Prerequisite: EDUC 481 or EDUC 507 or consent of instructor.

Digital moviemaking as the centerpiece of constructivist learning projects in K-12 classrooms. Project-based. Tools and skills for digital moviemaking. Designing constructivist lessons that require K-12 students to make their own movies. 3 seminars, 1 activity.

**EDUC 509. Robotics for K-12 Educators. 4 units.**

Prerequisite: EDUC 480 or EDUC 481 or EDUC 507 or consent of instructor.

The use of robots as the centerpiece of constructivist learning projects in K-12 classrooms. Project-based. Learning to build and program robots and design constructivist lessons around them. No engineering background required. 3 seminars, 1 activity.

**EDUC 510. Education Finance and Resource Allocation. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Financing public schools in America: historical and current sources and types of funding. District level and site level funding and budgeting including priorities and purchasing procedures. Financial implications of personnel contracts and obligations. 3 seminars, 1 activity.



**EDUC 511. Educational Law and Governance. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Legal aspects of school administration including unions, collective bargaining, and contract administration. Governing roles of federal, state, and local agencies including boards and district administrators. 3 seminars, 1 activity.

**EDUC 512. Education Organization and Management. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Principles of organization, management, and leadership and their relationship to educational effectiveness and productivity. Activity experience in the application of management theory in schools. 3 seminars, 1 activity.

**EDUC 513. Education Planning and Decision Making. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Concepts of planning and decision making in educational administration that utilize a wide range of data gathering and analysis procedures. 3 seminars, 1 activity.

**EDUC 514. School Site Administration. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Principles and practices of effective building level administration in multicultural/multilingual environment. 4 seminars.

**EDUC 515. Educational Program Management and Evaluation. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Supervision, management, and evaluation of educational curriculum and educational programs. Current trends in program management including mapping, monitoring, alignment. 3 seminars, 1 activity.

**EDUC 516. Educational Personnel Supervision and Evaluation. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Principles and processes for the supervision and evaluation of certificated and classified staff including legal, research, and professional considerations. 3 seminars, 1 activity.

**EDUC 518. Administrative Services Fieldwork. 3 units.**

CR/NC

Prerequisite: Admittance to the Administrative Services Credential program and consent of instructor.

Supervised fieldwork in school administration for supervision at the elementary and secondary level. Assignments must encompass three of the four academic quarters and must involve some multicultural experience. Total credit limited to 18 units, only 9 of which may be applied toward master's degree. Credit/No Credit grading only.

**EDUC 519. Professional e-Portfolios for Educational Leaders. 1 unit.**

CR/NC

Prerequisite: Enrollment in the Educational Leadership and Administration Program (ELAP).

Demonstration of exemplars of professional practice keyed to standards for the California Preliminary Administrative Services Credential. Class meets two (2) times per quarter. Faculty meet individually with students as to address portfolio development on a case-by-case basis. Credit/No Credit grading only. 1 activity.

**EDUC 532. Advanced Field Experiences in Education. 3-12 units.**

CR/NC

Prerequisite: Graduate standing, completion of basic teaching or administrative credential, or consent of instructor.

Supervised advanced field experience and practical application of specialty for classroom teachers, reading and special education specialists, administrators and school support personnel. Total credit limited to 18 units for specialist credentials. Total credit limited to 6 units for the master's degree. 30 hours work experience per unit of credit. Credit/No Credit grading only.

**EDUC 542. Administration of Special Programs and Services. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Principles and practices of organizing and administering special education, reading, counseling, and other support programs. Assessment and placement procedures, middle management's role, overview of specially funded programs, historical precedents and future trends. 3 seminars, 1 activity.

**EDUC 543. Advanced Studies in Assessment, Behavioral Support, Curriculum for Transition in Special Education. 4 units.**

Prerequisite: Admission into the Professional Level II Special Education Credential Program, EDUC 441.

Advancement of Level II candidate's knowledge and skills in assessment driven decision making for pupils with disabilities, supporting pupils with serious emotional or behavioral problems, and preparing pupils with disabilities, including English Language Learners, for major life cycle school transitions. Analyzing assessment data to determine how to modify academic instruction, provide behavioral support, social skills training, career and vocational preparation. 3 seminars, 1 activity.

**EDUC 544. Advanced Collaboration and Consultation for Teachers of Students with Special Needs. 5 units.**

Prerequisite: Admission into the Level I Special Education Credential Program and master's degree program in education.

Advanced studies and skills in educational consultation. Emphasis on the collaborative and consultative role of the special educator with a wide range of individuals from diverse cultural backgrounds including school personnel, parents, outside agencies, and paraprofessionals. 3 seminars, 2 activities.

**EDUC 545. Characteristics and Instruction of Pupils with Mild/Moderate Disabilities. 5 units.**

Prerequisite: Admission into the Level I Special Education Credential Program and master's degree program in education.

Advanced studies and skills in educational consultation. Emphasis on the collaborative and consultative role of the special educator with a wide range of individuals from diverse cultural backgrounds including school personnel, parents, outside agencies, and paraprofessionals. 3 seminars, 2 activities.

**EDUC 546. Reading and Language Arts Instruction in Special Education. 5 units.**

Prerequisite: Admission into the Level I Special Education Credential Program and master's degree program in education.

Overview of principles of reading instruction, elements of the language arts program including literature-based reading, content area reading, and the role of phonics, emergent literacy, and diagnosis of reading problems for special education teachers. 3 seminars, 2 activities.

**EDUC 547. Advanced Curricular and Instructional Adaptations for Students with Special Needs. 4 units.**

Prerequisite: Acceptance into Level II Special Education Credential Program and EDUC 441.

Advanced studies and skills in adaptation and modification of curriculum and instructional techniques to meet the needs of students with special needs. Educational implications of current learning theories as applied to individuals with special needs. Development and application of a remedial therapy with appropriate individual(s). Development of instruction based on the adopted instructional program for English Language Development. 3 seminars, 1 activity.

**EDUC 548. Advanced Collaboration and Instructional Techniques for Education Specialists. 4 units.**

Prerequisite: Admission into the Professional Level II Special Education Credential Program, EDUC 441.

Advanced studies in assessment, adaptation and modification of curriculum, and instructional techniques for teachers of pupils with disabilities. Emphasis on the collaborative, consultative, and management roles of the special educator, focus on interactions with school staff, parents, and outside agencies. 3 seminars, 1 activity.

**EDUC 550. Assessment Strategies for Special Education. 5 units.**

Prerequisite: Acceptance into Level I Special Education Credential Program and MA in Education, EDUC 440, EDUC 446.

Using norm referenced, criterion referenced, and curriculum based testing for assessing academic, behavioral, and physical status of individuals with exceptional needs, including English language learners, for referral purposes. Instructional and evaluation decisions regarding exceptional students in school settings. 3 seminars, 2 activities.

**EDUC 551. Characteristics and Instruction of Pupils with Moderate/Severe Disabilities. 4 units.**

Prerequisite: Acceptance into Level I Special Education Credential Program, EDUC 440.

Definition and social behavioral characteristics of students with moderate to severe disabilities. Instructional strategies emphasizing law, assessment, educational settings, and the collaborative strategies necessary for facilitating the inclusion of students with moderate/severe disabilities in general education settings. Emphasis on the communication, social skills, movement, mobility, sensory and specialized health care issues of students with moderate to severe disabilities. 3 seminars, 1 activity.

**EDUC 552. Support and Transition Strategies in Special Education. 5 units.**

Prerequisite: Acceptance into Level I Special Education Credential Program and MA in Education, EDUC 440, EDUC 446.

Basic guidance techniques for teachers working with exceptional individuals and their families. Career selection, preparation, and counseling. Transition from school to work, and community resource utilization. 3 seminars, 2 activities.

**EDUC 553. Current Issues, Emerging Research and Practices in Special Education. 4 units.**

Prerequisite: Admission to Level I Special Education Credential Program or masters degree program.

Consideration of assumptions and techniques of educational research regarding the educational, personal, social and vocational difficulties affecting the development of individuals with exceptional needs; emphasizing their applicability to general and specific educational programs. 4 seminars.

**EDUC 554. Behavior Disorders and Positive Behavior Support Strategies. 5 units.**

Prerequisite: Acceptance into Level I Special Education Credential Program and MA in Education, EDUC 440, EDUC 446.

Assessment of students whose behavior impedes either their own learning or the learning of other students. Strategies for facilitating proactive educational, environmental and social-emotional techniques for supporting students with challenging behavior. 3 seminars, 2 activities.

**EDUC 555. Introduction to the Counseling Profession. 4 units.**

Prerequisite: Admission to MA Education program.

Overview of the counseling profession, history, philosophy, theory and ethics. Required activity. 3 seminars, 1 activity.

**EDUC 556. Multicultural Counseling. 4 units.**

Prerequisite: Admission to MA Education program.

Initiation of critical analysis of personal beliefs and attitudes regarding counseling in a diverse society. Focus on a variety of approaches to explore the beliefs and attitudes of the student in counseling settings, and examination of strategies considered effective in working with diverse populations. 3 seminars, 1 activity.

**EDUC 557. Career Counseling. 4 units.**

Prerequisite: Admission to MA Education program.

Focus on the study and application of career development theories in career counseling. Utilizing appraisal instruments, community referral resources, occupational information, computerized retrieval systems, and personal and social data and required activities. 3 seminars, 1 activity.

**EDUC 559. Secondary School Counseling. 4 units.**

Prerequisite: PPS credential candidate, or consent of instructor.

A basic understanding of the secondary school environment, the role and responsibilities of the counselor within the school environment/community, the components of a secondary school counseling program, the developmental issues of 13-18 year olds, emerging standards for school counselors and the changing nature of student populations. 3 seminars, 1 activity.

**EDUC 560. Counseling Theories. 4 units.**

Prerequisite: EDUC 555 and admission to MA Education program.

Theories and practice of counseling with special emphasis on the counseling process. Emphasis of conditions of counseling, counseling techniques, counseling diverse populations and the counselor as a professional helper. 3 seminars, 1 activity.

**EDUC 561. Group Counseling. 4 units.**

Prerequisite: EDUC 555, EDUC 560 or consent of instructor.

Theory and practice of group counseling, client selection, group structure, process and termination, and application of theories to specific developmental groups. Communication and facilitation skills emphasized with relevant ethics and law. 3 seminars, 1 activity.

**EDUC 562. Student Development - Higher Education. 4 units.**

Prerequisite: Admission to MA Education program.

Exploration of the roles and competencies of the student development specialist in higher education. Review of relevant developmental theory with emphasis on practical implementation. Explore current issues and trends in higher education, and organizational framework. 4 seminars.

**EDUC 563. Violence Prevention in Schools. 4 units.**

Prerequisite: Admission to MA Education program.

Specific counseling strategies and issues related to violence in the schools. Alienation, violence, parenting, as they relate to the factors associated with school violence. Evaluation of effective intervention programs for K-12 schools. 3 seminars, 1 activity.

**EDUC 564. Legal and Ethical Issues in Counseling. 4 units.**

Prerequisite: Admission to MA Education Program or PPS Credential Program.

Consideration of legal, ethical, cultural and related professional issues as they affect the practice of counseling. 3 seminars, 1 activity.

**EDUC 565. Counseling Measurement and Assessment. 4 units.**

Prerequisite: Admission to MA Education Program, Counseling and Guidance Specialization, or to PPS Credential Program.

Training and evaluation in the utilization of tests, scales, measures, and other instruments with K-12, and college-age students. An understanding of culturally appropriate tests and measures, collaboration with school personnel, parents, and students in the review and interpretation of test scores and measures. 3 seminars, 1 activity.

**EDUC 566. Leadership and Consultation in Counseling. 4 units.**

Prerequisite: Admission to MA Education Program or PPS Credential Program.

Development of skills in planning, organizing, coordinating, and delivering programs that generate systemic change through establishing collaboration within schools, communities and other stakeholders. Emphasis on social action and its role in the counseling profession. 3 seminars, 1 activity.

**EDUC 568. Individual Counseling Techniques. 4 units.**

Prerequisite: Admission to MA Education Program, Counseling and Guidance Specialization, or to PPS Credential Program.

Theory and practice of individual counseling, process and termination, and application of theories to specific developmental issues working with K-12 students. Communication and facilitation skills emphasized, working with diverse populations and following legal and ethical guidelines. 3 seminars, 1 activity.

**EDUC 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**EDUC 573. Field Experience, Counseling. 1-12 units.**

CR/NC

Prerequisite: EDUC 555, EDUC 560 and Advancement to Candidacy.

Practical application of guidance services and counseling in public schools, colleges and community settings. Seminars with university staff included. Total credit limited to 24 units. Credit/No Credit grading only. Maximum of 12 units may be applied toward MA Education.

**EDUC 581. Graduate Seminar in Education. 1-3 units.**

Prerequisite: Graduate standing.

Contemporary problems in education. Trends, developments, and issues. Total credit limited to 9 units.

**EDUC 586. Introduction to Inquiry in Education. 4 units.**

Prerequisite: Admission to School of Education master's program.

Introduction to professional literature search techniques and to professional organizations as a basis for educational inquiry. Explanation of social construction of knowledge, and the philosophical basis of quantitative and qualitative research. 3 seminars, 1 activity.

**EDUC 587. Educational Foundations and Current Issues. 4 units.**

Prerequisite: Graduate standing.

Historical, organizational, legal and philosophical characteristics of American education. Emphasis on the analysis of contemporary issues focusing on these characteristics. 4 seminars.

**EDUC 588. Education, Culture, and Learning. 4 units.**

Prerequisite: Graduate standing.

Cultural characteristics of educational institutions and practice. Review of theory and research relating to the social and organizational context in which learning and teaching takes place. 4 seminars.

**EDUC 589. Educational Research Methods. 4 units.**

Prerequisite: EDUC 586.

Introduction to research methodologies, application of inferential and descriptive statistics, critical analysis of research designs and data collection techniques. 3 seminars, 1 activity.

**EDUC 590. Research Application in Education. 4 units.**

Prerequisite: EDUC 589.

Application of social science research techniques to problems in education and human services. Capstone experience for the School of Education master's inquiry course sequence. Completion of an inquiry project required. 2 seminars, 2 activities.

**EDUC 599. Thesis or Project. 3 units.**

Prerequisite: Consent of graduate committee and supervising faculty member(s).

Completion of a thesis or project pertinent to the field of education. Student must register for each quarter of advisement. Total credit limited to 6 units.

## **Electrical Engineering (EE)**

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## Electrical Engineering Courses

### EE 111. Introduction to Electrical Engineering. 1 unit.

Concurrent: EE 151.

A general overview of the field of electrical engineering. Preparation for successful completion of the Electrical Engineering (EE) program at Cal Poly. 1 lecture. Not required for students with transfer credit for EE 211 or EE 241.

### EE 112. Electric Circuit Analysis I. 2 units.

Prerequisite: MATH 142 or equivalent. Recommended: EE 111/151.

Introduction to basic circuit analysis. Resistive circuits, voltage and current sources, network theorems. Course may be offered in classroom-based or online format. 2 lectures.

### EE 129. Digital Design. 3 units.

Prerequisite: An orientation course in student's major (EE 111 & EE 151 for EE students, CPE 100 for CPE students), CPE/CSC 101. Concurrent: CPE/EE 169.

Number systems, Boolean algebra, Boolean functions, and minimization. Analysis and design of combinational logic circuits. Feedback circuits. Analysis and design of sequential logic circuits. Applying Hardware Description Language (HDL) to synthesize digital logic circuits in Programmable Logic Devices (PLDs). Not open to students with credit in CPE/EE 133. 3 lectures. Crosslisted as CPE/EE 129.

### EE 133. Digital Design. 4 units.

Prerequisite: An orientation course in student's major (EE 111 & EE 151 for EE students, CPE 100 for CPE students), CPE/CSC 101.

Number systems, Boolean algebra, Boolean functions, and function minimization. Analysis and design of combinational and sequential logic circuits. Hardware Description Language (HDL) concepts and applications digital design and synthesis in Programmable Logic Devices (PLDs). Not open to students with credit in CPE/EE 129. Course may be offered in classroom-based or online format. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 133.

### EE 151. Introduction to Electrical Engineering Laboratory. 1 unit.

Concurrent: EE 111.

A variety of hands-on experiments and demonstrations in electrical engineering, providing background and motivation for successful completion of the Electrical Engineering (EE) program at Cal Poly. Not open to students with credit for EE 241. 1 laboratory.

### EE 169. Digital Design Laboratory. 1 unit.

Prerequisite: An orientation course in student's major (EE 111 & EE 151 for EE students, CPE 100 for CPE students), CPE/CSC 101. Concurrent: CPE/EE 129.

Experiments to analyze and design combinational and sequential logic circuits with discrete ICs and PLDs. Introduction to laboratory equipment such as the logic state analyzer for testing circuits. Introduction to a hardware description language for logic simulation and design. Not open to students with credit in CPE/EE 133. 1 laboratory. Crosslisted as CPE/EE 169.

### EE 200. Special Problems. 1-2 units.

Prerequisite: Consent of department chair.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

### EE 201. Electric Circuit Theory. 3 units.

Prerequisite: MATH 244, PHYS 133.

Application of fundamental circuit laws and theorems to the analysis of DC, and steady-state single-phase and three-phase circuits. Not for electrical engineering majors. 3 lectures.

### EE 211. Electric Circuit Analysis II. 3 units.

Prerequisite: EE 112. Prerequisite or Concurrent: PHYS 133, MATH 244. Concurrent: EE 241.

Continuation of basic circuit analysis. Op-amp circuits. Energy storage elements, RC and RL circuits, and AC steady state analysis. 3 lectures.

### EE 212. Electric Circuit Analysis III. 3 units.

Prerequisite: MATH 244, EE 211. Concurrent: EE 242.

AC power, 3-phase circuits. Mutual inductance, series and parallel resonance and two-port networks. Frequency response, including Bode plots. 3 lectures.

### EE 228. Continuous-Time Signals and Systems. 4 units.

Prerequisite: EE 212 & EE 242. Recommended: MATH 241.

Continuous-time systems analysis, with emphasis on linear time-invariant (LTI) systems. Classifications of continuous-time systems. Convolution and its application to LTI systems. The Laplace transform, Fourier transform, and Fourier series, and their application to the analysis of LTI systems. 4 lectures.

### EE 229. Computer Design and Assembly Language Programming. 3 units.

Prerequisite: CPE/EE 129&169 or CPE/EE 133. Concurrent: CPE/EE 269.

Design and implementation of digital computer circuits via CAD tools for programmable logic devices (PLDs). Computer design including datapath components and control unit. Assembly language programming. Instruction set architecture, hardware/software interface, performance evaluation of computer processors. Not open to students with credit in CPE/EE 233. 3 lectures. Crosslisted as CPE/EE 229.

### EE 233. Computer Design and Assembly Language Programming. 4 units.

Prerequisite: CPE/EE 129 and CPE/EE 169, or CPE/EE 133.

Design and implementation of digital computer circuits via CAD tools for programmable logic devices (PLDs). Basic computer design with its datapath components and control unit. Introduction to assembly language programming of an off-the-shelf RISC-based microcontroller. Not open to students with credit in CPE/EE 229. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 233.

### EE 241. Electric Circuit Analysis Laboratory II. 1 unit.

Prerequisite: EE 112; EE 151 for EE students. Prerequisite or concurrent: MATH 244; PHYS 133. Concurrent: EE 211.

Use of electrical and electronic test equipment. Experimental verification of circuit analysis concepts including Kirchhoff's Laws, Thevenin's Theorem, maximum power transfer and superposition. 1 laboratory.

### EE 242. Electric Circuit Analysis Laboratory III. 1 unit.

Prerequisite: MATH 244, EE 241 or consent of department chair. Concurrent: EE 212.

Observation of transient and steady-state phenomena, phase-shift circuits, resonance. Use of phasor diagrams. 1 laboratory.



**EE 251. Electric Circuits Laboratory. 1 unit.**

Concurrent: EE 201.

Techniques of measurement of DC and steady-state AC circuit parameters. Equivalent circuits, nonlinear elements, resonance. 1 laboratory.

**EE 255. Energy Conversion Electromagnetics. 3 units.**

Prerequisite: EE 212 & EE 242, or EE 201 & EE 251. Concurrent: EE 295.

Fundamentals of electro-mechanical energy conversion. Magnetic circuits and electromagnetic devices. Theory of operation and operating characteristics of transformers, DC machines, and AC induction and synchronous machines. 3 lectures.

**EE 269. Computer Design and Assembly Language Programming Laboratory. 1 unit.**

Prerequisite: CPE/EE 129&169 or CPE/EE 133. Concurrent: CPE/EE 229.

Experiments to design and test digital computer circuits and systems with programmable logic devices (PLDs). Design projects to implement a basic computer with data path components and control. Assembly language programming projects for an off-the-shelf RISC-based microcontroller. Not open to students with credit in CPE/EE 233. 1 laboratory. Crosslisted as CPE/EE 269.

**EE 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**EE 295. Energy Conversion Electromagnetics Laboratory. 1 unit.**

Prerequisite: EE 212 & EE 242 or EE 201 & EE 251. Concurrent: EE 255.

Single-phase and three-phase transformers. Starting of rotating machines, evaluation of characteristics of rotating machines. 1 laboratory.

**EE 302. Classical Control Systems. 3 units.**

Prerequisite: EE 228. Concurrent: EE 342. Recommended: EE 368.

Introduction to feedback control systems. System modeling. Transfer functions. Graphical system representation. System time response, stability. Root Locus. Frequency response. Compensation. 3 lectures.

**EE 306. Semiconductor Device Electronics. 3 units.**

Prerequisite: CHEM 124, EE 212 & EE 242, IME 156 or IME 157 or IME 458, PHYS 211. Concurrent: EE 346.

Internal operation, semiconductor physics, terminal characteristics, models and application of diodes (LEDs, solar cells, and photo-diodes) and transistors (field-effect and bipolar). 3 lectures.

**EE 307. Digital Electronics and Integrated Circuits. 3 units.**

Prerequisite: EE/CPE 129 & EE/CPE 169 or EE/CPE 133, EE 306 & EE 346. Concurrent: EE 347, EE/CPE 229 or EE/CPE 233 (may be taken previously).

Analysis, design, application and interfacing of integrated logic circuits, including NMOS, CMOS, TTL, ECL, and other logic families. 3 lectures.

**EE 308. Analog Electronics and Integrated Circuits. 3 units.**

Prerequisite: EE 302 & EE 342, EE 307 & EE 347. Concurrent: EE 348.

Analysis and design of integrated circuits for use in analog applications. Gain, frequency response, and feedback of linear small-signal amplifiers. 3 lectures.

**EE 314. Introduction to Communication Systems. 3 units.**

Prerequisite: STAT 350.

Analog modulation, including: double-sideband modulation, amplitude modulation, single-sideband modulation, frequency modulation, phase modulation. Performances of such systems in the presence of white Gaussian noise. Implementations of transmitters and receivers. 3 lectures.

**EE 321. Electronics. 3 units.**

Prerequisite: EE 201 or BRAE 216 for BRAE majors.

Semiconductor devices and circuits. Instrumentation amplifiers, power control rectifiers, feedback, pulse circuits, digital logic circuits. Not for Electrical Engineering majors. 3 lectures.

**EE 328. Discrete Time Signals and Systems. 3 units.**

Prerequisite: EE 228. Concurrent: EE/CPE 368.

Discrete-time systems and analysis, with emphasis on linear time-invariant (LTI) systems. Sampling theorem. Classification of discrete-time systems. Convolution and its application to LTI systems. The z transform, discrete-time Fourier transform, and discrete Fourier transform. Introduction to digital filters. 3 lectures. Crosslisted as CPE/EE 328.

**EE 329. Programmable Logic and Microprocessor-Based Systems Design. 4 units.**

Prerequisite: EE 307&347, EE 229&269 or CPE/EE 233.

Design, implementation and testing of programmable logic microprocessor-based systems. Hardware/software tradeoffs (such as timing analysis and power considerations), system economics of programmable logic and microprocessor-based system design. Interfacing hardware components (such as ADCs/DACs, sensors, transducers). 3 lectures, 1 laboratory. Not open to students with credit in CPE/EE 336. Crosslisted as CPE/EE 329.

**EE 335. Electromagnetic Fields and Transmission. 4 units.**

Prerequisite: MATH 241, EE 212 & EE 242. Concurrent: EE 375.

Maxwell's equations. Plane wave propagation in free space. Static electric and magnetic fields. Distributed-circuit concepts and transmission line parameters. Reflections and standing waves. The Smith chart and its applications. Transmission line measurements and impedance matching techniques. 4 lectures.

**EE 336. Microprocessor System Design. 4 units.**

Prerequisite: CPE/EE 229 & CPE/EE 269 or CPE/EE 233.

Introduction to microcontrollers and integrated microprocessor systems. Hardware/software trade-offs, system economics, and functional configurations. Interface design, real-time clocks, interrupts, A/D conversion, serial and parallel communications, watch-dog timers, low power operation, event-based inter-peripheral communication, and assembly and higher-level language programming techniques. Architecture and design of sampled data and low-power systems. Not open to students with credit in CPE/EE 329. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 336.



**EE 342. Classical Control Systems Laboratory. 1 unit.**

Prerequisite: EE 228. Concurrent: EE 302. Recommended: EE 368.

Laboratory work pertaining to classical control systems, including servo control, transient and frequency responses, stability, and computer-aided analysis of control systems. 1 laboratory.

**EE 346. Semiconductor Device Electronics Laboratory. 1 unit.**

Prerequisite: CHEM 124, EE 212 & EE 242, IME 156 or IME 157 or IME 458, PHYS 211. Concurrent: EE 306. Recommended: ENGL 134.

Experimental determination of device characteristics and models. 1 laboratory.

**EE 347. Digital Electronics and Integrated Circuits Laboratory. 1 unit.**

Prerequisite: EE/CPE 129 & EE/CPE 169 or EE/CPE 133, EE 306 & EE 346. Concurrent: EE 307, EE/CPE 229 or EE/CPE 233 (may be taken previously).

Computer simulation and experimental investigation of the characteristics, applications and interfacing of different logic families. 1 laboratory.

**EE 348. Analog Electronics and Integrated Circuits Laboratory. 1 unit.**

Prerequisite: EE 302 & EE 342, EE 307 & EE 347. Concurrent: EE 308.

Design, simulation, construction and testing of solid state amplifiers and sub-circuits to meet stated specifications. 1 laboratory.

**EE 361. Electronics Laboratory. 1 unit.**

Prerequisite: EE 251 or BRAE 216 for BRAE majors. Concurrent: EE 321.

Instrumentation amplifiers, feedback, rectifiers and power control, pulse and digital logic circuits. 1 laboratory.

**EE 368. Signals and Systems Laboratory. 1 unit.**

Prerequisite: EE 228. Concurrent: EE/CPE 328.

Laboratory work pertaining to linear systems, including Fourier analysis, time and frequency responses, and system transfer function. 1 laboratory. Crosslisted as CPE/EE 368.

**EE 375. Electromagnetic Fields and Transmission Laboratory. 1 unit.**

Concurrent: EE 335.

Transmission line and passive component measurements at microwave frequencies. Response to pulse excitation using time domain techniques and sinusoidal excitation using frequency domain techniques. Application of the Smith Chart and network analyzers in transmission line characterization and impedance matching techniques. 1 laboratory.

**EE 400. Special Problems. 1-5 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 5 units.

**EE 402. Electromagnetic Waves. 4 units.**

Prerequisite: EE 335.

Maxwell's equations and plane wave propagation in materials. Reflection and transmission of normal and oblique incidence plane waves at planar boundaries between different media. Wave guides. Antennas. 4 lectures.

**EE 403. Fiber Optic Communication. 3 units.**

Prerequisite: EE 335 or PHYS 323. Concurrent: EE 443.

Propagation of light in optical fibers, attenuation and bandwidth. LED and Laser Diode sources for use with optical fibers. Optical sources, detectors, and receivers. Design of optical communication systems with applications in telecommunications and local area networks (LANs). 3 lectures.

**EE 405. High Frequency Amplifier Design. 3 units.**

Prerequisite: EE 308 & EE 348, EE 335. Concurrent: EE 445.

Design of modern electronic amplifiers and amplifier systems with advanced techniques. UHF and microwave small signal amplifier design utilizing microstrip transmission lines, S parameters of GaAs FET, and bipolar transistors. Low noise, broadband, and power amplifier designs. Oscillator designs. 3 lectures.

**EE 406. Power Systems Analysis I. 4 units.**

Prerequisite: EE 335, EE 255 & EE 295.

Introduction to electric power systems. Representation of power systems and its components including transmission lines, synchronous machines, transformers and loads. One line diagrams and per unit calculations. symmetrical faults. Load flow analysis. 4 lectures.

**EE 407. Power Systems Analysis II. 4 units.**

Prerequisite: EE 406.

Symmetrical components, unbalanced faults, power system stability, system protection, relays and relay systems, power system instrumentation and measurement techniques, economic operation. 4 lectures.

**EE 409. Electronic Design. 3 units.**

Prerequisite: EE 308 & EE 348; CPE/EE 328 & CPE/EE 368; CPE/EE 329 or CPE/EE 336. Concurrent: EE 449.

Design of electronic systems and subsystems using analog and digital integrated circuits. Design principles and techniques. Analysis and design of feedback amplifiers; operational amplifier applications. Design of analog/digital and digital/analog converters. Power supply design. Emphasis on IC implementation. 3 lectures.

**EE 410. Power Electronics I. 4 units.**

Prerequisite: EE 308 and EE 348, or EE 321 and consent of instructor.

Introduction to power electronics and power semiconductor devices. Analysis, performance characterization, and design of power electronics converters such as: rectifiers, DC choppers, AC voltage controllers, and single-phase inverters. Operation of DC motor drives. Use of commercially available software. 3 lectures, 1 laboratory.

**EE 411. Power Electronics II. 4 units.**

Prerequisite: EE 410.

Switching losses. Analysis, performance characterization, and design of snubber circuits and resonant converters. Operation of DC transmission lines, flexible AC transmission system (FACTS) controllers, three-phase inverters, and AC motor drives. Use of commercially available software. 3 lectures, 1 laboratory.

**EE 412. Advanced Analog Circuits. 3 units.**

Prerequisite: EE 314, EE 409 & EE 449. Concurrent: EE 452.

Application of linear integrated circuits to data acquisition problems: transducer interfacing, linear and nonlinear preprocessing, phase-locked loops, and high performance quantization and recovery (A/D, D/A conversion). 3 lectures.

**EE 413. Advanced Electronic Design. 4 units.**

Prerequisite: CSC 101, EE 409 &amp; EE 449.

Advanced design of electronic circuits and subsystems. Design as a process. Implementation of specific design projects. Automated test using GPIB instruments. 3 lectures, 1 laboratory.

**EE 415. Communication Systems Design. 3 units.**

Prerequisite: EE 409 &amp; EE 449, EE 314.

Design of modern electronic communication and telemetry systems. Emphasis: practical implementation and comparative evaluation of various modulation systems. 3 lectures.

**EE 416. Digital Communication Systems. 3 units.**

Prerequisite: EE 314, EE 328.

Baseband (PCM, PAM, DM) signals and transmission. Bandpass (PSK, FSK, ASK) modulation and demodulation techniques. Digital communication signals in the presence of noise and detection of signals in Gaussian noise. Other topics such as: quantization, multiplexing and multiple access, spread spectrum techniques, coding, synchronization. 3 lectures.

**EE 417. Alternating Current Machines. 4 units.**

Prerequisite: EE 255 &amp; EE 295.

Alternating current machines. Generalized, operational and dynamic analysis. Steady-state and transient operation of synchronous machines and linear induction machines. 3 lectures, 1 laboratory.

**EE 418. Photonic Engineering. 3 units.**

Prerequisite: EE 335 or PHYS 323. Concurrent: EE 458.

Modern optical design with emphasis on the use of computers to design simple optical systems and to evaluate existing optical designs. Paraxial and exact ray tracing through thin and thick lenses, mirrors, and prisms. Radiometry and photometry. Electro-optic, acousto-optic, and magneto-optic modulators and their applications. Thermal detectors, semiconductor detectors, and charge coupled device (CCD) arrays. 3 lectures.

**EE 419. Digital Signal Processing. 3 units.**

Prerequisite: CSC 101, EE 328 &amp; EE 368. Concurrent: EE 459.

Review of Z-transform, convolution and discrete Fourier Transform. Digital filter design. Fast Fourier Transform. Theory and applications of digital signal processors. 3 lectures.

**EE 420. Sustainable Electric Energy Conversion. 4 units.**

Prerequisite: CHEM 124 and EE 255 &amp; EE 295 or consent of instructor.

Electrical engineering aspects of photovoltaic and wind power generation and usage, and electrochemical energy conversion. Power control, processing, and quality for grid-connected and stand-alone systems. Distribution and storage of electric energy. Hydrogen and synthetic fuels. Distributed generation. 3 lectures, 1 laboratory.

**EE 421. Solid-state Microelectronics. 3 units.**

Prerequisite: EE 307.

Physical basis of solid-state microelectronics. Passive and active integrated circuit components in Bipolar, MOS, thin and thick film systems. Diffusion, oxidation, ion implantation and other fabrication techniques. Microcircuit layout and design: system development, reliability and economic considerations. Future trends. 3 lectures.

**EE 422. Polymer Electronics Laboratory. 1 unit.**

Prerequisite: EE 347 or MATE 340 or CHEM 319 or PHYS 340.

Experimental procedures in polymer electronics. Investigation of the characteristics of a polymer electronic device. 1 laboratory. Crosslisted as EE/PHYS 422.

**EE 424. Introduction to Remote Sensing. 4 units.**

Prerequisite: MATH 244, senior or graduate standing in engineering, or consent of instructor.

Radiation characteristics, sensor technology and platforms, satellite systems, system design tradeoffs, collection and transmission of radio-metric data, GPS, thermal remote sensing, active radar and microwave remote sensing, interpretation and exploitation of remotely sensed data for various applications. 3 lectures, 1 laboratory.

**EE 425. Analog Filter Design. 3 units.**

Prerequisite: EE 409 &amp; EE 449. Concurrent: EE 455.

Approximation Theory. All pole filters. Frequency transformations. Elements of passive synthesis. Time delay filters. Theory and design of active filter. Sensitivity analysis. 3 lectures.

**EE 427. Digital Computer Subsystems. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336.

Design of components and subsystems in digital computers. Use of modern techniques and devices (CPLDs and FPGAs) in implementation. Consideration given to cost/speed tradeoffs. Implementation of a basic digital computer using pre-designed subsystems. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 427.

**EE 428. Computer Vision. 4 units.**

Prerequisite: EE 328 or CPE/CSC 357 or ME 305 or consent of instructor.

Introduction to the concepts of 2D and 3D computer vision: low-level image processing methods such as filtering and edge detection; feature extraction; segmentation and clustering; stereo vision; appearance-based and model-based algorithms. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 428.

**EE 431. Computer-Aided Design of VLSI Devices. 4 units.**

Prerequisite: EE 307 &amp; EE 347, EE 308 &amp; EE 348 or consent of instructor.

Design of VLSI circuits, design of subsystems using static CMOS, transmission gates, and other methods. Variety of CAD tools for design, verification, test, and simulation. Several design projects. 3 lectures, 1 laboratory. Crosslisted as CPE 441/EE 431.

**EE 432. Digital Control Systems. 3 units.**

Prerequisite: EE 302 &amp; EE 342. Concurrent: CPE/EE 472.

Recommended: Prior background in discrete time systems, for example EE 328, EE 368.

Theory and applications of digital computers in linear control systems. Discrete time methods are used in analysis and design studies. Digital control systems are synthesized. 3 lectures. Crosslisted as CPE/EE 432.

**EE 433. Introduction to Magnetic Design. 4 units.**

Prerequisite: EE 255 & EE 295 or consent of instructor.

Design of magnetic components. Fundamentals of magnetics, magnetic cores, design of power transformer, three-phase transformer, dc inductor, ac inductors, dc-dc converter transformer design, actuators. Use of commercially available software. 3 lectures, 1 laboratory.

**EE 434. Alternative Energy Vehicles. 4 units.**

Prerequisite: Junior standing; Engineering majors, Bioresource and Agricultural Engineering majors, Chemistry or Physics majors; completion of GE Areas B1 and B3.

Multidisciplinary investigation of automotive renewable fuels and electric/hybrid vehicles. Analysis and design of related technologies and systems. Methods for complete-cycle energy and GHG analysis. Comparative emissions, efficiency, power output, and production, distribution and storage infrastructure requirements. May require some supplemental self-study. 3 lectures, 1 laboratory.

**EE 438. Digital Computer Systems. 3 units.**

Prerequisite: CPE 427 or consent of instructor.

Design of computer ALU's, microprogram controllers, memory systems, and I/O controllers. Use of LSI components in CPU design. Microprogram and nanoprogram development. 3 lectures. Crosslisted as CPE/EE 438.

**EE 439. Real-Time Embedded Systems. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336.

Introduction to operating systems as they apply to real-time embedded applications. Use of standard and/or softcore microcontroller platforms with communications to discrete peripherals through common bus interfaces. 3 lectures, 1 laboratory. Crosslisted as CPE/EE 439.

**EE 440. Wireless Communications. 3 units.**

Prerequisite: EE 335, EE 314. Concurrent: EE 480.

Wireless microwave system design and analysis. RF transmission lines, microwave networks, receiver design, modulation techniques, and mixer characterization and realizations. Noise and distortion, RF oscillators and frequency synthesizers, filter design. Radiating systems and electromagnetic wave propagation, microwave amplifier design. 3 lectures.

**EE 443. Fiber Optics Laboratory. 1 unit.**

Prerequisite: EE 335 or PHYS 323. Concurrent: EE 403.

Experimental investigation of the properties of optical fibers, sources, and detectors. Measurement of fiber physical characteristics, attenuation, losses, and bandwidth. Evaluation of an analog and digital fiber optic data link. 1 laboratory.

**EE 444. Power Systems Laboratory. 1 unit.**

Prerequisite: EE 406.

Protective relaying, coordination, and relay calibration. Power control using transformers, parallel operation of generators, and computer simulation of power systems. 1 laboratory.

**EE 445. High Frequency Amplifier Design Laboratory. 1 unit.**

Prerequisite: EE 308 & EE 348, EE 335. Corequisite: EE 405.

Experimental investigation employing advanced techniques. Design of high-frequency electronic amplifiers utilizing S-parameters of bipolar transistors, network analyzers, and computer simulation techniques. 1 laboratory.

**EE 449. Electronic Design Laboratory. 1 unit.**

Prerequisite: EE 308 & EE 348; CPE/EE 328 & CPE/EE 368; CPE/EE 329 or CPE/EE 336. Concurrent: EE 409.

Design of electronic systems and subsystems using integrated circuits. 1 laboratory.

**EE 452. Advanced Analog Circuits Laboratory. 1 unit.**

Prerequisite: EE 314, EE 409 & EE 449. Concurrent: EE 412.

Advanced laboratory study of LC and VCO oscillators, phase detectors, phase-locked loop circuits, transducer interface circuits, noise sources and signal-to-noise determination, ADC and DAC for data conversion. Formal experiments and computer SPICE simulation. 1 laboratory.

**EE 455. Analog Filter Design Laboratory. 1 unit.**

Prerequisite: EE 409 & EE 449. Concurrent: EE 425.

Advanced laboratory study of sensitivity and stability of active networks prescribed for realization of transfer functions by active network synthesis techniques. Formal experiments and individual project work. 1 laboratory.

**EE 456. Communication Systems Laboratory. 1 unit.**

Prerequisite: EE 328 & EE 368, EE 314.

Methods of analog modulation and demodulation. Emphasis on spectral analysis, bandwidth requirements and other practical considerations of modulation and demodulation. 1 laboratory.

**EE 458. Photonic Engineering Laboratory. 1 unit.**

Concurrent: EE 418.

Experimental investigation of the techniques used in processing optical signals. Formal experiments on electro-optic modulation, acousto-optic modulation. Construction of an RF spectrum analyzer. Analog processing of optical signals, and charge-coupled array devices. 1 laboratory.

**EE 459. Digital Signal Processing. 1 unit.**

Prerequisite: CSC 101, EE 328 & EE 368. Concurrent: EE 419.

Experiments in digital filter design and digital signal processing emphasizing various areas of applications (communications, audio signals, speech processing). Formal experiments and individual project work. 1 laboratory.

**EE 460. Senior Project Preparation. 2 units.**

Prerequisite: EE 314, EE 335. Corequisite: EE 409 & EE 449.

Introduction to teamwork and team-oriented project execution. Project planning, scheduling and analysis. Usage of tools for project management including Gantt and Pert Charts. Project development, cost and time estimation using top-down and bottom-up approaches. Ethics and ethical issues as they pertain to the conduct of engineering. Development of senior project proposal. 1 lecture, 1 laboratory.

**EE 461. Senior Project I. 3 units.**

Prerequisite: EE 409 & EE 449, EE 460.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time.

**EE 462. Senior Project II. 2 units.**

Prerequisite: EE 409 &amp; EE 449, EE 460.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 150 hours total time.

**EE 463. Senior Project Design Laboratory I. 3 units.**

Prerequisite: EE 409 &amp; EE 449, EE 460.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. 3 laboratories. Note: although EE 463, EE 464 substitute for EE 461, 462, students may not use repeat credit for the purpose of increasing GPA.

**EE 464. Senior Project Design Laboratory II. 2 units.**

Prerequisite: EE 463.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. 2 laboratories. Note: although EE 463, 464 substitute for EE 461, 462, students may not use repeat credit for the purpose of increasing GPA.

**EE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**EE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**EE 472. Digital Control Systems Laboratory. 1 unit.**

Concurrent: CPE/EE 432.

Design and programming of microprocessor-based digital controls for electro-mechanical plants. Topics include digital control laws, translation of transfer functions into algorithms, assembly language programming, real-time software design, sample rate selection, finite word-length considerations. 1 laboratory. Crosslisted as CPE/EE 472.

**EE 480. Wireless Communications Laboratory. 1 unit.**

Prerequisite: EE 335, EE 314. Concurrent: EE 440.

Wireless microwave system design and analysis. RF transmission lines, microwave networks, receiver design, modulation techniques, and mixer characterization and realizations. Noise and distortion, RF oscillators and frequency synthesizers, filter design. Radiating systems and electromagnetic wave propagation, microwave amplifier design. 1 laboratory.

**EE 494. Cooperative Education Experience. 6-12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**EE 495. Cooperative Education Experience. 6-12 units.**

Prerequisite: Two consecutive quarters of EE 494 immediately preceding EE 495; sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units.

**EE 500. Individual Study. 1-3 units.**

Prerequisite: Consent of department chair, graduate advisor, and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limit at discretion of graduate advisor, not to exceed 9 units.

**EE 502. Microwave Engineering. 4 units.**

Prerequisite: EE 402 or equivalent.

Application of Maxwell's equations and boundary value problems to waveguide structures. Striplines and microstrip lines. S-parameters. Microwave equivalent circuit theorem. Passive microwave devices. Charge and field interactions in oscillators and amplifiers. Transferred electron devices, avalanche transit-time devices, and microwave transistors. Circuits associated with oscillators and reflection type amplifiers. 4 seminars.

**EE 509. Computational Intelligence. 4 units.**

Prerequisite: Senior or graduate standing.

Theory, design, and applications of biologically inspired computational paradigms, including artificial neural networks, evolutionary computation, swarm intelligence, and hybrid intelligent systems. 4 seminars.

**EE 511. Electric Machines Theory. 4 units.**

Prerequisite: EE 255 or equivalent, and graduate standing or consent of instructor.

Advanced topics in electric machines theory. Introduction to Park's transformation. Analysis of electric machines using Kron's generalized concept. Vector control of induction machines. 4 seminars.

**EE 513. Control Systems Theory. 4 units.**

Prerequisite: EE 302 or equivalent, and graduate standing or consent of instructor.

State representation of dynamic systems. Mathematical models of physical devices, controllability and observability. Design of closed-loop systems. Optimal control theory. 4 seminars.



**EE 514. Advanced Topics in Automatic Control. 4 units.**

Prerequisite: EE 513 or equivalent, EE 328 or similar course on discrete-time linear systems.

Summary course covering five selected graduate-level topics in automatic control theory and practice; implementation issues in digital control, nonlinear control theory and design, LQ and time optimal control, variable structure control, and fuzzy logic/model-free control. 4 seminars.

**EE 515. Discrete Time Filters. 4 units.**

Prerequisite: EE 314 or equivalent, and graduate standing or consent of instructor.

Advanced topics in filter design and implementation. Emphasis placed on current applications and on the processing of real signals. Topics may include signal analysis via spectral estimation, short time Fourier transforms, and spectrograms. Effects of coefficient quantization, and limits of practical filters. State space realization. Optimal and adaptive filters for signal prediction, system identification, and noise cancellation. Techniques implemented in programming assignments. 4 seminars.

**EE 518. Power System Protection. 4 units.**

Prerequisite: EE 406 or equivalent, and graduate standing or consent of instructor.

Unsymmetrical faults. Protection fundamentals. Instrument transformers. Power system grounding. Generator protection, transformer protection, busbar protection, line and motor protection. 4 seminars.

**EE 519. Advanced Analysis of Power Systems. 4 units.**

Prerequisite: EE 406 or equivalent, and graduate standing or consent of instructor.

Advanced power system stability analysis, numerical methods in power system analysis. 4 seminars.

**EE 520. Solar-Photovoltaic Systems Design. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Solar radiation and insolation variability. Solar cell theory. Photovoltaic module and array design. Interfacing PV generators with various kinds of loads. Power processing circuits and systems. Energy storage options. Stand-alone and grid-connected systems. Economic and policy issues. 4 seminars.

**EE 521. Computer Systems. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336, or equivalent, and graduate standing or consent of instructor.

Organization of modern general purpose, high speed digital computer systems. Design of arithmetic units, control units, memories and memory subsystems. Cost, power and speed trade-offs in the design of such systems. 3 seminars, 1 laboratory. Crosslisted as CPE/EE 521.

**EE 522. Advanced Real-Time Embedded Systems Design. 4 units.**

Prerequisite: Advanced C programming skills, CPE/EE 329 or CPE/EE 336 or equivalent, or consent of instructor.

Theory, design and implementation of real-time operating system-based embedded systems. Scheduling algorithms, operating system resources, peripheral device interfacing and embedded system architecture. Resource management issues in a resource-limited (microcontroller-based) environment. 3 seminars, 1 laboratory. Crosslisted as CPE/EE 522.

**EE 523. Digital Systems Design. 4 units.**

Prerequisite: CPE/EE 329 or CPE/EE 336 or equivalent, and graduate standing or consent of instructor.

Full-custom design and analysis of digital circuits using full CMOS, pass-transistor and dynamic circuit topologies. Transistor sizing for minimizing power consumption, delay and other design criteria. 3 seminars, 1 laboratory. Crosslisted as CPE/EE 523.

**EE 524. Solid State Electronics. 3 units.**

Prerequisite: PHYS 412 or equivalent, and graduate standing or consent of instructor.

Physical theory of solid-state devices. Properties of metal-semiconductor junctions and p-n junctions. Derivation of properties of diodes, transistors, and four-layer devices from basic physical and mathematical considerations. 3 seminars.

**EE 525. Stochastic Processes. 4 units.**

Prerequisite: STAT 350 or equivalent, and graduate standing or consent of instructor.

Probability and stochastic processes used in random signal analysis. Response of linear systems to random inputs. Auto-correlation and power spectral densities. Applications in signal processing using the discrete Kalman filter. 4 seminars.

**EE 526. Digital Communications. 4 units.**

Prerequisite: EE 314 or equivalent, EE 525, and graduate standing or consent of instructor.

M-ary signals. Vector space representation of signals. Optimum receiver principles. Common signal sets. Signal space dimensionality versus time-bandwidth product. 4 seminars.

**EE 527. Advanced Topics in Power Electronics. 4 units.**

Prerequisite: EE 410 or equivalent, and graduate standing or consent of instructor.

Selected advanced topics in power electronics such as dc-dc converters, phase-controlled rectifiers, switched-mode inverters, ac and dc drives, HVDC transmission, or utility applications of power electronics. 4 seminars.

**EE 528. Digital Image Processing. 4 units.**

Prerequisites: EE 314 or equivalent, EE 525, and graduate standing or consent of instructor.

Processing and interpretation of images by computer. Emphasis on current applications with real images used in programming assignments. Topics may include histogram equalization, 2-D convolution, correlation, frequency-domain processing, median filtering, compression, Hough transform, segmentation and region growing, morphological operations, texture description, shape description, Bayes classifier. 4 seminars.

**EE 529. Microwave Device Electronics. 3 units.**

Prerequisite: EE 402 or equivalent, PHYS 412 or equivalent, and graduate standing or consent of instructor.

Emphasis on device and circuit principles of active microwave solid-state devices, their noise aspects and systems applications. 3 seminars.



**EE 530. Fourier Optics. 4 units.**

Prerequisite: EE 402 or equivalent, EE 314 or equivalent, and graduate standing or consent of instructor.

Approach to the design and analysis of optical systems using linear communication theory, including Fourier analysis. Analysis of two-dimensional signals and systems, foundations of scalar diffraction theory. Fresnel and Fraunhofer diffraction. Wave-optics analysis of coherent optical systems, frequency analysis of optical imaging systems, holo-graphy. 4 seminars.

**EE 533. Antennas. 4 units.**

Prerequisite: EE 402 or equivalent.

Principles of antenna theory. Antenna parameters, radiation integrals. Duality and reciprocity theorems. Wire antennas. Antenna arrays. Traveling wave antennas. Broadband and frequency independent antennas. Aperture and reflector antennas. Microstrip antennas. Antenna design. 4 seminars.

**EE 541. Advanced Microwave Laboratory. 2 units.**

Prerequisite: EE 402 or equivalent and graduate standing or consent of instructor. Corequisite: EE 502.

Experimental measurement in waveguide and microstrip circuits employing the advanced Network Analyzer. Design of both passive and active microwave circuits using microstrip. Graphical and analytical design techniques as well as the use of computer-aided design codes. 2 laboratories.

**EE 544. Solid-state Electronics Laboratory. 1 unit.**

Prerequisite: Graduate standing or consent of instructor. Concurrent: EE 524.

Experimental procedures in solid-state electronics. Investigation and improvement of the characteristics of a solid-state electronic device. 1 laboratory.

**EE 563. Graduate Seminar. 1 unit.**

CR/NC

Current developments in the fields of electrical and electronic engineering. Participation by students, faculty and guest lecturers. Open to graduate students with a background in electrical or electronic engineering. Credit/No Credit grading only. Total credit limited to 3 units. 1 seminar.

**EE 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to graduate students and selected seniors with electrical and electronic engineering background. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 seminars.

**EE 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**EE 594. Cooperative Education Experience. 6-12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only. Total credit limited to 24 units.

**EE 595. Cooperative Education Experience. 6-12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Total credit limited to 12 units.

**EE 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Each individual or group will select, with faculty guidance and approval, a topic for independent research or investigation resulting in a thesis or project to be used to satisfy the requirement for the degree. An appropriate experimental or analytical thesis or project may be accepted.

## Engineering (ENGR)

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### Engineering Courses

**ENGR 110. Engineering Science I. 2 units.**

Introduction to engineering and computer science. Graphical communication and visualization as well as engineering orientation. Cultural pluralism and gender issues. 2 lectures.

**ENGR 111. Engineering Science II. 3 units.**

Introduction to engineering and computer science. Computer-aided design (CAD) and manufacturing (CAM), and fabrication, as well as engineering orientation. Cultural pluralism and gender issues. 3 lectures.

**ENGR 213. Bioengineering Fundamentals. 2 units.**

GE Area B2

Prerequisite: MATH 142; for engineering students only. Corequisite: BIO 213. Recommended: CHEM 124.

Treatment of the engineering applications of biology. Genetic engineering and the industrial application of microbiology. Systems physiology with engineering applications. Structure and function relationships in biological systems. The impact of life on its environment. 2 lectures. Crosslisted as BRAE/ENGR 213. Fulfills GE B2.

**ENGR 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ENGR 302. Transportation and Manufacturing in the Twenty-First Century. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B, or consent of instructor.

Role of transportation and manufacturing technology in the twenty-first century. Effects of technological change upon society, and the principles associated with the advancement of transportation and manufacturing technologies in the automotive industry and the industrial-military complex. Case studies of systems to compare alternative approaches to problem solving. 4 lectures. Fulfills GE Area F.

**ENGR 322. The Learn By Doing Lab Teaching Practicum. 2 units. CR/NC**

Prerequisite: Completion of GE Area B and consent of instructor.

Early teaching experience in an informal science/technology/engineering/mathematics (STEM) teaching and learning environment. Principles of inquiry-driven STEM education, lesson design, implementation and assessment. Intended for undergraduates exploring STEM teaching as a career. Total credit limited to 4 units. Credit/No Credit grading only. 1 seminar, 1 laboratory. Crosslisted as ENGR 322/SCM 302/HNRS 302.

**ENGR 350. The Global Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary investigation of how human activities impact the Earth's environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 4 lectures. Crosslisted as AG/EDES/ENGR/HUM/SCM/UNIV 350. Fulfills GE Area F.

**ENGR 400. Special Problems for Advanced Undergraduates. 2-4 units.**

Prerequisite: ME 212 or consent of department head.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units.

**ENGR 451. Special Topics in Bioengineering. 4 units.**

Prerequisite: MATH 242.

Current topics in bioengineering, including medical applications and industrial applications. Total credit limited to 16 units, with a maximum of 4 units per quarter. See The Schedule of Classes for topic selected. 4 lectures.

**ENGR 459. Multidisciplinary Senior Design Project I. 2 units.**

Prerequisite: Senior standing and consent of instructor.

First of three courses taken sequentially in a team based multidisciplinary senior design project. Identification of sponsor's needs and development of design solution. Test plan development to validate design meets user requirements. Communication of results to project sponsor. Project management, cost analysis, intellectual property analysis, impact analysis on society, and ethical considerations. 2 laboratories.

**ENGR 460. Multidisciplinary Senior Design Project II. 2 units.**

Prerequisite: ENGR 459.

Continuation of ENGR 459 and senior project. Activities focus on detail design, analysis and material procurement. 2 laboratories.

**ENGR 461. Multidisciplinary Senior Design Project III. 2 units.**

Prerequisite: ENGR 460.

Continuation of ENGR 460 and completion of senior project. Design verified through prototyping and testing. 2 laboratories.

**ENGR 462. Senior Project. 4 units.**

Prerequisite: ME 212, junior standing, and consent of instructor.

Selection and completion of project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results presented in a formal report. Minimum commitment of 150 hours.

**ENGR 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**ENGR 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**ENGR 481. Senior Project Design Laboratory I. 2 units.**

Prerequisite: MATH 244, IME 314, ME 302 or consent of instructor.

Selection, development, and completion of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning scheduling and research and may involve students from several disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories.

**ENGR 482. Senior Project Design Laboratory II. 2 units.**

Prerequisite: ENGR 481 or consent of instructor.

Selection, development, and completion of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning scheduling and research and may involve students from several disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories.

**ENGR 483. Senior Project Design Laboratory III. 2 units.**

Prerequisite: ENGR 482 or consent of instructor.

Continuation of ENGR 482. Completion of project by individuals or team typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research, and may involve students from several disciplines. Formulation of outline, literature review, and project schedule. 2 laboratories.

**ENGR 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**ENGR 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**ENGR 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**ENGR 500. Individual Study. 2-4 units.**

Prerequisite: Graduate standing and consent of Program Director.

Advanced study planned and completed under the direction of faculty. Open to graduate students who have demonstrated the ability to do independent work. Total credit limited to 8 units.

**ENGR 551. Advanced Topics in Bioengineering. 4 units.**

Prerequisite: ENGR 450 or consent of instructor.

Current topic in bioengineering research/application in detail, including medical applications and industrial applications. Takes advantage of capabilities of resident or visiting faculty. Total credit limited to 16 units. See The Schedule of Classes for topic selected. 4 lectures.

**ENGR 563. Graduate Seminar. 2 units.**

Prerequisite: Graduate standing or consent of instructor.

Selected topics of interest to engineering and other graduate students. Open to graduate students and selected seniors. A forum to share information about research and research tools; an opportunity to discuss topics of interest with professionals in the field, academics, and other graduate students. The Schedule of Classes will list topic selected. Total credit limited to 4 units. 1 seminar, 1 laboratory.

**ENGR 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**ENGR 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**ENGR 581. Biochemical Engineering I. 4 units.**

Prerequisite: MCRO 221 and CHEM 312.

Fundamentals of Biotechnology. Types of microorganisms and their structure. Stoichiometric and thermodynamic principles for microbial growth and metabolism. Material and energy balances for aerobic and anaerobic growth and bioreactor design. Kinetics of enzyme catalyzed reactions. 3 seminars, 1 laboratory. Crosslisted as ENGR/ENVE 581.

**ENGR 582. Biochemical Engineering II. 4 units.**

Prerequisite: ENGR/ENVE 581 or consent of instructor.

Kinetics of growth, product formation and cell death. Continuous culture. Cell recycle and immobilization. Air sterilization. Transport processes in bioreactors. Scale-up of bioprocesses. Biochemical processes. Biocatalysis. Recombinant DNA and non-microbial processes. 3 seminars, 1 laboratory. Crosslisted as ENGR/ENVE 582.

**ENGR 583. Biochemical Engineering III. 4 units.**

Prerequisite: ENGR/ENVE 582 or consent of instructor.

Biochemical separations. Removal of insoluble products by centrifugation and filtration. Cell disruption. Primary product isolation: extraction, ultrafiltration, adsorption, ion exchange, gel electrophoresis, affinity chromatography. Final isolation: drying, crystallization. Molecular tools and biosensors for assay of biological materials. 3 seminars, 1 laboratory. Crosslisted as ENGR/ENVE 583.

**ENGR 591. Thesis Project Design Laboratory. 2 units.**

Prerequisite: Graduate standing.

Selection and development of project, by individuals or team, typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research. Formulation of outline, literature review, and project schedule. 2 laboratories.

**ENGR 592. Thesis Project Design Laboratory. 2 units.**

Prerequisite: ENGR 591 or consent of instructor.

Continuation of ENGR 591. Completion of project by individuals or team which is typical of problems graduates must solve in their fields of employment or applied research. Project may involve, but is not limited to, physical modeling and testing of integrated design projects, costs, planning, scheduling and research. Formulation of outline, literature review, and project schedule. 2 laboratories.

**ENGR 593. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**ENGR 594. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**ENGR 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only.

**ENGR 596. Industry Sponsored Project Experience. 1-9 units.**

Prerequisite: Graduate standing.

Designed for MS students who are performing a work-for-others research project that requires a Non-disclosure Agreement. Students who qualify will be required file a detailed, supervised report and undergo an examination on the work performed.

**ENGR 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing.

Each individual or group will select, with faculty guidance and approval, a topic for independent research or investigation resulting in a thesis or project to be used to satisfy the degree requirement. An appropriate experimental or analytical thesis or project may be accepted.

## English (ENGL)

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### English Courses

**ENGL 102. Basic Writing II. 4 units.**

CR/NC

Instruction in the writing process. Practice in the strategies of writing, revising, and editing paragraphs and essays with attention paid to focus, support, and organization. Directed readings of exemplary prose. Not for baccalaureate credit. Credit/No Credit grading only. Repeatable. 4 lectures.

**ENGL 103. Writing and Rhetoric Tutorial. 1 unit.**

CR/NC

Concurrent: ENGL 133 or ENGL 134.

Directed, weekly practice in writing in a laboratory environment. Required of all students scoring below 147 on the English Placement Test (EPT). Students scoring below 147 must enroll in the Writing and Rhetoric Stretch Program and take ENGL 103 during the second quarter of the stretch class, concurrently with ENGL 133 or ENGL 134. Not for baccalaureate credit. Credit/No Credit grading only. 1 laboratory.

**ENGL 111. English Sentence Structure for ESL/EFL Students. 4 units.**

CR/NC

Prerequisite: Non-native English speakers who need to develop skill in writing English sentences.

Focus on the fundamentals of sentence patterns, sentence construction, and sentence combining within the context of the paragraph and story. Practice in writing a variety of effective sentences; practice in linking sentences in a unified paragraph controlled by a topic sentence. Not for baccalaureate credit. Credit/No Credit grading only. 4 lectures.

**ENGL 112. English Paragraph Development for ESL/EFL Students. 4 units.**

CR/NC

Focus on the fundamentals of paragraph development within the context of the essay and story. Writing paragraphs with strong topic sentences that control paragraph unity; linking paragraphs for a unified essay through transitions and the control of the thesis statement. Not for baccalaureate credit. Credit/No Credit grading only. 4 lectures.

**ENGL 113. Essay Writing/ESL. 4 units.**

CR/NC

Prerequisite: ENGL 111 or ENGL 112, or consent of instructor.

Practice in essay writing with special attention paid to the writing process. Focus on using details and examples for effective development. Review of grammar problems specific to ESL students. Journal writing to enhance fluency. Directed readings of essays and fiction. Not for baccalaureate credit. Credit/No Credit grading only. 4 lectures.

**ENGL 115. Graduation Writing Requirement Preparation. 4 units.**

CR/NC

Prerequisite: At least two unsuccessful attempts at the GWR.

Writing practice of extemporaneous expository and argumentative essays under time pressure. Discussion and application of rhetorical and grammatical principles through critical reading of student and professional essays. Satisfactory completion of the course fulfills the Graduation Writing Requirement. Not for baccalaureate credit. Credit/No Credit grading only. 4 lectures.

**ENGL 133. Writing & Rhetoric for English as a Second Language Students. 4 units.**

GE Area A1

Prerequisite: ENGL 111, ENGL 112, and ENGL 113, or satisfactory score on the English Placement Test, or consent of instructor.

Rhetorical principles and tactics applied to written work. Writing as a recursive process that leads to greater organizational coherency, stylistic complexity, and rhetorical awareness with an emphasis on grammatical elements appropriate for English as a Second Language students. 4 lectures. Fulfills GE A1.

**ENGL 134. Writing and Rhetoric. 4 units.**

GE Area A1

Prerequisite: Satisfactory score on the English Placement Test.

Rhetorical principles and tactics applied to written work. Writing as a recursive process that leads to greater organizational coherency, stylistic complexity, and rhetorical awareness. 4 lectures. Fulfills GE A1.

**ENGL 145. Reasoning, Argumentation, and Writing. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor. Recommended: Completion of GE Area A2.

The principles of reasoning in argumentation. Examination of rhetorical principles and responsible rhetorical behavior. Application of these principles to written and oral communications. Effective use of research methods and sources. 4 lectures. Crosslisted as COMS/ENGL/HNRS 145. Fulfills GE A3.

**ENGL 148. Reasoning, Argumentation and Professional Writing. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor. Recommended: Completion of GE Area A2.

The principles of reasoning in professional writing. Discussion and application of rhetorical principles, both oral and written, in professional environments. Study of methods, resources and common formats used in corporate or research writing. 4 lectures. Crosslisted as ENGL/HNRS 148. Fulfills GE A3.

**ENGL 149. Technical Writing for Engineers. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor; for Engineering students only. Recommended: Completion of GE Area A2.

The principles of technical writing. Discussion and application of rhetorical principles in technical environments. Study of methods, resources and common formats used in corporate or research writing. 4 lectures. Crosslisted as ENGL/HNRS 149. Fulfills GE A3.

**ENGL 150. Writing Tutorial. 1 unit.**

CR/NC

Prerequisite: Completion of GE Area A1 and consent of instructor.

Guided discussion and practice of writing strategies for students seeking support for writing-related coursework and/or the GWR. Weekly, individualized and group sessions with a peer writing consultant offering feedback based on the audience, purpose, and context of a writing task. Credit/No Credit only. Total credit limited to 4 units. 1 activity.

**ENGL 202. Introduction to Literary Studies. 4 units.**

Prerequisite: Completion of GE A1; for English majors only.

Introduction to literary genres, concepts, and terms. Emphasis on explication and interpretation, and on writing about literature. 4 lectures.

**ENGL 203. Core I: 450-1485. 4 units.**

Prerequisite: Completion of GE Area A, and ENGL 251; for English majors only.

Representative canonical and non-canonical readings in the literature of the period. Selections may include such readings as Beowulf, Chaucer, Dante, a mystery or morality play, the Pearl Poet and others, as chosen by the instructor. 4 lectures.

**ENGL 204. Core II: 1485-1660. 4 units.**

Corequisite: ENGL 203; for English majors only.

Representative canonical and non-canonical readings in the literature of the period. Selections may include such readings as Bradstreet, Donne, Milton, Shakespeare, Spenser, and others, as chosen by the instructor. 4 lectures.

**ENGL 205. Core III: 1660-1789. 4 units.**

Corequisite: ENGL 204; for English majors only.

Representative canonical and non-canonical readings in the literature of the period. Selections may include such readings as Defoe, Franklin, Pope, Swift, Wheatley, and others, as chosen by the instructor. 4 lectures.

**ENGL 210. New Media Technology. 4 units.**

CR/NC

An introduction to and application of new media software used for the production of online help, professional live technical presentations, and high-level technical document design, production and distribution. Credit/No Credit grading only. 4 lectures.

**ENGL 230. Masterworks of British Literature through the Eighteenth Century. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Covers a thousand years of British literature, from the eighth to the eighteenth century and may include such readings as Beowulf, The Canterbury Tales, Utopia, Othello, Paradise Lost, Oroonoko and Gulliver's Travels. 4 lectures. Fulfills GE C1.

**ENGL 231. Masterworks of British Literature from the Late 18th Century to the Present. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Broadly surveys Romantic, Victorian, Modern, and Contemporary British literature in an historical-cultural context. Investigates works from several genres and a variety of national and cultural voices. May include such writers as Wordsworth, Wollstonecraft, Dickens, G. Eliot, Wilde, Woolf, Yeats, and Gordimer. 4 lectures. Crosslisted as ENGL 231/HNRS 232. Fulfills GE C1.

**ENGL 240. The American Tradition in Literature. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

A broadly based survey of American literature, exploring the impact of various world cultures on the evolving definition of the American experience. Literary expression of movements that shape the American character over time, such as Puritanism, Transcendentalism, and Naturalism. 4 lectures. Fulfills GE C1.

**ENGL 251. Great Books I: Introduction to Classical Literature. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Examination of the ancient epics and classical literature of Mesopotamia, Greece, and Rome. May include such readings as The Epic of Gilgamesh, the Iliad, the Odyssey, Genesis, Exodus, Antigone, the Symposium, the Aeneid, and Marcus Aurelius's Meditations. 4 lectures. Crosslisted as ENGL/HNRS 251. Fulfills GE C1.



**ENGL 252. Great Books II: Medieval to Enlightenment Literature. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Examination of key works marking the transition from Mediterranean Classicism (c. 500 CE) to an emergent European tradition (c. 1800 CE). May include such readings as Augustine's Confessions, Song of Roland, Egil's Saga, the Consolation of Philosophy, The Romance of Tristan, the Inferno, Cellini's Autobiography, Utopia, Princess of Cleves, Candide, Discourse on Method, and Rousseau's Confessions. 4 lectures. Fulfills GE C1.

**ENGL 253. Great Books III: Romanticism to Modernism Literature. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Examination of key works marking the Romantic Revolution and the realist and modernist movements that followed in its wake. May include such readings as the poetry of Blake, Wordsworth, Eliot, Rimbaud, Plath, Ginsberg, and Stein; Notes from Underground, The Death of Ivan Ilych, The Metamorphosis and/or The Hunger Artist, Heart of Darkness, 'Sonny's Blues,' and Virginia Woolf's short fiction and essays. 4 lectures. Fulfills GE C1.

**ENGL 260. Children's Literature. 4 units.**

Prerequisite: Completion of GE Area A.

Analysis and evaluation of traditional literature, fantasy, realistic fiction, historical fiction, informational books, picture books, and poetry for children in multiple subject classroom grades K-6. Emphasis on multicultural texts. 4 lectures. Crosslisted as ENGL/LS 260.

**ENGL 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ENGL 290. Introduction to Linguistics. 4 units.**

Prerequisite: Completion of GE Area A.

Introduction to the nature of language; concepts and methods of linguistic science. 4 lectures.

**ENGL 301. Advanced Composition - ESL. 4 units.**

GWR

Prerequisite: Completion of GE Area A.

Writing and critical analysis of expository and argumentative papers. Emphasis on rhetorical, stylistic, and grammatical problems specific to non-native speakers. Critical reading of essays and/or fiction. Practice in revision and editing of papers. Journal writing to promote fluency. 4 lectures. Fulfills GWR.

**ENGL 302. Writing: Advanced Composition. 4 units.**

GWR

Prerequisite: Completion of GE Area A.

Writing and analysis of expository and argumentative papers at an advanced level. Special attention paid to issues of style and voice. Critical reading of models of effective writing. 4 lectures. Fulfills GWR.

**ENGL 303. Core IV: 1789-1861. 4 units.**

Corequisite: ENGL 205; for English majors only.

Representative canonical and non-canonical readings in the literature of the period. May include such authors as Austen, Emerson, Hawthorne, Keats, Wordsworth, and others, as chosen by the instructor. 4 lectures.

**ENGL 304. Core V: 1861-1914. 4 units.**

Corequisite: ENGL 303; for English majors only.

Representative canonical and non-canonical readings in the literature of the period. May include such authors as Arnold, Dickinson, James, Tennyson, Whitman, and others, as chosen by the instructor. 4 lecture.

**ENGL 305. Core VI: 1914 - Present. 4 units.**

Corequisite: ENGL 304; for English majors only.

Representative canonical and non-canonical readings in the literature of the period. May include such authors as Eliot, Faulkner, Morrison, Woolf, Yeats, and others, as chosen by the instructor. 4 lectures.

**ENGL 310. Corporate Communication. 4 units.**

GWR

Prerequisite: Completion of GE Area A. Recommended: Junior standing.

Instruction and practice in forms of communication characteristic of business and industry. 4 lectures. Fulfills GWR.

**ENGL 317. Technical Editing. 4 units.**

GWR

Prerequisite: Completion of GE Area A. Recommended: Junior standing.

Instruction and practice in editing skills commonly used in workplace settings. Includes practical instruction in copyediting, sentence level editing, and substantive editing for accuracy and consistency. Editing documents, illustrations, web pages for consistency and use. Application of grammar and punctuation. 4 lectures. Fulfills GWR.

**ENGL 319. Information Design and Production. 4 units.**

Prerequisite: ENGL 148 or ENGL 149, ENGL 210 or consent of instructor.

Mid-level presentation of the theory and practice involved with the production of technical documents. Focus on history, typography, information design principles, the effective integration of text and graphics, project management, and recent industry trends in software use. 4 lectures.

**ENGL 326. Literary Criticism. 4 units.**

GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Theory and practice of current and traditional literary criticism, including writing and revising critical statements based on current models. 4 lectures. Fulfills GWR.

**ENGL 330. British Literature in the Age of Belief: to 1485. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The historical development of medieval English literature through selected canonical and non-canonical works of various genres. Medieval authorship and textual practice, the relationship between gender and writing, and the forging of a national poetic identity. Interdisciplinary support material (artwork and music) illustrating key themes. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 331. British Literature in the Age of Discovery: 1485-1660. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The literary, historical, political, religious and scientific concerns of the Age of the Renaissance. May include such readings as More's Utopia, Spenser's Faerie Queene, Shakespeare's Othello, Donne's Songs and Sonnets, Milton's Paradise Lost. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 332. British Literature in the Age of Enlightenment: 1660-1798. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth exploration of the dominant themes and preoccupations of the Age of Enlightenment. Historical and cultural contexts of canonical and non-canonical literature emphasized to illustrate 18th century Britons' views of themselves and their changing world. May include such writers as Dryden, Behn, Defoe, Swift, Pope, and Johnson. 4 lectures. Fulfills GE C4 except for English majors. Crosslisted as ENGL/HNRS 332. Fulfills GWR for students with junior standing (90 units).

**ENGL 333. British Literature in the Age of Romanticism: 1798-1832. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth exploration of the literature of the British Romantic period. Cultural, historical, and philosophic contexts will also be examined in both canonical and non-canonical works. May include such writers as Blake, Wordsworth, Keats, and Wollstonecraft. 4 lectures. Fulfills GE C4 except for English majors. Crosslisted as ENGL/HNRS 333. Fulfills GWR for students with junior standing (90 units).

**ENGL 334. British Literature in the Age of Industrialism: 1832-1914. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth study of historical, philosophical, and literary reaction to the rise of the modern industrial state. Special focus on the literary response to the following: industry, democracy, class, art, and culture. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 335. British Literature in the Age of Modernism: 1914-Present. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth exploration of the dominant concerns and achievements of British literature from Modernism through Postmodernism. Historical and cultural contexts of canonical and non-canonical literature explored to illustrate 20th century Britain's reactions to the breakdown of traditional beliefs, the World Wars, the legacy of colonialism, the changing politics and problems of a multicultural nation. May include such writers as Conrad, Joyce, Woolf, Yeats, Heaney, Ishiguro, Walcott. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 338. Introduction to Shakespeare-London Study. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Shakespeare's works as texts, productions, and major historical, aesthetic and cultural touchstones. The author's intellectual and social influences on four centuries of theatre and his subsequent impact on literature and other arts in London. Attendance at play performances required. 3 lectures, 1 activity. Fulfills GE C4 except for English majors.

**ENGL 339. Introduction to Shakespeare. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Shakespeare's works as texts, productions and major historical, aesthetic and cultural touchstones. The author's intellectual and social influences on four centuries of theatre and his subsequent impact on literature and other arts. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 340. The Literary Sources of the American Character: 1600-1865. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The literature of the United States from its sources in the accounts of the early British and Spanish explorers to the works of the American Renaissance. The relationship between mainstream and marginalized voices in the American character. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 341. The Literary Sources of the American Character: 1865-1914. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Analysis of literary Realism and Naturalism in their cultural and historical contexts. May include such writers as Whitman, Dickinson, Twain, Chopin, James, Wharton, Dreiser, Norris, and Crane who are seen to accommodate the sense of danger, doubt, and disorder of the time. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 342. The Literary Sources of the American Character: 1914-1956. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The writers of the modern period and those of the early post-modern age, including writers marked by stylistic innovation and a willingness to challenge traditionally accepted standards. May include such writers as Hemingway, Fitzgerald, Stein, Hughes. 4 lectures. Crosslisted as ENGL/HNRS 342. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 343. Multiple Voices of Contemporary American Literature. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth study of American fiction, poetry, and drama written since 1956. How contemporary literature examines enduring American themes and breaks new ground with the inclusion of diverse voices. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units). Crosslisted as ENGL/HNRS 343.

**ENGL 345. Women Writers of the Twentieth Century. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth exploration of works of 20th century women authors within their historical and cultural contexts. Analysis of canonical and non-canonical writing by women of differing classes, races, ethnicities, and sexual preferences. Literary techniques through which texts reflect or challenge such cultural constructs as gender, identity, sexuality, motherhood, etc. The emergence of a female literary tradition. May include such writers as Woolf, Rich, Kingston, Yamamoto, Morrison, Cervantes. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units).

**ENGL 346. Ethnic American Literature. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Investigation of the primary issues, themes, and tropes of literature written in English by African-American, Asian-American, Native American, Hispanic and Jewish writers. Cultural and historical contexts explored to consider effects of marginalization on this literature, and its subsequent relation to the American canon. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units).

**ENGL 347. African American Literature. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The writings of African Americans from the end of the eighteenth century to the present. Individual works and literary trends among African Americans of various periods and contexts: intellectual, political, and cultural. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units). Crosslisted as ENGL/HNRS 347.

**ENGL 349. Gender in Twentieth Century Literature. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth study of issues related to male and female identity and the relations between men and women as depicted in twentieth-century fiction, poetry, non-fiction, and/or drama. How gender issues are created and viewed from different perspectives, such as social/economic class, ethnicity, and sexual orientation. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units).

**ENGL 350. The Modern Novel. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Readings in the modern novel in its historical and cultural context. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 351. Modern Poetry. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Modern poetry, considered in its historical and cultural context. The rise of experimental styles designed to reflect the disorder of the twentieth century - fragmentation, alienation, dislocation, and the absence of connections. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 352. Modern Drama. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Reading and analysis of world drama of the last 150 years, thereby enhancing student awareness of modern culture, history, ethics, politics, and the human condition. Design work, multi-media forms, art, music, and cinema as components or informing elements of the works under consideration. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 353. Drama in London. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Reading in drama of the Twentieth Century and/or earlier periods, exclusive of Shakespeare, with special emphasis on form and ideas. Attendance at play performances required. 3 lectures, 1 activity. Fulfills GE C4 except for English majors.

**ENGL 354. The Bible as Literature and in Literature and the Arts. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The most important and representative books of the Bible. Exposure to works based on the Bible in literature, painting, sculpture, architecture, music, and film. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 360. Literature for Adolescents. 4 units.**

Prerequisite: ENGL 230, ENGL 231, ENGL 240, ENGL 251, ENGL 252, or ENGL 253. Recommended: Junior standing.

Analysis and evaluation of young adult literature appropriate for classroom instruction in grades 6-12 with special attention to the relationship of young adult literature to popular culture and themes relevant to adolescents. Pedagogical approaches also explored. Twenty hours of fieldwork in secondary schools required. 3 lectures, 1 activity.

**ENGL 361. Reading Instruction for the Teaching of Young Adult Literature. 5 units.**

Prerequisite: Completion of GE Area A1 and GE Area C1; junior standing. Recommended: EDUC 300.

Analysis and evaluation of young adult literature appropriate for classroom instruction in grades 6-12. Special attention paid to metacognitive strategies of making sense of text with an emphasis on pedagogical approaches. Twenty hours of fieldwork in secondary schools required. Participation in public schools requires mandated fingerprint clearance. 4 lectures, 1 activity.

**ENGL 365. Complexities of Literacy in Literature and Non-fiction Text. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Cognitive elements of reading and writing processes decoding and encoding, construction of meaning, recognizing and using text conventions of different genres. Metacognitive strategies for making sense of text. Twenty hours of fieldwork in secondary schools required. 3 lectures, 1 activity.

**ENGL 368. Theory and Practice of Peer-to-Peer Writing Instruction. 4 units.**

Prerequisite: Junior standing; completion of GE C1 with a grade of 'B' or better, or consent of instructor.

Discussion and application of theories and practices central to writing center work, such as collaborative learning, the writing process, social dimensions of the peer/tutor relationship, and strategies for working with specific student populations including second-language writers and writers from across the disciplines. Required for those interested in becoming tutors in the University Writing and Rhetoric Center and/or new teaching assistants in English. 3 lectures, 1 activity.

**ENGL 370. World Cinema. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Major works of international cinema with emphasis on critical interpretation, on the ways film communicates visually and aurally, and on the historical and cultural contexts in which films are created. 3 lectures, 1 laboratory. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 371. Film Styles and Genres. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Major films within particular cinematic genres or styles, with emphasis on critical interpretation, aesthetic appreciation, and the films' historical and cultural contexts. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 laboratory. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 372. Film Directors. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Films of one or more major film directors, with emphasis on critical interpretation, aesthetic appreciation, and the films' historical and cultural contexts. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 laboratory. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**ENGL 380. Literary Themes. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Literature selected according to a particular theme. Emphasis on critical interpretation, aesthetic appreciation, and historical and cultural contexts. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units). Crosslisted as ENGL/HNRS 380.

**ENGL 381. Diversity in Twentieth-Century American Literature. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Literature selected according to a particular theme, with a focus on issues of ethnicity and gender. Emphasis on critical interpretation, aesthetic appreciation, and historical and cultural contexts. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units).

**ENGL 382. LGBT Literature and Media. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Representations of lesbian, gay, bisexual, transgendered (LGBT) individuals and issues, late 19th century to the present. Topics include the closet, homophobia, coming out, AIDS, same-sex marriage, intersections of sexuality, race, class, gender identity. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units).

**ENGL 386. Creative Nonfiction. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Writing creative nonfiction (the memoir, the nature essay, the personal narrative, cultural criticism, literary journalism) by adding composition skills of fictional and poetic techniques. A publication workshop. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for English majors.

**ENGL 387. Fiction Writing. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

How to write and read fiction. Exploring and understanding the elements of fiction writing, employing models by established writers. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for English majors.

**ENGL 388. Poetry Writing. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

How to write and read poetry. Exploring a variety of formal options, employing model poems by established writers and identifying and enhancing what is best in poetry written in class. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for English majors.

**ENGL 389. Creative Writing: Drama. 4 units.**

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Instruction and practice in writing, revising, and evaluating drama. Total credit limited to 8 units. 4 lectures.

**ENGL 390. The Linguistic Structure of Modern English. 4 units.**

Prerequisite: Completion of GE Area A.

Linguistic analysis of the English language, including phonology, morphology, syntax, and style and dialect variation. 4 lectures.

**ENGL 391. Topics in Applied Linguistics. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Topics in applied linguistics including sociolinguistics, first and second language acquisition, literacy, bilingualism, and dialectology. Applications to teaching the English language. 4 lectures.

**ENGL 392. English Grammar for Writers and Teachers. 4 units.**

Prerequisite: Completion of GE Area A.

Linguistics-based study of standard English word categories, sentence parts and types, punctuation, and the role of sentence structure in text style and coherence; consideration of grammar standards in social context. Preparation for professional writing, editing, and teaching standard grammar. 4 lectures.

**ENGL 395. History of the English Language. 4 units.**

Prerequisite: Completion of GE Area A.

Linguistic approach to the history of the English language: evolution of phonology, morphology, lexicon, syntax, and semantics within the changing cultural context of the last 2000 years. 4 lectures.

**ENGL 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of the department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units.

**ENGL 408. Internship. 2-12 units.**

CR/NC

Prerequisite: Consent of instructor.

Advanced study and part-time work experience; current innovation, practices, and problems in administration, supervision, and organization. Must be able to do independent work in career field. Weekly reports and evaluation by work supervisor required. Total credit limited to 12 units. Credit/No Credit grading only.

**ENGL 411. New Media Arts I. 4 units.**

Prerequisite: Completion of GE Area A; Junior standing.

Advanced-level presentation of new media theory, design and practice. Topics covered include, but are not limited to, interactivity theory, user-centered system design, cognitive psychology, media analysis, and basic web design theory. Total credit limited to 8 units. 4 lectures. Crosslisted as ENGL/HNRS 411.

**ENGL 412. New Media Arts II. 4 units.**

Prerequisite: ENGL 411 or consent of instructor.

Advanced level of work with the primary technologies and design/critique theories currently at use in the professional creation of new media works. Lectures and readings expand upon material presented in ENGL 411. 4 lectures. Crosslisted as ENGL/HNRS 412.

**ENGL 416. New Media Study. 4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Theoretical, critical, or applied study of new electronic communication media. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 seminars.

**ENGL 418. Technical Communication Practicum. 2-4 units.**

CR/NC

Prerequisite: Senior standing and at least two of the following: ENGL 148 or ENGL 149, ENGL 210, ENGL 310, ENGL 317, ENGL 408, ENGL 411, ENGL 412.

Supervised work experience in government, corporate, or volunteer setting, as approved by department chair. Placement may be student or employer initiated or through Cooperative Education. Proposal, progress reports, and final report. Total credit limited to 8 units, with a maximum of 4 units per quarter. Credit/No Credit grading only.

**ENGL 419. Multimedia Projects. 2 units.**

CR/NC

Prerequisite: Junior standing and consent of instructor.

Supervised independent projects creating new media works for academic, professional, or popular audiences. Students are paired with teachers, business people, service organizations, or others who need new media projects designed for specific uses. Total credit limited to 8 units. Credit/No Credit grading only.



**ENGL 420. Client-Based Technical Communication. 4 units.**

Prerequisite: Junior standing and ENGL 317 or ENGL 319 or consent of instructor.

Capstone course for the technical communication program. Students work for one or more commercial client(s) to produce a set of professional print and/or electronic documents. 4 lectures.

**ENGL 424. Teaching English in Secondary Schools. 5 units.**

Prerequisite: Completion of GE Area A, senior or graduate standing and admission to the teacher education program, or consent of instructor.

Research-based methods of teaching English in secondary schools, with emphasis on practical approaches to teaching grammar/mechanics and the writing process in a literature-based classroom. Attention to lesson and unit planning and integration of state standards and technology. 5 lectures.

**ENGL 430. Chaucer. 4 units.**

Prerequisite: Junior standing and two of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305. Recommended: ENGL 203.

Selected readings from *Canterbury Tales* and Chaucer's other major poems. 4 seminars.

**ENGL 431. Shakespeare. 4 units.**

Prerequisite: Junior standing and two of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305. Recommended: ENGL 204.

Representative comedies, tragedies, and histories. 4 seminars.

**ENGL 432. Milton. 4 units.**

Prerequisite: Junior standing and two of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305. Recommended: ENGL 204.

*Paradise Lost*, *Paradise Regained*, and *Samson Agonistes*, with some attention to the minor poems. 4 seminars.

**ENGL 439. Significant British Writers. 4 units.**

Prerequisite: Junior standing and two of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305. Recommended: English Major CORE class in the relevant period.

Selected British writers, as individual writers or in groups. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**ENGL 449. Significant American Writers. 4 units.**

Prerequisite: Junior standing and two of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305. Recommended: English Major CORE class in the relevant period.

Selected American writers, as individual writers or in groups. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**ENGL 459. Significant World Writers. 4 units.**

Prerequisite: Junior standing and two of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305. Recommended: English Major CORE class in the relevant period.

Selected world writers as individual writers or in groups. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**ENGL 460. Senior Project Portfolio. 4 units.**

Prerequisite: Senior standing; completion of the GWR; four of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305; and three of the following: ENGL 430, ENGL 431, ENGL 432, ENGL 439, ENGL 449, ENGL 459.

Creation of a portfolio of original and substantially revised work. Significant research, revision, and editing in a workshop setting. 3 lectures and portfolio project.

**ENGL 461. Senior Project. 4 units.**

Prerequisite: Senior standing; completion of the GWR; four of the following: ENGL 203, ENGL 204, ENGL 205, ENGL 303, ENGL 304, ENGL 305; and three of the following: ENGL 430, ENGL 431, ENGL 432, ENGL 439, ENGL 449, ENGL 459.

Capstone course which must be taken during the last two quarters of the student's undergraduate career.

**ENGL 468. The Rhetoric of the Image. 4 units.**

Prerequisite: Completion of GE Areas A and C4; junior standing.

The complicated and dependent relationship between still and moving images and written texts. How images and print communicate rhetorically with people as readers, viewers, and consumers. 4 lectures.

**ENGL 469. Women's Rhetoric(s): Definitions, Contexts, Issues. 4 units.**

Prerequisite: Completion of GE Areas A and C4; junior standing.

Theoretical questions about what constitutes women's rhetoric(s), and how women have used and accommodated traditional methods of persuasion to argue for and enact a changed world. 4 lectures.

**ENGL 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ENGL 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 12 units. Credit/No Credit grading only.

**ENGL 486. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 8 units; total credit limited to 12 units. Credit/No Credit grading only.

**ENGL 487. Advanced Creative Writing: Fiction. 4 units.**

Prerequisite: ENGL 387.

Instruction and practice in advanced writing, revising and evaluating of fiction. Total credit limited to 8 units. 4 lectures.

**ENGL 488. Advanced Creative Writing: Poetry. 4 units.**

Prerequisite: ENGL 388.

Instruction and practice in advanced writing, revising and evaluating of poetry. Total credit limited to 8 units. 4 lectures.

**ENGL 489. Advanced Creative Writing: Drama. 4 units.**

Prerequisite: ENGL 389.

Instruction and practice in advanced writing, revising and evaluating of drama. Total credit limited to 8 units. 4 lectures.

**ENGL 495. Topics in Applied Language Study. 4 units.**

Prerequisite: ENGL 290 or ENGL 390.

Application of linguistics to human communications, human relations, and language policy and planning, or literature. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**ENGL 497. Theories of Language Learning and Teaching. 4 units.**

Prerequisite: Two of the following: ENGL 290, ENGL 390, ENGL 391, ENGL 395, ENGL 495.

Theories of first and second language learning and acquisition in the context of teaching English as a second language/dialect. 4 lectures.

**ENGL 498. Approaches to Teaching English as a Second Language/Dialect. 4 units.**

Prerequisite: ENGL 497.

Approaches to teaching English as a second language. Attention to materials development and testing. 4 lectures.

**ENGL 499. Practicum in Teaching English as a Second Language/Dialect. 2 units.**

CR/NC

Prerequisite: ENGL 498 or consent of instructor.

Practical experience in the English as a second language classroom under supervision of a cooperating teacher. Teaching materials development and curriculum design. Credit/No Credit grading only. 1 seminar and supervised work.

**ENGL 501. Techniques Literary Research. 4 units.**

Prerequisite: Graduate standing in English.

Purposes and methods of literary research in literature. Acquaintance with printed and on-line materials of research and practical experience in collecting material, weighing evidence, reaching conclusions, and writing scholarly articles. Analysis of dissemination of scholarly information. Discussion of ethics of scholarship. 4 seminars.

**ENGL 502. Seminar in Critical Analysis. 4 units.**

Prerequisite: Graduate standing in English.

Basic approaches used by critics. Multiple points of view. Application to literary works. Class Schedule will list topic selected. Total credit limited to 8 units. 4 seminars.

**ENGL 503. Graduate Introduction to Linguistics. 4 units.**

Prerequisite: Graduate standing in English.

Introduction to linguistics for graduate students. Phonology, morphology lexicon, syntax, and variation within language; application of linguistics to real-world issues. 4 seminars.

**ENGL 504. Seminar in English Linguistics. 4 units.**

Prerequisite: Graduate standing in English and one of the following: ENGL 290, ENGL 390, or ENGL 503, or consent of instructor.

Examination of varying theoretical approaches to the structure of English, or applications of linguistic methods in the study of literature, dialectology, language acquisition, literacy, bilingualism, or discourse analysis. Class Schedule will list topic selected. Total credit limited to 12 units. 4 seminars.

**ENGL 505. Composition Theory. 4 units.**

Prerequisite: Graduate standing in English.

Special problems in composition. Direct application of composition and rhetorical theory to composition instruction. 4 seminars.

**ENGL 506. Pedagogical Approaches to Composition. 4 units.**

Prerequisite: Graduate standing in English and ENGL 505, or consent of instructor. Concurrent: Teaching of ENGL 134.

Practical problems in the teaching of English composition. Application and study of practical approaches. Discussion of classroom organization and management. Discussion of research into the nature and resolution of student writing problems. Required of all new teaching assistants in English. 4 seminars.

**ENGL 510. Seminar in Authors. 4 units.**

Prerequisite: Graduate standing in English. Recommended: ENGL 501.

Intensive study of major British and American literary figures, singly, doubly or in small groups. Written and oral reports of individual investigation. Class Schedule will list topic selected. Total credit limited to 16 units. 4 seminars.

**ENGL 511. Seminar in American Literary Periods. 4 units.**

Prerequisite: Graduate standing in English. Recommended: ENGL 501.

American periods. Written and oral reports of individual investigation. The Schedule of Classes will list topic selected. Total credit limited to 20 units. 4 seminars.

**ENGL 512. British Literary Periods. 4 units.**

Prerequisite: Graduate standing in English. Recommended: ENGL 501.

British periods. Written and oral reports of individual investigation. Class Schedule will list topic selected. Total credit limited to 20 units. 4 seminars.

**ENGL 513. Seminar in Special Topics. 4 units.**

Prerequisite: Graduate standing in English. Recommended: ENGL 501.

Themes and ideas in language and literature not ordinarily covered in the routine graduate course offerings. Written and oral reports of individual investigation. Class Schedule will list topic selected. Total credit limited to 16 units. 4 seminars.

**ENGL 515. Apprenticeship in Teaching Literature, Composition, or Linguistics at College Level. 2 units.**

CR/NC

Prerequisite: Graduate standing in English and 8 units of successful graduate work.

Supervised experience in planning, teaching, and evaluating a 100-, 200- or 300-level linguistics, composition, or literature class taught by English faculty member. Planning, selecting texts, conferring with students, discussing and constructing assignments, lecturing, leading small group discussions. Credit/No Credit grading only. Total credit limited to 8 units.

**ENGL 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 4 lectures.

**ENGL 587. Graduate Seminar in Creative Writing: Fiction. 4 units.**

Prerequisite: Graduate standing in English and ENGL 487, or consent of instructor.

Graduate instruction in writing, revising, and evaluating fiction. Total credit limited to 8 units. 4 seminars.

**ENGL 588. Graduate Seminar in Creative Writing: Poetry. 4 units.**

Prerequisite: Graduate standing in English and ENGL 488, or consent of instructor.

Graduate instruction in writing, revising, and evaluating poetry. Total credit limited to 8 units. 4 seminars.

**ENGL 590. Directed Study. 1-4 units.**

Prerequisite: Graduate standing in English and the permission of the graduate advisor.

Supervised independent or group study of special problems in selected areas of language, composition, or literature. Total credit limited to 12 units.

## **Environmental Design (EDES)**

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### **Environmental Design Courses**

**EDES 101. Introduction to Architecture and Environmental Design. 2 units.**

Familiarization with the professional fields of architecture, landscape architecture, structural engineering, construction, and city planning. Introduction to the college's programs as they relate to individual aptitudes. The design process. Visiting speakers. 2 lectures.

**EDES 333. Professional Presentations. 4 units.**

Prerequisite: Third-year standing or permission of instructor.

Skills and tools for employment acquisition or graduate school admissions. Individual resume design and production. Documentation of personal, professional and academic experience via written, oral and image based systems. Employment interview dynamics. Electronic and hardcopy portfolio production. Internet marketing. 1 lecture, 3 activities.

**EDES 350. The Global Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary investigation of how human activities impact the Earth's environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/ historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 4 lectures. Crosslisted as AG/EDES/ENGR/ HUM/SCM/UNIV 350. Fulfills GE Area F.

**EDES 406. Sustainable Environments. 4 units.**

Prerequisite: Fourth year or graduate standing, or consent of instructor.

Collaboration of interdisciplinary faculty and guest speakers/panelists. Introduction, illustration and analysis of concepts and principles for sustainability to be used in all aspects of environmental design. Integration and application of knowledge of human and natural systems with environmental, social and economic concerns, from a global-to-local perspective. 4 lectures.

**EDES 408. Implementing Sustainable Principles. 4 units.**

Prerequisite: EDES 406 or consent of instructor.

A primarily project-based course, intended to aid students who wish to collaborate with the purpose of implementing sustainability principles by developing tools, process or designs, for community-based projects and proposals at various scales of planning, architecture and design of the human environment to address social, environmental and economic issues. 4 lectures.

**EDES 410. Advanced Implementation of Sustainable Principles. 4 units.**

Prerequisite: EDES 408.

Advanced continuation of community-based projects defined and initiated in EDES 408. Ongoing projects, individual and group, address variable scales of planning, architecture, and environmental design, with required completion at the end of the course. 2 seminars and supervised work.

**EDES 420. Historic Preservation and Adaptive Reuse in the Built Environment. 4 units.**

Prerequisite: Any GE Area D course or consent of instructor.

Historic preservation, restoration, and rehabilitation issues in the built environment. Focus on the process and issues of preserving cultural heritage through preserving environmental artifacts (i.e., structure and landscape). The importance of preserving historical districts, buildings and landscapes as well as techniques for accomplishing preservation goals within the existing regulatory environments. Total credit limited to 8 units. 2 lectures, 2 seminars.

**EDES 430. Collaborative Process. 3 units.**

Prerequisite: Minimum junior standing or consent of instructor.

A comprehensive set of tools and practices that allow for high performance, interdisciplinary collaborative teams to focus on extraordinary outcomes at each step of project development, including planning, design, bidding, permitting, construction and management phases. 3 activities. Crosslisted as CM/EDES 430.

## **Environmental Engineering (ENVE)**

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## Environmental Engineering Courses

### **ENVE 111. Introduction to the Environmental Engineering**

**Profession. 1 unit.**

CR/NC

Introduction to the Environmental Engineering Program including course planning, opportunities for global and regional problems such as water quality, waste management, and sustainability. Credit/No Credit grading only. 1 lecture.

### **ENVE 264. Environmental Fluid Mechanics. 4 units.**

Prerequisite: MATH 241, PHYS 132, and ME 211.

Theory and application of fluid statics and fluid dynamics to environmental problems in air and water systems. Fluid properties, pressure within stationary and moving systems, fluid momentum, pipe and channel flow including Bernoulli's Equation and friction effects, flow measurement systems. 4 lectures.

### **ENVE 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

### **ENVE 304. Process Thermodynamics. 3 units.**

Corequisite: CHEM 125 or CHEM 129; ENVE 331.

First and second laws of thermodynamics, properties of gases, liquids and mixtures, vapor-liquid equilibria, solubility and absorption, equilibrium in chemical reactions, thermodynamic applications in environmental engineering. 3 lectures.

### **ENVE 309. Noise and Vibration Control. 3 units.**

Prerequisite: MATH 241 and PHYS 132. Corequisite: ENGL 149.

Impact of noise and methods for noise reduction in industrial environments. Behavior of sound waves, selection of instrumentation, practical measurements, criteria for noise and vibration control. Laboratory and field measurements to investigate the basic principles of sound propagation and control. Assessment of noise produced by transportation and other engineering facilities. 2 lectures, 1 laboratory.

### **ENVE 324. Introduction to Air Pollution. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Causes and effects of air pollution on the individual, the community and industry. Application of mathematics and chemistry to solve air pollution problems. For non-majors. 4 lectures. Fulfills GE Area F.

### **ENVE 325. Air Quality Engineering. 4 units.**

Prerequisite: CHEM 128 and CSC 231. Recommended: ENVE 264.

Causes and effects of air pollution on individual, regional, and global scales including meteorology, pollutant chemistry, global and regional transport, health impacts, regulations, air pollution control technology, and global climate change. Engineering principles to understand, model, and predict air quality. 4 lectures.

### **ENVE 330. Environmental Quality Control. 4 units.**

Prerequisite: Completion of GE Area B and junior standing.

Application of scientific and engineering principles to control the development and use of air, water and land resources. Control of pollution of the environment. Disposal of wastes. Administrative and legal aspects. For non-Engineering majors. 4 lectures.

### **ENVE 331. Introduction to Environmental Engineering. 4 units.**

Prerequisite: CHEM 125 or CHEM 128, MATH 242 or MATH 244 (or concurrent).

Description and quantification of water and air quality characteristics important for water and wastewater treatment and air pollution control. Fundamentals of kinetics, reactor configurations, toxicity and dose-response relationship. Regulations governing ambient pollutant levels and discharges. Introduction to the modeling of pollutant fate and transport. Overview of solid waste management and global environmental issues. 4 lectures.

### **ENVE 400. Special Problems. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

### **ENVE 405. Environmental Engineering Research. 1-2 units.**

Prerequisite: CHEM 124 or CHEM 127 and consent of instructor. Recommended: Prior or concurrent enrollment in ENVE 438 and ENVE 434.

Participation in environmental engineering research projects with emphasis on professional safety procedures for lab and field work and data quality assurance/quality control. Research projects focus on developing technologies or techniques that improve the sustainability of environmental engineering infrastructure. Total credit limited to 8 units. 1 laboratory.

### **ENVE 411. Air Pollution Control. 3 units.**

Prerequisite: ENVE 304 or ME 302; ENVE 264 or ME 341, ENVE 325; and ENVE 331.

Theory, principles, and practices related to the control of particulate emissions. Mechanical separations. Cost and design of control systems. 3 lectures.

### **ENVE 421. Mass Transfer Operations. 4 units.**

Prerequisite: ENVE 325, ENVE 331, ENVE 304 or ME 302, ENVE 264 or ME 341.

Theory of mass transfer principles applied to environmental problems. Diffusion and dispersion modeling of contaminant transport. Design principles of scrubbers, absorbers, and membrane systems for air and water pollution control. 4 lectures.

### **ENVE 426. Air Quality Measurements. 3 units.**

Prerequisite: ENVE 325, CHEM 212/312, ENVE 264 or ME 341, STAT 312, and ENGL 149.

Planning and conducting air quality measurements in the atmosphere, indoors and at the source. Topics include quality control, calibration, and instrument operation for particulate matter, gas and meteorological measurements. 2 lectures, 1 laboratory.

### **ENVE 434. Water Chemistry and Water Quality Measurements. 4 units.**

Prerequisites: CHEM 125 or CHEM 129, ENVE 330 or ENVE 331.

Aquatic environmental chemistry and water quality measurements. Equilibrium chemistry, carbonate systems, redox reactions, and electrochemistry. Laboratories include topics such as measurement of suspended solids, turbidity, alkalinity, BOD, and coliform detection. Quality analysis and control. 3 lectures, 1 laboratory.

**ENVE 436. Introduction to Solid and Hazardous Waste Management. 4 units.**

Prerequisite: ENVE 325 and ENVE 331.

Overview of solid and hazardous waste generation, storage, transport, treatment, and remediation. Principles of toxicology, unit operations and processes for the treatment, reduction, and remediation of wastes. Ultimate disposal including incineration and secure landfills. 4 lectures.

**ENVE 438. Water and Wastewater Treatment Design. 3 units.**

Prerequisite: ENVE 331 and ME 341 or ENVE 264.

Theory and design of facilities for physical and chemical treatment of water and wastewater, biological treatment of wastewater, and treatment and disposal of sludge. 3 lectures.

**ENVE 439. Solid Waste Management. 3 units.**

Prerequisite: ENVE 330 or ENVE 331.

Chemical and physical properties of municipal and industrial refuse. Landfill disposal, incineration, composting. Industrial and commercial solid waste disposal problems and treatment methods. Pyrolysis. Salvage and recycle operations. Economics of disposal methods. Interrelationship between water quality and landfill operations. 3 lectures.

**ENVE 443. Bioremediation Engineering I. 4 units.**

Prerequisite: ENVE 331.

State-of-the-art bioremediation technologies for soil, groundwater and contaminated air stream remediation and pollution prevention. Introduction to engineering design combining biogenetics, reactor configuration, and basic biological and engineering principles. Various in-situ and ex-situ technologies. 3 lectures, 1 laboratory.

**ENVE 450. Industrial Pollution Prevention. 4 units.**

Prerequisite: ENVE 331.

Theory and case studies of innovative industrial waste minimization and resource conservation through principles of pollution prevention. Life-cycle assessment, pollution prevention, economic analysis, and sustainable designs. 3 lectures, 1 laboratory.

**ENVE 455. Environmental Health and Safety. 4 units.**

Prerequisite: ENVE 331.

Physical, chemical and biological hazards associated with industrial processes. Toxicology. Safety analysis and design. Causes and prevention of occupational and environmental hazards. Development and implementation of industrial hygiene programs. 4 lectures.

**ENVE 466. Senior Project Design Laboratory I. 2 units.**

Prerequisite: Senior standing and consent of instructor.

Capstone team project on a complex, integrated design problem typical of the environmental engineering profession. Formal reports and presentations are prepared. Non-technical issues addressed: ethics, teamwork, leadership, communication, and professional practice. 2 laboratories.

**ENVE 467. Senior Project Design Laboratory II. 2 units.**

Prerequisite: ENVE 466.

Continuation of ENVE 466. Continuation of capstone project by individuals or teams with submission of final reports and presentations 2 laboratories.

**ENVE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**ENVE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**ENVE 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**ENVE 500. Individual Study. 1-3 units.**

Prerequisite: Graduate standing and consent of department chair.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Total credit limited to 4 units.

**ENVE 516. Advanced Environmental Modeling. 4 units.**

Prerequisite: CE 251 or CSC 231, or graduate standing/consent of instructor.

Application, adaptation, and limitations of advanced computer models in environmental engineering. The Schedule of Classes will list topics selected. Total credit limited to 8 units. 4 lectures.

**ENVE 535. Physico-Chemical Water and Wastewater Treatment. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Physical and chemical processes used in potable water treatment and advanced wastewater treatment. Coagulation, flocculation, sedimentation, filtration, membrane separation, disinfection, and absorption. Wastewater recycling regulations. Integration of treatment processes. 4 lectures.

**ENVE 536. Biological Wastewater Treatment Processes Engineering. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Fundamentals of biological wastewater treatment. Suspended and attached growth bioreactors. Activated sludge, biotower, and anaerobic process design. Biological nutrient removal. 4 lectures.

**ENVE 537. Decentralized Wastewater Management. 4 units.**

Prerequisite: Senior or graduate standing.

Design and management of decentralized wastewater treatment systems. Septic tanks, aerobic nutrient removal systems, ponds, constructed wetlands, and improved latrines; surface and subsurface effluent recycling or disposal; and septage management. 4 lectures.



**ENVE 542. Sustainable Environmental Engineering. 4 units.**

Prerequisite: Graduate or senior standing or consent of instructor.

Critical analysis of environmental engineering practices such as solid waste management, recycling, and wastewater treatment from the viewpoint of energy efficiency, lifecycle cost, and sustainability. Both laboratory experiments and computer models to assess sustainability. 3 lectures, 1 laboratory.

**ENVE 551. Environmental Unit Operations. 4 units.**

Prerequisite: ENVE 421 and graduate standing or consent of instructor.

In-depth laboratory study of unit operations and processes used in environmental engineering. Performance tests on laboratory scale equipment. Computer simulations. 2 lectures, 2 laboratories.

**ENVE 552. Environmental Problems of the Semiconductor Industry. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Introduction to the environmental, health, and safety issues of the semiconductor industry. Semiconductor manufacturing processes and their environmental emissions. Engineering and management options for pollution control and prevention. Management of environmental systems in the semiconductor industry. 4 lectures.

**ENVE 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 seminars.

**ENVE 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**ENVE 581. Biochemical Engineering I. 4 units.**

Prerequisite: MCRO 221 and CHEM 312.

Fundamentals of Biotechnology. Types of microorganisms and their structure. Stoichiometric and thermodynamic principles for microbial growth and metabolism. Material and energy balances for aerobic and anaerobic growth and bioreactor design. Kinetics of enzyme catalyzed reactions. 3 seminars, 1 laboratory. Crosslisted as ENGR/ENVE 581.

**ENVE 582. Biochemical Engineering II. 4 units.**

Prerequisite: ENGR/ENVE 581 or consent of instructor.

Kinetics of growth, product formation and cell death. Continuous culture. Cell recycle and immobilization. Air sterilization. Transport processes in bioreactors. Scale-up of bioprocesses. Biochemical processes. Biocatalysis. Recombinant DNA and non-microbial processes. 3 seminars, 1 laboratory. Crosslisted as ENGR/ENVE 582.

**ENVE 583. Biochemical Engineering III. 4 units.**

Prerequisite: ENGR/ENVE 582 or consent of instructor.

Biochemical separations. Removal of insoluble products by centrifugation and filtration. Cell disruption. Primary product isolation: extraction, ultrafiltration, adsorption, ion exchange, gel electrophoresis, affinity chromatography. Final isolation: drying, crystallization. Molecular tools and biosensors for assay of biological materials. 3 seminars, 1 laboratory. Crosslisted as ENGR/ENVE 583.

**ENVE 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing.

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis.

## Environmental Horticultural Science (EHS)

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### Environmental Horticultural Science Courses

**EHS 123. Landscape Installation and Maintenance. 4 units.**

Prerequisite: HCS 120.

Planting and maintenance of trees, shrubs, ground covers, perennial plantings, color beds, specialty plantings, and small turf areas. Site selection, cultural requirements, scheduling of maintenance activities, pruning, landscape renovation and irrigation system repair. Equipment operation, maintenance, and safety. Speakers from industry. 3 lectures, 1 laboratory.

**EHS 126. Landscape Construction. 3 units.**

Prerequisite: HCS 120.

Design, construction techniques, and materials used in landscape and horticulture construction. Material quantity estimating, sustainable building practices, construction material substitutions, tools and equipment associated with landscape and horticulture construction, and equipment safety. Field trip required. 2 lectures, 1 laboratory.

**EHS 127. Horticulture and Landscape Design. 4 units.**

Aesthetic aspects of environmental horticulture, introduction to computer aided design, presentation techniques and garden history. Field trip required. 2 lectures, 2 laboratories.

**EHS 210. Enterprise Project I. 1-4 units.**

CR/NC

Prerequisite: HSC 110 and consent of instructor.

Selection and completion of a management/production project under faculty supervision. Project participation is voluntary and subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to two units. Credit/No Credit grading only.

**EHS 215. Floral Design I. 3 units.**

Fundamentals of theory, techniques and skills currently practiced in the floral industry. Intended as consumer education for non-majors as well as initial preparation for pre-professionals. Includes applied art principles, post-harvest care and handling practices, and proper use of florist tools and materials in developing basic designs. 1 lecture, 2 laboratories.

**EHS 225. Floral Design II. 3 units.**

Prerequisite: EHS 215.

Expanded exploration and application of design theory to commercial products and services in the retail floral industry. Appropriate utilization of current sales and business practices in a florist setting. Advanced techniques and skills for construction of designs for weddings, advanced arrangements, and designs for events. 1 lecture, 2 laboratories.

**EHS 230. Environmental Horticulture. 4 units.**

Technical information and recommendations for the residential horticulturist. Propagation, pruning, planting, media, fertilizers, pest and weed control, landscaping, maintenance, identification and care of ornamental plants. Being a wise horticultural consumer. Not open to AEPS or EHS majors. 3 lectures, 1 laboratory.

**EHS 231. Plant Materials I. 4 units.**

Identification, habits of growth, cultural requirements, and use of ornamental plants in the landscape. 3 lectures, 1 laboratory.

**EHS 232. Plant Materials II. 4 units.**

Identification, habits of growth, cultural requirements, and use of ornamental plants in the landscape. 3 lectures, 1 laboratory.

**EHS 245. Horticultural Production Techniques. 3 units.**

Prerequisite: HCS 120, SS 121, CHEM 110 or CHEM 111.

Applied principles of plant growth in relation to the production horticulture industry. Emphasis on container media, fertilizing practices, irrigation, plant growth regulators, and miscellaneous growing structures. 2 activities, 1 laboratory.

**EHS 301. Principles of Landscape Design. 4 units.**

Prerequisite: EHS 127, and EHS 231 or EHS 232.

Introduction to basic principles and elements of residential landscape design, design theory, plant composition, creative problem solving, functional and aesthetic uses of landscape materials, client and maintenance criteria, and sustainable design concepts. Intermediate computer aided design drafting and drawing skills. 2 lectures, 2 laboratories.

**EHS 310. Enterprise Project II. 2-4 units.**

CR/NC

Prerequisite: Consent of instructor.

Selection and completion of a management/production project under faculty supervision. Project participation is voluntary and subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to two units. Maximum degree credit for EHS 210 and EHS 310 limited to four units. Credit/No Credit grading only.

**EHS 315. Herbaceous and Specialty Plant Production. 4 units.**

Prerequisite: EHS 245, HCS 327, and SS 221.

An in-depth view of three herbaceous and specialty plant groups (annuals, perennials, cacti/succulents) that are an important part of the wholesale and retail nursery industry. Plant identification, specific techniques of propagation, production, scheduling, growing media and forcing structures for these plants. 3 lectures, 1 laboratory.

**EHS 324. Interior Plant Management. 4 units.**

Prerequisite: EHS 245 and HCS 120 and HCS 124.

Plant materials used in the interior plantscape. Identification, production, utilization, placement. Interior plant specifics and maintenance. 3 lectures, 1 laboratory.

**EHS 331. Landscape Contracting. 4 units.**

Prerequisite: EHS 126 and EHS 127.

Practices in supervising personnel and applying standard techniques in landscape construction. Cost finding and estimating for landscape trades. 3 lectures, 1 laboratory.

**EHS 341. Cut Flower Production. 4 units.**

Prerequisite: HCS 120.

Production of cut flowers and other fresh florists' commodities in greenhouses and outdoors. Preparation and scheduling of such commodities for major markets. Field trip required. 3 lectures, 1 laboratory.

**EHS 342. Potted Plant Production. 4 units.**

Prerequisite: EHS 245.

Production of major commercial flowering potted plants in greenhouses and outdoors. Preparation and scheduling of potted flowering greenhouse crops for major markets. Field trip required. 3 lectures, 1 laboratory.

**EHS 343. Turfgrass Management. 4 units.**

Prerequisite: EHS 123 and SS 121.

Turfgrass species and uses. Principles of turfgrass physiology and communities under different environments. Overview of procedures and equipment for propagation, mowing, irrigation, fertilization, aerification, and pest control. 3 lectures, 1 laboratory.

**EHS 381. Native Plants for California Landscapes. 4 units.**

Prerequisite: BOT 121 and junior standing.

Horticultural investigation of the California flora with emphasis on landscape use and potential. Plant recognition, identification, propagation and culture. Utilization of native plants in landscape design and habitat restoration. Field trips required. 3 lectures, 1 laboratory.

**EHS 382. Restoration Horticulture. 4 units.**

Prerequisite: HCS 124, EHS 381, SS 121.

Role of horticulture in the successful implementation of restoration projects, including mitigation, revegetation, and erosion control. Practical application of restoration methods and guidelines for specific California plant communities including site-specific plant production. 3 lectures, 1 laboratory.

**EHS 402. Retailing Horticultural Products. 4 units.**

Prerequisite: HCS 124.

Economics of operating and managing retail horticulture outlets. Location, selection, layout, and demographic studies. Personnel management, merchandising, advertising, pricing strategies and selling techniques, cooperative buying and industry contributions. Field trip required. 3 lectures, 1 laboratory.

**EHS 421. Arboriculture. 4 units.**

Prerequisite: EHS 123, EHS 231, and EHS 232 or NR 208 for FNR majors.

Theory and practice for the care and management of ornamental trees. Selection, planting, establishment, maintenance of specimen trees. Professional use of ropes and safety equipment. Tree evaluation, scheduling cultural practices, bracing, cabling, specialty hand and power equipment operation, safety regulations. 2 lectures, 2 laboratories.

**EHS 424. Nursery Crop Production. 4 units.**

Prerequisite: HCS 124.

Comprehensive and historical overview of the nursery industry. Types of wholesale nurseries and their products. Plant production systems, scheduling, and marketing. Emphasis on medium to large woody plants and deciduous field-grown ornamental trees and shrubs in the western U.S. Field trips required. 3 lectures, 1 laboratory.

**EHS 427. Advanced Landscape Design. 4 units.**

Prerequisite: EHS 231, EHS 232, EHS 301. Recommended: EHS 381.

Advanced principles of landscape design for residential properties. Design process, form, and space composition emphasized. Application of sustainable design concepts. Computer aided design applications, including three-dimensional design, emphasized. Required field trips. 2 lectures, 2 laboratories.

**EHS 430. Sports Field Construction and Management. 4 units.**

Prerequisite: EHS 343, and junior standing.

Construction and maintenance of sports fields. Basic agronomics including sports field construction, sports turf establishment and maintenance, environmental issues, and personnel management. 3 lectures, 1 laboratory. Crosslisted as EHS/RPTA 430.

**EHS 433. Golf Course Management Operations. 4 units.**

Prerequisite: EHS 343.

Advanced maintenance and operation of golf course facilities. Systems of management, maintenance, business and finance. 3 lectures, 1 laboratory.

**EHS 434. Landscape Management. 4 units.**

Prerequisite: EHS 123 and EHS 126 and junior standing.

Maintenance procedures and operations. Operating a landscape management business. Estimating, scheduling, recordkeeping and implementation of landscape maintenance projects. Interior landscape maintenance. 3 lectures, 1 laboratory.

**EHS 437. Park and Public Space Management. 4 units.**

Prerequisite: Junior standing.

Management and maintenance of private and public parks, arboreta, botanical gardens and recreational areas. Maintenance personnel management, safety and liability issues. Field trips required. 3 lectures, 1 laboratory.

**EHS 438. Teaching Methods in Environmental Horticulture. 4 units.**

Prerequisite: Completion of GE B2 and EHS 230 and AGED 102 and junior standing.

Use of horticulture as a context for teaching core academic subjects in science, mathematics, English and history/social science. Daily and unit lesson plans that adopt horticultural content, teaching methods and assessment for English language learners and students with special needs. Class demonstrations, analysis, assessment and reflection. 2 lectures, 2 activities.

**EHS 581. Graduate Seminar in Ornamental Horticulture. 3 units.**

Prerequisite: Graduate standing.

Group study of current problems of the ornamental horticulture industry; current experimental and research findings as applied to production and management. Repeatable for credit up to 9 units. 3 seminars.

**EHS 599. Thesis in Environmental Horticulture Science. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem in environmental horticulture. Thesis will include problem identification, significance, methods, data analysis and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Ethnic Studies (ES)

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### Ethnic Studies Courses

**ES 112. Race, Culture and Politics in the United States. 4 units.**

GE Area D1; USCP

Introductory and interdisciplinary study of the ways that race and ethnicity are created by both historical processes and American institutional formation - specifically social, political, economic, legal and cultural institutions. Special attention paid to the interlocking systems of race, class, gender and sexuality. 4 lectures. Crosslisted as ES/HNRS 112. Fulfills GE D1 and USCP.

**ES 114. Race in American Culture. 4 units.**

USCP

The social practices, cultural representations, and public policies that construct race and racism in the development of American institutions, and their effect upon ethnic groups and women. The cultural discourses that reinforce racist ideology and pseudo-scientific conceptions of race. 4 lectures. Fulfills USCP.

**ES 200. Special Problems. 1-4 units.**

Prerequisite: Consent of department chair.

Supervised investigation, including a written report, of a topic chosen with prior approval of instructor. Total credit limited to 4 units.

**ES 212. Global Origins of United States Cultures. 4 units.**

GE Area D3; USCP

How the global dispersal of Europeans, Asians, and Africans, the hemispheric dispersal of Latin Americans, and the forced internal migration of Native Americans have contributed to American cultural heritage and the struggles for ethnic, class and gender equality, and justice. 4 lectures. Crosslisted as ES/HNRS 212. Fulfills GE D3 and USCP.

**ES 215. Planning for and with Multiple Publics. 4 units.**

USCP

Prerequisite: Completion of GE Area D1. Recommended: ES 112.

How the social/spatial relationships among racial/ethnic and gender groups are expressed in terms of human settlement patterns, civic involvement and everyday negotiations. Ways in which segregation and marginalization are expressed in western and non-western contexts. 4 lectures. Crosslisted as CRP/ES 215. Fulfills USCP.

**ES 241. Survey of Indigenous Studies. 4 units.**

GE Area D3; USCP

A survey of the interdisciplinary field of indigenous studies and specifically the social, political, economic, legal, and cultural institutions of American Indian, Native Alaskan, and Native Hawaiian peoples within a transnational and global context. Special attention paid to the interlocking systems of race, class, gender, and sexuality, particularly within but not limited to the United States. 4 lectures. Fulfills GE D3 and USCP.

**ES 242. Survey of Africana Studies. 4 units.**

GE Area D3; USCP

A survey of the interdisciplinary field of Africana Studies and specifically the social, political, economic, legal, and cultural institutions of African American, Afro-Caribbean, and African diasporic peoples within a transnational and global context. Special attention paid to the interlocking systems of race, class, gender, and sexuality, particularly within but not limited to the United States. 4 lectures. Fulfills GE D3 and USCP.

**ES 243. Survey of Latino/a Studies. 4 units.**

GE Area D3; USCP

A survey of the interdisciplinary field of Latino/a Studies and specifically the social, political, economic, legal, and cultural institutions of Chicano/a and other Latino/a peoples within a transnational and global context. Special attention paid to the interlocking systems of race, class, gender, and sexuality, particularly within but not limited to the United States. 4 lectures. Fulfills GE D3 and USCP.

**ES 244. Survey of Asian American Studies. 4 units.**

GE Area D3; USCP

A survey of the interdisciplinary field of Asian American Studies and specifically the social, political, economic, legal, and cultural institutions of West Asian, South Asian, Southeast Asian, and East Asian peoples in the United States within a transnational and global context. Special attention paid to the interlocking systems of race, class, gender, and sexuality, particularly within but not limited to the United States. 4 lectures. Fulfills GE D3 and USCP.

**ES 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ES 300. Chicano/a Non-Fiction Literature. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Overview of contemporary Chicano/a non-fiction literature since 1848. Thematic concerns, literary criticism, literary techniques, historical and socio-cultural factors influencing non-fiction Chicano/a literary genres. Instructor reserves option to select non-fiction genres to be studied. 4 lectures. Fulfills GE C4 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 308. Fire and Society. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A3 and one lower division course in GE Area D.

Prehistorical and historical record of human use of and attitude toward fire. Mythology and religion of fire. Traditional, cultural and ethnic variations and their influence on modern U.S. institutions involved in managing fire. 3 lectures, 1 activity. Crosslisted as ES/NR 308. Fulfills GE D5 except for Comparative Ethnic Studies majors.

**ES 310. Hip-Hop, Poetics and Politics. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

Dynamics of hip-hop culture, its historical development, political significance, and social influence. How hip-hop exemplifies cross-cultural hybridization within not only Black communities nationally and internationally, but also amongst indigenous, Latino/a, and Asian peoples in the U.S. and beyond. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 320. African American Cultural Images. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

Comparative study of the cultural representations of, and counter-representations by, American racial/ethnic groups in American popular opinion and consciousness, with particular emphasis on African Americans. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 321. Native American Cultural Images. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

Comparative study of the cultural representations of, and counter-representations by racial/ethnic groups in American popular opinion and consciousness, with particular emphasis on Native Americans. The cultural images of Native peoples in the United States that have characterized relationships. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 322. Asian American Cultural Images. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

Comparative study of the cultural representations of, and counter-representations by, American racial/ethnic groups in American popular opinion and consciousness, with particular emphasis on Asian-Americans. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 323. Mexican American Cultural Images. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

Comparative study of the cultural representations (racializing images and discourses) of, and counter-representations by, American cultural/ethnic groups in American popular opinion and consciousness, with particular emphasis on Mexican Americans/Latinos. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 325. Sex and Gender in African American Communities. 4 units.**

USCP

Prerequisite: Completion of a course in GE Area D1 or D3.

Recommended: ES 112 or ES 212.

Gender and sexuality issues that influence the social, political, economic and cultural development of African-America. Special attention given to how racism affects the realization of standard gender conventions within black communities, as well as to myths of black sexuality, black feminism, and queer politics. 4 lectures. Fulfills USCP.

**ES 326. Native American Architecture and Place. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The role of culture and setting in the construction of spatial, material and landscape concepts and artifacts, through the introduction of selected North American cultures, with focus from 1300 AD through contemporary time. 4 lectures. Crosslisted as ARCH/ES 326. Fulfills GE C4 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 330. The Chinese American Experience. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

History and current status of Chinese Americans, with emphasis on the international contexts, organizations and institutions of Chinese America, and on Chinese Americans' demographic compositions, spatial patterns, and cultural, socioeconomic, and political adaptation experiences. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 335. The Filipina/o American Experience. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

An interdisciplinary examination of the historical development of Filipina/o American identities and communities. The social, cultural and political institutions that have influenced Filipina/o immigration, participatory citizenship, activism and cultural practices. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 340. Cultural Production and Ethnicity. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one lower division course in Area C. Recommended: Completion of one ES course; Junior standing.

Culture and ethnicity as key factors in the production, perception, and interpretation of art and the humanities. Critical analysis of cultural attitudes and knowledge in expressive arts and cultural production, and of the contexts of cultural production as reflective of ethnicity. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for Comparative Ethnic Studies majors.

**ES 350. Gender, Race, Science and Technology. 4 units.**

GE Area F; USCP

Prerequisite: Completion of GE Area B2 or B3. Recommended: Junior standing.

Interdisciplinary examination of the complex relationships between gender, race, science, and technology in educational, work, knowledge production, policy, and ethical contexts. Topics may include reproductive, medical, genetic, and emerging technologies and exploration of efforts to create more socially responsible science/technology. 3 lectures, 1 activity. Crosslisted as ES/WGS 350. Fulfills GE Area F and USCP.

**ES 351. Global Engineering: Gender, Race, Class, Nation. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two lower division courses in Area D.

Cross-cultural, comparative analysis of what it means to be an engineer, do engineering work, the structure of engineering education; focus on social, economic, political, legal institutions and 21st century challenges; special attention to interlocking systems of gender, race, class, nation. 4 lectures. Crosslisted as ES/WGS 351. Fulfills GE Area D5 except for Comparative Ethnic Studies majors.

**ES 360. Ethnicity and the Land. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Area A and one lower division course in Area C. Recommended: One lower division Ethnic Studies course and an introductory natural resources course; junior standing.

Comparative study of how race and culture shape landscapes, and how social hierarchies allocate the use of natural resources and the burdens of environmental pollution. 4 lectures. Crosslisted as ES/NR 360. Fulfills GE C4 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 380. Critical Race Theory. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A, and D1 or D3. Recommended: Junior standing.

History and evolution of the critical race theory movement. Defining issues of the field; in particular, the relationship between race, power and the law. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.



**ES 381. The Social Construction of Whiteness. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and two lower division courses in Area D. Recommended: ES 112 (D1) and/or ES D3 courses; Junior standing.

The investigation of the social construction of race in the United States through historicizing the category of 'whiteness.' Why 'white' was invented as a racial category and how white privilege has been sustained through social, political, economic and legal practices. 4 lectures. Fulfills GE D5 except for Comparative Ethnic Studies majors. Fulfills USCP.

**ES 390. Research Methodology in Comparative Ethnic Studies. 4 units.**

Prerequisite: Completion of Area A, STAT 217, ES 112, junior standing and three courses from ES 241, ES 242, ES 243, ES 244.

Theory and practice of research methodology in comparative ethnic studies. Topics include the scientific method, qualitative and quantitative methodologies, and ethical practices. Research report prepared from start to finish, including database searching, collecting pilot data, and proper formatting of a research report. Issues of race in research practice and use foregrounded throughout. 3 lectures, 1 activity.

**ES 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Junior standing and consent of department chair.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units.

**ES 406. Indigenous Peoples and International Law and Policy. 4 units.**

Prerequisite: ES 241; and NR 141 or NR 142; and junior standing required.

Interdisciplinary examination of the evolution of international law effecting indigenous peoples in the U.S. and in the Americas. Development of international legal and sociological norms and their impact on human rights of indigenous peoples with particular attention to environmental issues. 4 lectures. Crosslisted as ES/NR 406.

**ES 410. Advanced Topics in Comparative Ethnic Studies. 4 units.**

Prerequisite: ES 390 or consent of instructor.

Selected topics and issues in comparative ethnic studies. Class Schedule will list topic selected. Repeatable for a maximum of 8 units. 4 seminars.

**ES 450. Fieldwork in Comparative Ethnic Studies. 4 units.**

Prerequisite: ES 390 or consent of instructor.

Supervised project based on fieldwork in comparative ethnic studies. 4 seminars.

**ES 461. Senior Project. 4 units.**

Prerequisite: ES 390 and departmental approval.

Completion of a project under faculty supervision. Results presented in a formal paper or project.

**ES 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: At least one course in Ethnic Studies and consent of instructor.

Directed group study of selected topics for advanced students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

## Fire Protection Engineering (FPE)

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### Fire Protection Engineering Courses

**FPE 500. Individual Study. 1-4 units.**

Prerequisite: Consent of graduate coordinator and supervising faculty member.

Advanced study planned and completed under the direction of a member of the program faculty. Open only to graduate students in the FPE program who have demonstrated ability to do independent work. FPE 500 must be taken as a 4-unit class when substituting for a required course in the FPE program.

**FPE 501. Fundamental Thermal Sciences. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Introduction to the thermal sciences, including thermodynamics, fluid dynamics and heat transfer, as they relate to fire protection engineering. Includes 1st and 2nd laws of thermodynamics, conservation relations, hydrostatics, internal and external flows, and heat transfer by conduction, convection and radiation. 4 lectures.

**FPE 502. Fire Dynamics. 4 units.**

Prerequisite: FPE 501 or consent of instructor.

First exposure to fire dynamics phenomena. Includes fundamental fire and combustion topics such as thermodynamics of combustion, fire chemistry, premixed and diffusion flames, ignition, burning of liquids and solids, heat release rates, flame spread and fire plumes. 4 lectures.

**FPE 503. Flammability Assessment Methods. 4 units.**

Prerequisite: FPE 502.

Characterization of flammability properties of gaseous, liquid and solid materials. Fire test methods for evaluating flammability properties of materials and burning characteristics of products. Overview of regulatory requirements for restricting the flammability of products and materials used in buildings. 4 lectures.

**FPE 504. Fire Modeling. 4 units.**

Prerequisite: FPE 502, FPE 503.

Fire modeling techniques for fire safety assessment. Application of various engineering correlations and computer-based fire models, including zone models and computational fluid dynamics models, to representative fire problems. 4 lectures.

**FPE 521. Egress Analysis and Design. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Regulatory requirements for egress systems in buildings, including occupancy classifications, occupant loads, means of egress components and exit capacities. Introduction to human behavior in fire and to methods for calculating people movement under emergency conditions, including computer-based evacuation models. 4 lectures.

**FPE 522. Fire Detection, Alarm and Communication Systems. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Analysis of the operating characteristics of fire detection devices and alarm notification appliances. Introduction to modern fire alarm systems and components. Introduction to mass communication systems. Current installation and approval standards. 4 lectures.

**FPE 523. Water-based Fire Suppression. 4 units.**

Prerequisite: FPE 501 or consent of instructor.

Analysis and design of water-based fire suppression systems, including water supply analysis and hydraulic calculations. Overview and design considerations for automatic sprinkler, water spray, water mist and foam suppression systems. Typical contemporary installations and current installation and approval standards. 4 lectures.

**FPE 524. Structural Fire Protection. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Regulation and analysis procedures for structural components of wood, steel, concrete, composites. Structural capabilities, modifications under fire induced exposures. Calculation methods for predicting fire resistance of structural components. Definition of types of building construction. 4 lectures.

**FPE 551. Fire Safety Regulation and Management. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Use of model building and fire codes, administrative regulation, retrospective codes, performance-based codes, and risk-based regulation to manage fire safety. Identification and application of different fire risk management tools and techniques. 4 lectures.

**FPE 552. Smoke Management and Special Hazards. 4 units.**

Prerequisite: FPE 502 and FPE 504.

Analysis and design of smoke management systems. Assessment of smoke hazards. Identification of special hazards. Analysis and design of fire suppression systems used for fire control of special hazards, including gaseous and chemical agents and systems. 4 lectures.

**FPE 554. Forensic Fire Analysis. 4 units.**

Prerequisite: Consent of graduate coordinator and instructor.

Recommended: FPE 502, FPE 503 and FPE 504.

Introduction to the processes of fire investigation and reconstruction. Engineering analysis of structural and wildland fires. Identification of failure mechanisms in fire safety systems. Case studies of actual fire incidents to address and reinforce concepts related to different types of system and performance failures. 4 lectures.

**FPE 555. Fire Protection Management in the Wildland-Urban Interface (WUI). 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Recommended: LA/NR 318 and NR 340.

Social, economic, political, and technological issues affecting fire management in urbanized landscapes where fire continues its ecological role. Fire risk analysis; needs assessment, legislative codes, standards and policies; liability issues; evacuation; incident response planning. 3 lectures, 1 laboratory.

**FPE 556. Advanced Heat Transfer III. 4 units.**

Prerequisite: ME 343, and ME 347 or FPE 502.

Advanced principles of heat transfer. Classical solution techniques to problems in radiation with applications related to the role of radiation heat transfer in the development of fire in buildings. 4 lectures. Crosslisted as FPE/ME 556.

**FPE 596. Culminating Experience in Fire Protection Engineering. 2-5 units.**

Prerequisite: FPE 504, advanced graduate standing, completion of, or concurrent enrollment in, engineering courses in program, and consent of instructor.

Performance of comprehensive fire and life safety evaluations of buildings and other structures. Communication of the results and findings of such evaluations in written report and by oral presentation. Conducted under supervision of faculty.

**FPE 599. Design Thesis. 1-9 units.**

Prerequisite: Consent of graduate coordinator and graduate standing.

Each individual will be assigned a thesis project for solution under faculty supervision as a requirement for the master's degree, culminating in a written thesis.

## Food Science and Nutrition (FSN)

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### Food Science and Nutrition Courses

**FSN 101. Orientation to the Food Science and Nutrition Majors. 1 unit.**

CR/NC

Understanding the depth and breadth of the Food Science and Nutrition programs. Emphasis on academic and career planning. Students are required to complete this course within their first year in the major. Separate sections will be offered for each major. Credit/No Credit grading only. 1 lecture.

**FSN 121. Fundamentals of Food. 4 units.**

Theoretical aspects and practical applications of the principles of culinary science and food preparation. 3 lectures, 1 laboratory.

**FSN 125. Introduction to Food Science. 4 units.**

Basic principles of food science. Chemical, physical, and microbiological properties of foods. Ingredient properties, preservation, and processing. Overview of the commercial food processing industry at state and national levels. Field trip may be required. 3 lectures, 1 laboratory.

**FSN 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 4 units per quarter.

**FSN 201. Enterprise Project. 1-4 units.**

CR/NC

Prerequisite: FSN 125 or FSN 230 or FSN 121 and consent of instructor.

Post-harvest processing of a high quality food product. Project participation is voluntary and subject to approval by the department head and the Cal Poly Corporation. Total degree credit for FSN 201 and FSN 401 combined limited to 12 units. Credit/No Credit grading only.

**FSN 204. Food Processing Operations. 4 units.**

Prerequisite: FSN 125 or FSN 230.

Applied food manufacturing and processing technology emphasizing unit operations. Water removal in foods (dehydration, spray drying, vacuum concentration), heat removal (refrigeration, freezing), and osmotic preservation. Students produce processed foods in a pilot plant. Field trip may be required. 3 lectures, 1 laboratory.

**FSN 210. Nutrition. 4 units.**

GE Area B5

Introduction to the science of human nutrition. Nutrient structure, metabolism, function and requirements. Application of nutrition science principles to promote optimal health. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE B5.

**FSN 230. Elements of Food Processing. 4 units.**

Principles of food processing operations covering thermal processing, freezing, dehydration, fermentation and raw material handling. Overview of food technology, food quality, spoilage, packaging and label requirements. For non-Food Science majors only. Field trip may be required. 3 lectures, 1 laboratory.

**FSN 244. Cereal and Bakery Science. 4 units.**

Prerequisite: FSN 125 or FSN 230.

Applied science of cereal-based products. Theory and practice underlying preparation of doughs, batters, fillings, and glazes. Chemistry of baking doughs and batters and storage of finished products. Marketing and product development of breads, cakes, cookies, and pastries. Comparative nutritional evaluation of flours, grains, and finished products. 3 lectures, 1 laboratory.

**FSN 250. Food and Nutrition: Customs and Culture. 4 units.**

GE Area D4; USCP

Anthropological perspective of traditional and contemporary food customs and culture. Major emphasis on U.S. cultures including Native American, Hispanic American, African American, and Asian American. Opportunities to explore personal cultural food experiences. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE D4 and USCP.

**FSN 275. Elements of Food Safety. 4 units.**

Introduction to food safety from farm-to-fork. Topics include good agricultural practices, good manufacturing practices, food safety regulations, and an overview of Hazard Analysis Critical Control Point (HACCP). Emphasis on control of biological, chemical, and physical hazards to assure food safety. Not open to Food Science majors. 4 lectures.

**FSN 285. Certified Organic Food Processing. 4 units.**

Prerequisite: FSN 125, FSN 230 or consent of instructor.

Certification and legal requirements for the processing of fruit, vegetable, wine, cereal, beer, distilled spirits and muscle foods according to USDA, EU and JAS requirements. Basic principles of certified organic handling, process operations, ingredient sourcing and product development. 4 lectures.

**FSN 290. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**FSN 304. Advanced Culinary Principles and Practice. 4 units.**

Prerequisite: FSN 121 and CHEM 127.

Chemistry of starch, fat and proteins and its impact on texture, taste, flavor and appearance of food. Effects of microorganisms on changes of food during preparation and storage. Strong emphasis on baking technology. 3 lectures, 1 laboratory.

**FSN 310. Maternal and Child Nutrition. 4 units.**

Prerequisite: FSN 210 and junior standing.

Nutritional needs and related nutritional challenges of women and children, including fertility, pregnancy and lactation; physical, nutritional, social growth and development from infancy through adolescence. Current nutrition issues in maternal and child nutrition. 4 lectures.

**FSN 311. Sensory Evaluation of Food. 4 units.**

Prerequisite: STAT 218; FSN 125 or FSN 230.

Sensory attributes of food, physiological basis of sensory evaluation, sensory panels, environment for sensory evaluation, sample preparation and presentation, types of score cards, statistical methods for data analysis and interpretation. 3 lectures, 1 laboratory.

**FSN 315. Nutrition in Aging. 4 units.**

Prerequisite: FSN 210; sophomore standing.

Nutrition issues in the middle and later years. Changes in organ systems, nutrient needs, functional status, and food preferences as adults age. Nutrition and chronic disease. Nutritional assessment and screening. Nutrition-related health care and social services. 4 lectures.

**FSN 319. Food Technology for the Consumer. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Overview of the science and technology used to produce the foods consumed on a daily basis. Food science, biotechnology, food law, processing, preservation, ingredient functionality, package label information, and food safety information. Not open to Food Science Majors. 4 lectures. Fulfills GE Area F.

**FSN 321. Contemporary Issues in Food Choice and Preparation. 4 units.**

Prerequisite: FSN 121, FSN 210, sophomore standing.

Principles involved in the choice, purchase, and preparation of foods in a variety of settings and for various populations. Contemporary and ongoing issues associated with food and cooking in the context of nutrition and health. Planning and preparation of meals with emphasis on nutritional, aesthetic, economic and cultural aspects of food. 3 lectures, 1 laboratory.

**FSN 322. French Foods in French. 4 units.**

Prerequisite: FR 103 or consent of instructor.

Blend of French language, culture, food preparation techniques, and basic food chemistry and nutrition. Total immersion in language and cooking: preparation of French food while interacting in French with classmates and instructors, in lectures, discussion, and laboratory. 3 lectures, 1 laboratory. Crosslisted as FR/FSN 322.

**FSN 328. Nutrient Metabolism I. 4 units.**

Prerequisite: FSN 210, CHEM 313 or CHEM 371, BIO 111 or BIO 161, junior standing.

Metabolism of carbohydrates, fats and proteins as it applies to human nutrition. Integration and regulation of metabolic pathways. 4 lectures.

**FSN 329. Nutrient Metabolism II. 4 units.**

Prerequisite: FSN 328.

Continuation of FSN 328. Biochemical, molecular, and physiological functions of vitamins and minerals and their interaction with other nutrients. 3 lectures, 1 laboratory.

**FSN 330. Introduction to Principles of Food Engineering. 4 units.**

Prerequisite: FSN 125; MATH 118 or equivalent; and PHYS 121.

Introduction to principles of food engineering and basic calculations needed for food plant operations. Unit conversions, material balance, heat balance, steam heating, psychrometry, vacuum and pressure. Field trip may be required. 3 lectures, 1 laboratory.

**FSN 334. Food Packaging. 3 units.**

Prerequisite: FSN 125 and FSN 204.

Function of food packaging in food processing and preservation. Packaging materials and forms. Regulations and testing of food packaging material. Oral presentation required. 3 lectures.

**FSN 335. Food Quality Assurance. 4 units.**

Prerequisite: FSN 125 or FSN 230; junior standing.

Chemical, microbiological, and physical methods of analyses of foods used in food quality assurance and product development laboratories. Organization and management of quality assurance programs utilizing basic statistical control. Development of food production standards and interpretation of specifications. Packaging and container evaluation. 3 lectures, 1 laboratory.

**FSN 341. Wines and Fermented Foods. 4 units.**

Prerequisite: Junior standing and completion of GE Area B.

Processing, manufacturing, historical and bio-technical applications of fermentation technology for the production of food products focusing on wine. Wines of the world, distilled beverages, beers, fermented dairy, vegetable and meat products important to the post-harvest economy of California. 4 lectures.

**FSN 343. Institutional Foodservice I. 3 units.**

Prerequisite: FSN 121 and junior standing.

Principles of equipment selection and food service facility, planning with emphasis on sanitation and safety. 2 lectures, 1 laboratory.

**FSN 344. Institutional Foodservice II. 4 units.**

Prerequisite: FSN 321, FSN 343.

Continuation of FSN 343. Economic principles and problems involved in planning and preparing food using institutional equipment to meet specific product standards for large groups. Field trip may be required. 3 lectures, 1 laboratory.

**FSN 354. Packaging Function in Food Processing. 3 units.**

Prerequisite: Junior standing.

Basic food spoilage and preservation mechanisms. The role of food packaging in food processing. Package and food compatibility. For non-Food Science majors. 3 lectures.

**FSN 364. Food Chemistry. 4 units.**

Prerequisite: FSN 125 or FSN 230, CHEM 313.

Study of molecular properties of major food components such as water, carbohydrates, lipids, proteins, vitamins, minerals, pigments, enzymes and other important molecules as well as chemical reactions of these compounds occurring as a result of processing and or storage. Laboratory focus on assessment of the role of food components in food systems and food products. 3 lectures, 1 laboratory.

**FSN 368. Food Analysis. 4 units.**

Prerequisite: FSN 364.

Principles of chemical and biochemical methods and techniques for measuring food protein, carbohydrates, lipids, water, vitamins, minerals and other components of foods using approved methods. 3 lectures, 1 laboratory.

**FSN 370. Food Plant Sanitation and Prerequisite Programs. 4 units.**

Prerequisite: FSN 204 and MCRO 221.

Principles and practice of food plant sanitation and prerequisite programs to ensure production of a safe and wholesome food supply. Topics include good manufacturing practices, sanitary design, cleaning and sanitizing compound selection, pest management, waste treatment, and allergen control programs. Field trips required. 4 lectures.

**FSN 374. Food Laws and Regulations. 4 units.**

Prerequisite: FSN 125 or FSN 230 or WVIT 102.

Federal, state, and local laws and regulations affecting the production, processing, packaging, marketing, and distribution of food. Emphasis on FDA, USDA and California codes. 4 lectures.

**FSN 375. Food Safety. 4 units.**

Prerequisite: FSN 370.

Principles, practices, and regulations governing and ensuring the chemical, physical, and biological safety of the food supply. Topics include Hazard Analysis Critical Control Point (HACCP), risk assessment, import safety, food bioterrorism and defense, product recalls, and traceability. 3 lectures, 1 activity.

**FSN 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 4 units per quarter.

**FSN 401. Advanced Enterprise Project. 1-4 units.**

Prerequisite: FSN 201 and junior standing and consent of instructor.

Leadership responsibility on enterprise projects. Lead students, under the supervision of instructor, will be accountable for all phases of the project: scheduling times, securing raw product, record keeping, and marketing of the product. Total degree credit for FSN 201 and FSN 401 combined limited to 12 units.

**FSN 408. Food Composition Science and Product Development. 4 units.**

Prerequisite: FSN 311; FSN 364; CHEM 313; and senior standing.

Chemical and physical properties of food ingredients. Functionality of water, carbohydrates, proteins, lipids, additives and other food ingredients used in the formulation, development, and processing of foods. Product development processes from idea generation to concept to commercialization. 3 lectures, 1 laboratory.

**FSN 410. Nutritional Implications of Food Industry Practices. 4 units.**

Prerequisite: FSN 210; FSN 125 or FSN 230; and junior standing.

Methods for assessing nutritional quality of foods/diets. Nutrient databases for raw and processed foods. Effects of food industry practices (e.g., processing, fortification, new product development, biotechnology) on nutritional quality of foods/diets. Evolution of public policy. 4 seminars.

**FSN 415. Nutrition Education and Communications. 4 units.**

Prerequisite: Senior standing. Corequisite: FSN 329.

Application of appropriate behavior and learning theories in nutrition education and communications across diverse population groups. Effective use of techniques, materials, and computer-based technology to enhance communications. Includes community-based learning projects. 4 lectures.

**FSN 416. Community Nutrition. 4 units.**

Prerequisite: FSN 328; senior standing. Recommended: FSN 310, FSN 315 and FSN 415.

Federal, state and local nutrition assessment activities and program services. Emphasis on public health, health promotion and disease prevention. Development of skills in assessing community nutrition problems and planning community interventions. 4 lectures.

**FSN 417. Nutrition Counseling. 4 units.**

Prerequisite: Senior standing, PSY 201/202. Corequisite: FSN 415.

Communication, behavioral, and counseling theories as they relate to nutrition counseling. Emphasis on development of skills to promote healthy eating behaviors. Examination of eating disorders and obesity, including preventative and therapeutic interventions. 4 lectures.

**FSN 420. Critical Evaluation of Nutrition Research. 4 units.**

Prerequisite: STAT 218; and senior standing. Corequisite: FSN 329.

Nutrition research terminology and methods. Critical evaluation and interpretation of nutrition research with emphasis on human studies of diet-health relationships. Evidence based review. 4 seminars.

**FSN 426. Food Systems Management. 4 units.**

Prerequisite: FSN 344.

Principles of successful organization and management with their application to the effective operation of food service. Administrative responsibilities of the food service manager. Management theories and practice. Labor relations. Discipline and performance appraisal. 4 lectures.

**FSN 429. Clinical Nutrition I. 4 units.**

Prerequisite: ZOO 331, 332 (transfer equivalent ZOO 231, 232) and senior standing. Corequisite: FSN 329.

Application of the nutrition care process to physiological disorders which may alter nutritional requirements or require dietary modifications. Anthropometric, biochemical, clinical, and dietary assessment. Diabetes mellitus, electrolytes, acid-base balance, hydration and enteral and parenteral nutrition. Anemias, pharmacology, cardiovascular disease and obesity. 3 lectures, 1 laboratory.

**FSN 430. Clinical Nutrition II. 4 units.**

Prerequisite: FSN 429.

Continuation of FSN 429. Application of the nutrition care process to physiological and metabolic disorders which may alter nutritional requirements or require dietary modifications. GI disease, respiratory diseases, metabolic stress, burns, cancer, inborn errors of metabolism, cardiovascular disease, liver disease, and renal disease. 3 lectures, 1 laboratory.

**FSN 440. Internship. 1-12 units.**

Prerequisite: Junior standing and consent of instructor.

Career experience with private or public agencies. Total credit limited to 12 units. Maximum of 6 units may be applied toward degree requirements.

**FSN 444. Food Engineering. 4 units.**

Prerequisite: FSN 204 and FSN 330.

Engineering principles governing heat transfer, fluid flow, and introductory mass transfer and application of these principles to selected unit operations; theoretical aspects of the scientific and engineering principles of fluid flow and the transfer and change of materials and energy primarily by physical means during processing of food. 4 lectures.

**FSN 461. Senior Project I. 3 units.**

Prerequisite: For FDSC and NUTR majors, completion of GE A3, STAT 218, and senior standing. For WVIT majors (enology concentration), junior standing and consent of instructor. Corequisite for NUTR majors: FSN 329 and FSN 420.

Selection of scientific research topic in major area. Development of literature review, research questions in Senior Project I. Research design, data collection, and analysis in Senior Project II. Project requires a formal report which must follow departmental guidelines. Minimum of 90 hours per quarter.

**FSN 462. Senior Project II. 3 units.**

Prerequisite: FSN 461.

Selection of scientific research topic in major area. Development of literature review, research questions in Senior Project I. Research design, data collection, and analysis in Senior Project II. Project requires a formal report which must follow departmental guidelines. Minimum of 90 hours per quarter.



**FSN 463. Professional Practice in Nutrition and Dietetics. 2 units.**  
CR/NC

Prerequisite: Senior standing. Recommended: FSN 329.

Exploration of students' transition to professional practice, career opportunities, and factors to be considered in career decisions. Application of strategic planning, critical thinking, written and oral communication skills in preparation for nutrition and dietetics professions. 2 lectures.

**FSN 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Senior standing.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**FSN 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Senior standing.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**FSN 474. Advanced Food Processing. 4 units.**

Prerequisite: FSN 444 and senior standing.

Advanced topics in processing operations with emphasis on thermal processing. Non-traditional processing technology such as microwave, ionizing radiation, and high pressure. 3 lectures, 1 laboratory.

**FSN 480. Policy Arguments in Food and Nutrition. 2 units.**

Prerequisite: Junior standing and consent of instructor.

Analysis and evaluation of law and policy in foods, nutrition, and related healthcare issues. Planning and presentation of successful arguments supporting or refuting key food and health policies. Critical assessment of advocacy processes and determination of best approaches to achieving legislative and policy goals. 2 seminars.

**FSN 485. Cooperative Education Experience in Food Science and Nutrition. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience with an approved Food Science or Nutrition firm engaged in production or related business, industry or governmental agency. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 12 units. Degree credit limited to 6 units. Credit/No Credit grading only.

**FSN 495. Cooperative Education Experience in Food Science and Nutrition. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full time work experience with an approved Food Science or Nutrition firm engaged in production or related business, industry or governmental agency. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 12 units. Degree credit limited to 6 units. Credit/No Credit grading only.

**FSN 500. Individual Study. 1-6 units.**

Prerequisite: Graduate standing, consent of supervising faculty member and graduate advisor.

Advanced independent study planned and completed under the direction of a member of the department faculty. Total credit limited to 6 units.

**FSN 501. Lipid Metabolism and Nutrition. 3 units.**

Prerequisite: Graduate standing or consent of instructor.

Digestion, absorption and metabolism of lipids with emphasis on lipoprotein metabolism, regulation of lipid metabolism, effects of gene expression, essential fatty acid requirements and functions. 3 seminars.

**FSN 516. Population Health and Epidemiology. 3 units.**

Prerequisite: FSN 416 and graduate standing.

Advanced concepts and issues in population health and epidemiology. Covers epidemiologic methods, study design, and conceptual frameworks from public health perspective. Analytical considerations related to population health will be presented. Emphasis on nutrition-related issues at national and global levels. 3 lectures.

**FSN 528. Biochemical and Molecular Aspects of Human Macronutrient Metabolism. 4 units.**

Prerequisite: FSN 328 and graduate standing.

Advanced topics in the human metabolism of carbohydrates, lipids and proteins. Classic and recent findings related to mechanisms of nutrient-regulated gene expression. Metabolism related to specific diseases will also be covered. 4 lectures.

**FSN 541. Dietetic Internship Seminar. 2 units.**

CR/NC

Prerequisite: Acceptance into the Cal Poly, San Luis Obispo Dietetic Internship, a special session program in Extended Education.

A forum for dietetic interns to make presentations and share their experiences in their supervised practice. Guest presentations on current issues in nutrition therapy, foodservice management and community nutrition. Total credit limited to 6 units, with a maximum of 2 units per quarter. Credit/No Credit grading only. 2 seminars.

**FSN 570. Selected Topics in Food Science and Nutrition. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 seminars.

**FSN 571. Selected Advanced Laboratory in Food Science and Nutrition. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**FSN 581. Graduate Seminar in Food Science and Nutrition. 1-3 units.**

Prerequisite: Graduate standing or consent of instructor.

Current findings and research problems in the field and their application to food science and nutrition. Class Schedule will list topic selected. Total credit limited to 6 units with approval of advisor. 1-3 seminars.

**FSN 599. Thesis. 1-6 units.**

Prerequisite: Graduate standing and consent of instructor.

Individual research in food science and nutrition under faculty supervision leading to a graduate thesis of suitable quality. Total credit limited to 6 units.

## French (FR)

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### French Courses

**FR 101. Elementary French I. 4 units.**

Beginning French. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. 3 lectures, 1 activity.

**FR 102. Elementary French II. 4 units.**

Prerequisite: FR 101 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

**FR 103. Elementary French III. 4 units.**

Prerequisite: FR 102 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

**FR 201. Intermediate French I. 4 units.**

GE Area C5

Prerequisite: FR 103 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in French within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5. Formerly FR 121.

**FR 202. Intermediate French II. 4 units.**

GE Area C5

Prerequisite: FR 201 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in French within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5. Formerly FR 122.

**FR 203. Intermediate French III. 4 units.**

GE Area C5

Prerequisite: FR 202 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in French within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5.

**FR 233. Critical Reading in French Literature. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A and FR 203 or consent of instructor.

Selected readings in French from Francophone authors that illustrate the French literary tradition from the Middle Ages to the present in both France and other French-speaking countries. May include film and other media. Conducted in French. 4 lectures. Fulfills GE C1.

**FR 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. Open only to undergraduate students. Conducted in French. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**FR 301. Advanced French Composition and Grammar. 4 units.**

Prerequisite: FR 203 or consent of instructor.

Written and oral development of structural grammar, syntax and complex components of French. Expansion of vocabulary and idiomatic expressions through text study. Written compositions. May include French/English translation. Conducted in French. 4 lectures.

**FR 302. Advanced French Conversation and Grammar. 4 units.**

Prerequisite: FR 203 or consent of instructor.

Oral and written development of structural grammar, syntax and complex components of French. Expansion of vocabulary and idiomatic expressions through topics focusing on culture. Individual and/or group presentations. Conducted in French. 4 lectures.

**FR 305. Significant Works in French. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and FR 233 or consent of instructor.

Critical analysis and oral discussion of poetry, essays, novels, plays, films, and other media by selected French and Francophone authors. Conducted in French. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors.

**FR 322. French Foods in French. 4 units.**

Prerequisite: FR 103 or consent of instructor.

Blend of French language, culture, food preparation techniques, and basic food chemistry and nutrition. Total immersion in language and cooking: preparation of French food while interacting in French with classmates and instructors, in lectures, discussion, and laboratory. 3 lectures, 1 laboratory. Crosslisted as FR/FSN 322.

**FR 350. French Literature in English Translation. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course in Area C1.

Selected works to be read by students in English translation. Critical analysis, interpretation, and comparison of works by French and/or Francophone authors. Course may include film and other media. Discussion in English. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors.

**FR 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Conducted in French. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

## Fruit Science (FRSC)

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### Fruit Science Courses

**FRSC 123. Beekeeping. 3 units.**

Studies and exercises in the handling of European honey bees with special reference to pollination of commercial crops. Honey processing and marketing. Hive inspection and disease detection. 2 lectures, 1 laboratory.

**FRSC 132. Pomology I. 4 units.**

Prerequisite: HCS 120.

Orchard design and development, cultural practices, physiological responses of trees to cultural practices, propagation and strategies to maximize orchard profitability and sustainability. Not open to students with credit in FRSC 230. 3 lectures, 1 laboratory.

**FRSC 133. Pomology II. 4 units.**

Prerequisite: FRSC 132.

Analysis of production and management strategies for major fruit and nut crops in California. 3 lectures, 1 laboratory.

**FRSC 202. Enterprise Project. 2-4 units.**

CR/NC

Beginning field experience in management of orchards and vineyards or honeybees, under faculty supervision. Project participation is subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture, variable practicum.

**FRSC 210. Viticultural Practices. 2 units.**

Propagation, layout and planting of a new vineyard, including irrigation and trellis system installations and management practices of established vineyards. Total credit limited to 4 units. 2 activities. Crosslisted as FRSC/WVIT 210.

**FRSC 230. California Fruit Growing. 4 units.**

Interrelationship of climate and cultural techniques on orchard productivity. California's place in the international production-marketing scheme. Field trip required. Not open to AEPS or FRSC majors, or students with credit in FRSC 132. 3 lectures, 1 laboratory.

**FRSC 231. Viticulture I. 4 units.**

Understanding of internal and external factors affecting vine productivity. Historical and international perspectives on grape growing. Vineyard production strategies. 3 lectures, 1 laboratory. Crosslisted as FRSC/WVIT 231.

**FRSC 311. Survey of Viticulture. 4 units.**

Prerequisite: FRSC/WVIT 210 and completion of GE Area B2.

Introduction to winegrowing including the life cycle of the vine, site selection and the concept of 'terroir', canopy management and cultural practices influencing wine quality. Decision making processes in pest management, irrigation strategies, and organic and sustainable vineyard practices. Current issues in mechanization and its impact on labor management, in the concept of business decisions. Not open to students with credit in FRSC 231. 4 lectures. Formerly FRSC 211. Crosslisted as FRSC/WVIT 311.

**FRSC 331. Viticulture II. 4 units.**

Prerequisite: FRSC/WVIT 231.

Factors influencing vine physiology and winegrape quality. Recent advances in irrigation strategies, canopy management, and pest control. Budgets for profitable operation and mechanized viticulture. Field trip required. 3 lectures, 1 laboratory. Crosslisted as FRSC/WVIT 331.

**FRSC 342. Citrus and Avocado Fruit Production. 4 units.**

Prerequisite: FRSC 230 or HCS 120.

World citrus and avocado production and marketing. Orchard management techniques. Relationship of environment to species, cultivar, and rootstock selection. Field trip to a major California production area required. 3 lectures, 1 laboratory.

**FRSC 402. Enterprise Project Management. 2-4 units.**

CR/NC

Prerequisite: FRSC 202 and consent of instructor.

Advanced experience in production of orchards and vineyards. Development of a plan for field operations, a marketing plan, and a budget. Management decision-making. Degree credit limited to 2 units. Credit/No Credit grading only. 1 lecture, variable practicum.

**FRSC 415. Grapevine Physiology. 4 units.**

Prerequisite: FRSC/WVIT 231 and FRSC/WVIT 331.

Understanding of grapevine physiology, including anatomy, taxonomy, physiological growth processes, growth cycle phenology, bud break, flowering, fruit set, berry ripening. 3 lectures, 1 laboratory. Crosslisted as FRSC/WVIT 415.

**FRSC 599. Thesis in Fruit Science. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a significant problem in Fruit Science. Thesis will include problem identification, significance, methods, data analysis, and conclusion. Students must enroll every quarter in which facilities are used or advisement is received. Degree credit limited to 6 units.

## Geography (GEOG)

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## Geography Courses

### **GEOG 150. Introduction to Cultural Geography. 4 units.**

GE Area D3

The interplay of cultures, places, and environments, with emphasis on the diversity, interrelationships, and spatial features of global cultures. Topics include characteristics and patterns of population, ethnicity, agriculture, geopolitics, language, religion, urbanization, industry, and folk and popular culture. 4 lectures. Fulfills GE D3.

### **GEOG 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

### **GEOG 250. Physical Geography. 4 units.**

Addresses the origins and patterns of the earth's diverse assemblage of climates, landforms, biota and soils. A major focus on relationship between human cultures and these earthly environments. 4 lectures. Crosslisted as ERSC/GEOG 250.

### **GEOG 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

### **GEOG 300. Geography of United States. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A, D3. Recommended: Junior standing.

The population (including origin, ethnicity, migration, and distribution), land utilization, and economic development viewed against the background of the physical environment. Topically and regionally organized. Pervading themes include landscape evolution and alteration, regional cultural distinctiveness, and current problems. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

### **GEOG 301. Geography of Resource Utilization. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A, D3. Recommended: Junior standing.

A multicultural, world view of the interconnections of the following resource systems: food, energy, water, and non-fuel minerals. A pervading theme is the sustainability of these systems. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

### **GEOG 308. Global Geography. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

Examination of the major world regions such as Europe, the Middle East, Africa, Asia and Latin America. Focus on the origins and content of contemporary cultural landscapes and on their utility for understanding international differences, interactions, and current events. Particular attention to the relationship between humans and the environment. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

### **GEOG 317. The World of Spatial Data and Geographic Information Technology. 4 units.**

GE Area F

Prerequisite: Completion of GE Area B2.

Basic foundation for understanding the world through geographic information and tools available to utilize spatial data. Application of Geographic Information Systems (GIS) and related technologies, including their scientific basis of operation. Not open to students with credit in LA/NR 218. 3 lectures, 1 activity. Crosslisted as GEOG/LA/NR 317. Fulfills GE Area F.

### **GEOG 318. Applications in GIS. 4 units.**

Prerequisite: Junior standing and computer literacy, or consent of instructor.

ArcGIS Desktop Geographic Information System (GIS) computer software to explore environmental, natural resource, social and economic issues using spatial data. Principles of cartography and map interpretation. Development of data base and software management competencies. 2 lectures, 2 laboratories.

### **GEOG 325. Climate and Humanity. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Geographic perspective on the interrelationships between climate and human cultures. Effects of people on climate and the influence of climate and weather upon human activities and behavior. Focus on global human conditions which are responsible for the alteration of climate and in turn are vulnerable to climate change. 4 lectures. Crosslisted as ERSC/GEOG 325.

### **GEOG 328. Applications in Remote Sensing. 4 units.**

Prerequisite: GEOG 250 and junior standing.

Introduction to the use of satellite imagery to analyze natural and human features on the earth. Applications in geology, water, climate, vegetation, agriculture, and urban land use. Fundamentals of processing digital satellite images. Emphasis on bridging the earth and social sciences. 3 lectures, 1 activity.

### **GEOG 333. Human Impact on the Earth. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Global assessment of the impact of humans on the earth's vegetation, animals, soil, water and atmosphere. Emphasis on problems stemming from the interactions of human attitudes, technologies, and population with natural resources. 4 lectures. Crosslisted as ERSC/GEOG 333.

### **GEOG 340. Geography of California. 4 units.**

Prerequisite: Junior standing.

Geographic analysis of the land and people of California. Patterns of physical environment, natural resources, history, settlement, ethnicity, economy, politics, and urban growth. Current issues in a national and global context. 4 lectures.

### **GEOG 370. Geography of Latin America. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A, D3. Recommended: Junior standing.

Geographic analysis of Mexico, Central America, and South America. The patterns of physical environment, culture, economy, and development. The issues (local, regional, and global) that shape Latin America. 4 lectures. Fulfills GE D5 except for Anthropology/Geography and Social Sciences majors.

**GEOG 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**GEOG 408. Geography of Development. 4 units.**

Prerequisite: GEOG 308 or consent of instructor.

Detailed analysis of international development from a geographical perspective. Survey of various theories of development and their cultural and ecological components at multiple geographic scales, including institutions and actors involved. Applicable skills for development research and practice, emphasizing sustainability. 4 lectures.

**GEOG 414. Global and Regional Climatology. 4 units.**

Prerequisite: Junior standing.

The earth's pattern of climates and the physical processes that account for them. Focus on interrelationships between climate and the physical/biological and cultural environments. Special emphasis on modern climate changes and their consequences. 3 lectures, 1 laboratory. Crosslisted as ERSC/GEOG 414.

**GEOG 415. Applied Meteorology and Climatology. 4 units.**

Prerequisite: GEOG/ERSC 250 or consent of instructor.

Physical processes in the atmosphere that determine regional weather, climate and climate variability. Surface and satellite systems for weather observation, and weather/climate modeling. Dynamics of weather systems, including thunderstorms and hurricanes. Emphases on weather/climate affecting agriculture and other human activities. 3 lectures, 1 activity. Crosslisted as ERSC/GEOG 415.

**GEOG 440. Advanced-Applications in GIS. 4 units.**

Prerequisite: GEOG 318 or consent of instructor.

Applications in Geographic Information Systems (GIS) emphasizing research, methodologies, and career fields to geography, earth sciences, and the social sciences. 2 lectures, 2 laboratories.

**GEOG 455. Anthropology-Geography Research Design and Methods. 4 units.**

Prerequisite: Completion of one GE B2 and two upper division ANT or GEOG classes.

Development of knowledge and skills needed to conduct original scientific anthropology-geography research and prepares students for senior projects. Various empirical methodologies highlighted, with a focus on quantitative design and measurement of human culture, biology, behavior, environment and ecology. 3 lectures, 1 laboratory. Crosslisted as ANT/GEOG 455.

**GEOG 461. Senior Project I. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**GEOG 462. Senior Project II. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**GEOG 464. Professional Preparation for Anthropologists/Geographers. 1 unit.**

CR/NC

Prerequisite: Junior standing, ANT 201, GEOG 150.

Preparation for professional advancement in the fields of anthropology and geography. Supervised career planning emphasizing resume development, selection of an internship or international experience, exploration of career options and graduate programs. Lectures from outside, practicing professionals. Credit/No Credit grading only. 1 seminar.

**GEOG 465. Internship. 3-8 units.**

CR/NC

Prerequisite: GEOG 464, senior standing and/or consent of instructor.

Supervised training, research, and work in public and private organizations. Credit/No Credit grading only. Total credit limited to 18 units.

**GEOG 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1-4 lectures.

## Geology (GEOL)

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### Geology Courses

**GEOL 102. Introduction to Geology. 4 units.**

GE Area B3

Processes responsible for the Earth's minerals, rocks, and structure surface features. Volcanism; mountain building; plate tectonics; weathering. Erosion and deposition by streams, glaciers, wind and waves. Geological resources, earth hazards, and interaction of man with global processes. 3 lectures, 1 discussion. Fulfills GE B3.

**GEOL 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisites: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**GEOL 201. Physical Geology. 3 units.**

Prerequisite: MATH 119.

Processes responsible for the Earth's rocks, structural surface features, geologic hazards, and natural resources, with emphasis on interactions with human activities. 3 lectures.



**GEOL 203. Fossils and the History of Life. 4 units.**

GE Area B5

Fossil record. Geologic time scale. Evolution and the fossil record. Evolution - creation controversy. Early earth and early life. Features, lifestyles, origins, and histories of major invertebrate, vertebrate, and plant groups. Mass extinctions. 3 lectures, 1 discussion. Fulfills GE B5.

**GEOL 204. Geologic History of California. 3 units.**

Development of California through geologic time. Where and why the rocks appeared. Movement on faults, and mountain building. Geologic processes at work today and yesterday. Relationship of California geology to the rest of the world. 3 lectures.

**GEOL 205. Earthquakes. 4 units.**

GE Area B3

World-wide seismicity and plate tectonics. Seismic waves and their recording. Earth structure and composition. Intensity, magnitude, and energy. Major California faults and earthquakes. Paleoseismology, forecasting and prediction. Acceleration, resonance, and effects of ground shaking on structures. Earthquake safety. Tsunamis. 3 lectures, 1 discussion. Fulfills GE B3.

**GEOL 206. Geologic Excursions. 1 unit.**

CR/NC

Field trips to places of geologic interest. The Schedule of Classes will indicate destinations. Students must provide their own transportation, food, and camping equipment. May be repeated for a maximum of 3 units provided field trips are taken to different locations. Credit/No Credit grading only. 1 laboratory.

**GEOL 241. Physical Geology Laboratory. 1 unit.**

Corequisite: GEOL 102 or GEOL 201.

Properties and identification of minerals and rocks. Topographic maps and landform analysis. Geologic maps and interpretation of rock structure. 1 laboratory.

**GEOL 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**GEOL 305. Fundamentals of Seismology. 4 units.**

GE Area B6

Prerequisite: PHYS 132.

Theory of plate tectonics. Elastic waves in layered media. Principle of the seismometer. Seismic properties, structure and composition throughout the Earth. Intensity, magnitude, and seismic moment and energy calculations. Major California faults and earthquakes. Paleoseismology, forecasting and prediction. Analysis of ground motion. Resonance. Effects of ground shaking on structures and bodies of water. Earthquake safety. 3 lectures, 1 laboratory. Fulfills GE B6.

**GEOL 310. Igneous and Metamorphic Petrology. 4 units.**

Prerequisite: GEOL 102 or GEOL 201, and ERSC 223.

Processes associated with melting, igneous crystallization, and metamorphism of igneous and sedimentary rocks. Special attention to relationships with tectonic setting. Required field trip. 3 lectures, 1 laboratory.

**GEOL 330. Principles of Stratigraphy. 4 units.**

Prerequisite: GEOL 102 or GEOL 201, and GEOL 241.

Description and analysis of stratified rock and sediment. Sedimentology, diagenesis, transgressive/regressive sequences, bedform interpretation, marine and terrestrial sediment and sedimentary-rock sequence interpretation, and sequence stratigraphy. Required field trips. 3 lectures, 1 laboratory.

**GEOL 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigations, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**GEOL 401. Field-Geology Methods. 4 units.**

Prerequisite: GEOL 102 or GEOL 201, GEOL 241, GEOL 415, ERSC 223, ERSC 323.

Collecting and interpreting field-geologic data. Description of sedimentary rocks and construction of stratigraphic columns. Mapping geologic structures in the field. Surficial geologic stratigraphy and surficial geologic mapping. Understanding geologic processes through field study. Communicating results of field study. 1 lecture, 3 activities. Crosslisted as ERSC/GEOL 401.

**GEOL 402. Geologic Mapping. 4 units.**

Prerequisite: ERSC/GEOL 401.

Bedrock geologic mapping on topographic maps and aerial photos. Surficial geologic mapping on topographic maps and aerial photos. Correlating and defining surficial geologic map units on the basis of soil development. Understanding landscape evolution using soil development 4 activities. Crosslisted as ERSC/GEOL 402.

**GEOL 415. Structural Geology. 4 units.**

Prerequisite: GEOL 241 and ERSC 223.

Recognition, interpretation, and depiction of geological structures. Understanding rock deformation through the study of faults and folds. 3 lectures, 1 laboratory. Required weekend field trips.

**GEOL 420. Applied Geophysics. 3 units.**

Prerequisite: PHYS 132, GEOL 201.

Introduction to geophysical exploration of the shallow subsurface: seismic refraction, seismic reflection, electrical resistivity, magnetic and gravity methods. Application to determination of subsurface structure, groundwater and mineral resources. 2 lectures, 1 laboratory.

**GEOL 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**GEOL 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

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## German (GER)

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## German Courses

### GER 101. Elementary German I. 4 units.

Beginning German. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing and conversation. Language taught in its intercultural context. 3 lectures, 1 activity.

### GER 102. Elementary German II. 4 units.

Prerequisite: GER 101 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing and conversation. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

### GER 103. Elementary German III. 4 units.

Prerequisite: GER 102 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing and conversation. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

### GER 201. Intermediate German I. 4 units.

GE Area C5

Prerequisite: GER 103 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in German within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5. Formerly GER 121.

### GER 202. Intermediate German II. 4 units.

GE Area C5

Prerequisite: GER 201 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in German within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5. Formerly GER 122.

### GER 203. Intermediate German III. 4 units.

GE Area C5

Prerequisite: GER 202 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in German within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5.

### GER 233. Critical Reading in German Literature. 4 units.

GE Area C1

Prerequisite: Completion of GE Area A and GER 203 or consent of instructor.

Selected readings from German-language authors that show the literary tradition from the Middle Ages to the present. May include film and other media. Conducted in German. 4 lectures. Fulfills GE C1.

### GER 270. Selected Topics. 1-4 units.

Prerequisite: Consent of instructor.

Directed group study of selected topics. Open only to undergraduate students. Conducted in German. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

### GER 301. Advanced German Composition and Grammar. 4 units.

Prerequisite: GER 203 or consent of instructor.

Written and oral development of structural grammar, syntax and complex components of German. Vocabulary expansion and idiomatic construction. Written compositions. May include German/English translation. Conducted in German. 4 lectures.

### GER 302. Advanced German Conversation and Grammar. 4 units.

Prerequisite: GER 203 or consent of instructor.

Oral and written development of structural grammar, syntax and complex components of German. Expansion of vocabulary and idiomatic expressions through topics focusing on culture. Individual and/or group presentations. Conducted in German. 4 lectures.

### GER 305. Significant Works in German. 4 units.

GE Area C4

Prerequisite: Completion of GE Area A and GER 233 or consent of instructor.

Critical analysis and oral discussion of poetry, essays, novels, plays, films, and other media by selected German-language authors. Conducted in German. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors.

### GER 350. German Literature in English Translation. 4 units.

GE Area C4

Prerequisite: Completion of GE Area A and one course in Area C1.

Selected works to be read by students in English translation. Critical analysis, interpretation, and comparison of works by German-language authors. Course may include film and other media. Discussion in English. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors.

### GER 470. Selected Advanced Topics. 4 units.

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Conducted in German. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

## Graduate Studies (GS)

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## Graduate Studies Courses

### **GS 597. Continued Graduate Study. 1-15 units.**

CR/NC

Prerequisite: Must be in good standing in a graduate program at Cal Poly.

Activities other than regular coursework that are needed to complete the requirements for the degree. Analysis of data, thesis and project report writing, oral defense of the thesis/project, preparation for the comprehensive exam, and other activities related to the culminating experience for the student's program. Can be used to fulfill the continuous enrollment requirement for graduate students. Units earned in this course may not be used toward degree completion. Credit/No Credit grading only. Total credit limited to 15 units; repeatable in same term.

## Graduate Studies-Accounting (GSA)

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### Graduate Studies-Accounting Courses

#### **GSA 501. Graduate Accounting Individual Research. 1-4 units.**

Prerequisite: OCOB graduate standing in Accounting and formal petition with approval from the Associate Dean.

Advanced individual research in accounting topics planned and completed under the direction of a member of the college faculty. Designed to meet the needs of qualified students who wish to pursue investigations in accounting which cannot be followed effectively in regularly offered elective courses. A formal written proposal must be accepted by the Associate Dean of OCOB before work begins.

#### **GSA 536. Taxation of Trusts, Estates, and Transfer Taxes. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Income taxation of trusts and estates as flow-through entities; transfer taxation of gifts and estates, including generation-skipping transfers. 4 lectures.

#### **GSA 537. State and Local Taxation. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Multi-state income and franchise taxation; property taxes; sales and use taxes; and the constitutional authority for the imposition of state taxes. 4 lectures.

#### **GSA 538. Current Developments in Taxation. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Current developments in income taxation of individuals, trusts and estates and business entities; transfer taxation of gifts and estates; and ethics and professional responsibility in taxation. 4 lectures.

#### **GSA 539. Clinical Tax Education Internship. 9 units.**

CR/NC

Prerequisite: OCOB graduate standing in Specialization in Tax, MS Accounting program.

Accounting internship that allows graduate level accounting students the opportunity to apply skills and competencies to an employment opportunity. Placement in a full-time supervised work experience at a public accounting firm or in an accounting or internal audit department of a private enterprise or government agency. Credit/No Credit grading only.

#### **GSA 540. Taxation of Corporations and Partnerships. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Comparative study of the taxation of C corporations and flow-through tax entities, including S corporations, partnerships and limited liability companies. Not open to students with credit in BUS 417. 4 lectures.

#### **GSA 541. Advanced Financial Reporting Issues I. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Comprehensive coverage of selected advanced financial accounting and reporting topics. Topics include accounting changes and errors, leases, pensions and other post-employment benefits, income taxes, and consolidated financial statements. 4 seminars.

#### **GSA 542. Auditing. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Survey of the ethical, regulatory and legal environment in which audits occur. An appreciation of how audit risk is assessed, how auditors evaluate clients' internal control structures, the role of evidence in an audit, and the audit reporting requirements. 4 seminars.

#### **GSA 543. Advanced Financial Reporting Issues II. 5 units.**

Prerequisite: GSA 541 and OCOB graduate standing or approval from the Associate Dean.

Comprehensive coverage of selected advanced financial accounting and reporting topics. Topics include financial statement footnote and MD&A disclosures and coverage of SEC statutes, regulations and filing forms. 5 seminars.

#### **GSA 544. Advanced Enterprise Wide Business Processes for Accounting. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Study of various transactions in order to understand the underlying business processes and information flows between various business units, in order for a transaction to occur and be properly reported, and the information determined that is critical for the information system to capture. Emphasis of role of information systems in controlling the authorization of transactions, access to information, access to assets, preparation of accounting records and reports. 3 seminars, 1 activity.

**GSA 545. Applied Accounting Research and Communications. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Advanced use of authoritative accounting and auditing data bases and actual filings by public companies. Frequent writing and speaking exercises. Real world accounting and auditing issues facing public and private enterprises. In-depth coverage of federal and state regulation of securities transactions.

**GSA 546. Tax Research and Administrative Procedures. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Research techniques applicable to tax issues including the communication of research results. Administrative procedures necessary for tax compliance with the various tax jurisdictions with primary emphasis on IRS practices. 2 seminars, 2 activities.

**GSA 548. Advanced Individual Taxation and Tax Planning. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Advanced concepts concerning the impact of taxes on individuals. Introduction to transfer taxes imposed on individuals. Financial, estate and compensation tax planning issues. 4 seminars.

**GSA 549. Advanced Taxation of Flow-Through Entities. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Advanced and special topics related to the income tax treatment of partnerships, limited liability companies, trusts and S corporations and their owners and beneficiaries. Creation, operation, liquidation and sale of such organizations. 4 seminars.

**GSA 550. Advanced Corporate Taxation. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Advanced and special topics related to the income tax treatment of regular corporations and their shareholders. Mergers and acquisitions, tax accounting methods and periods, cross-boundary topics, and current issues. 4 seminars.

**GSA 551. International Taxation. 4 units.**

Corequisite: BUS 417, or BUS 414 and BUS 415, and OCOB graduate standing or approval from the Associate Dean.

Fundamental tax concepts of inbound and outbound investments of U.S. taxpayers, controlled foreign corporations, Subpart F, the foreign tax credit, transfer pricing and contracting country treaties. 4 lectures.

**GSA 552. Fraud Auditing and Examination. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Occupational and financial statement fraud; particular emphasis on the breakdown of corporate governance and ethics systems and developing internal control systems to prevent and detect fraudulent activities. 4 lectures.

**GSA 553. International Accounting. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

International accounting, auditing, and corporate governance standards including international financial reporting standards (IFRS). 4 lectures.

**GSA 554. Advanced Spreadsheet Modeling for Accounting. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Advanced topics in electronic spreadsheets and their use in accounting and financial applications. Developing spreadsheet models for data analysis and decision making. Integrating automation tools and external data sources into spreadsheets. 4 lectures.

**GSA 555. Database Modeling and Analysis for Accounting. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Fundamental concepts in database analysis, design, implementation, administration, and audit including issues such as requirements specification, REA modeling, ER modeling, normalization, SQL, transaction control, database security, and query optimization. May also include topics such as data warehouses, XBRL and ebXML. 4 lectures.

**GSA 556. Financial Accounting and Valuation. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Comprehensive coverage of approaches to the measurement of fair values that are used in accounting situations such as mergers and acquisitions, recognition of stock based compensation, and determination of impairments in the carrying amounts of long-lived assets including intangible assets and goodwill. Role of financial reporting in the valuation of securities, credit analysis, and the determination of the cost of capital. 4 lectures.

**GSA 570. Selected Advanced Topics for Accounting. 1-4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

## Graduate Studies-Business (GSB)

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### Graduate Studies-Business Courses

**GSB 500. Independent Study. 1-4 units.**

Prerequisite: OCOB graduate standing and formal petition with approval from the Associate Dean.

Advanced study planned and completed under the direction of the Director of Graduate Programs. Open only to graduate students who have demonstrated ability to do independent work. A formal written proposal must be accepted by the Associate Dean of OCOB Graduate Programs before work begins.

**GSB 501. Individual Research. 1-4 units.**

Prerequisite: OCOB graduate standing and formal petition with approval from the Associate Dean.

Advanced individual research planned and completed under the direction of a member of the college faculty. Designed to meet the needs of qualified students who wish to pursue investigations which cannot be followed effectively in regularly offered elective courses. A formal written proposal must be accepted by the Associate Dean of OCOB Graduate Programs before work begins.

**GSB 503. Collaborative Industry Project. 1-8 units.**

Prerequisite: OCOB graduate standing and formal petition with approval from the Associate Dean.

Collaborative business project with a client organization that allows graduate level students the opportunity to apply knowledge, skills and competencies to address a business problem. Small teams work in collaboration with a client organization and a faculty advisor. A formal written proposal must be accepted by the Associate Dean of OCOB Graduate Programs before work begins. The project may last up to one year.

**GSB 511. Accounting for Managers. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Emphasis on development of the ability to read and interpret public and internal financial reports. Public reporting responsibilities of companies and management's responsibilities for developing and maintaining effective internal control systems. 3 lectures, 1 activity.

**GSB 512. Quantitative Analysis. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Focus on a variety of statistical techniques that help to transform data into useful information that can be used to make informed business predictions and decisions. 3 seminars, 1 laboratory.

**GSB 513. Organizational Behavior. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Application of behavioral, social and organizational science concepts to management. Individual, team and organizational levels of analysis, including such topics as expectations, perception, motivation, communications, creativity, leadership, cultural and ethical behavior, group dynamics, team effectiveness, work design, organization change and development. 4 seminars.

**GSB 514. The Legal and Regulatory Environment of Business. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Legal and regulatory environment in which business operates. Consideration of historical, societal, and global perspectives reflecting political, social and/or economic beliefs and values. Strong emphasis on fundamental concepts of law and analytical tools to understand interaction between law, ethics and management decisions. 4 seminars.

**GSB 522. Advanced Management Information Systems. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Analysis of the challenges, successes, and failures managers face when planning for and implementing information system initiatives, particularly enterprise systems such as supply chain management, customer relationship management and enterprise resource planning systems. Focus on the strategic and operational impact of emerging information technologies in modern day business management. Design and development of knowledge worker applications including database and decision support systems. 3 lectures, 1 activity.

**GSB 523. Managerial Economics. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Managerial economics, or microeconomics, focuses on private markets. Choices made by firms and consumers within topics that include demand, supply, efficiency, marketing structure, and government intervention. Development of an analytical framework for analyzing how these topics are important for managers. 4 lectures.

**GSB 524. Marketing Management. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Introduction to marketing management. Concepts and principles necessary to plan, direct and control the product, promotion, distribution and pricing strategies of the firm. 4 lectures.

**GSB 525. Project Management. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Focus on project management tools and processes required to establish priorities for and management of projects within normal and abnormal scope, money and time constraints. Planning, organizational and resource challenges common to a variety of project types. Product life cycle, normal operational, new product introduction and profit oriented product family projects reviewed in service and production environments. 3 lectures, 1 laboratory.

**GSB 526. Knowledge Management and Business Intelligence. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Relationships among knowledge management (KM), knowledge organizations and knowledge workers. Mapping of the field of knowledge management and exploration of the nature and key features of KM. Discussion of knowledge management and business intelligence central themes using case studies; alternative ways to design, implement and improve KM systems in organizations; business intelligence, decision support systems and data warehousing. Integration of querying, reporting, OLAP, data mining and data warehousing functions. 3 lectures, 1 activity.



**GSB 528. Commercial Development of Innovative Technologies. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Conceptual business frameworks for commercialization of new and innovative products and technologies. Business aspects of innovative technologies as they relate to core functional areas such as finance, accounting, marketing, operations, and business and intellectual property law. 4 lectures.

**GSB 529. Effective Communication Skills for Managers. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Enhancement of business writing and oral presentation skills, organized around two areas: 1) preparing written business documents and reports, and 2) professional oral presentation skills. Preparation of a variety of business reports and documents. Multiple business presentations. 4 lectures.

**GSB 531. Managerial Finance. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Theories, practices and tools of corporate financial decision making. Topics include valuation of fixed income securities and stocks, capital budgeting, capital structure, dividends, and an overview of financial markets and institutions. Introduction to valuation of derivative securities, market efficiency, and agency costs. 4 seminars.

**GSB 533. Aggregate Economics Analysis and Policy. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Development of the theoretical and empirical framework of the macroeconomy in which businesses must operate. Topics include GDP, inflation, unemployment, interest rates and monetary and fiscal policies. The dynamics of the macroeconomic environment over time. 4 lectures.

**GSB 534. Lean Operations Management. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Introduction to the operations function and its interaction with other areas in an organization. Emphasis on applying lean six sigma thinking to achieve competitive advantage in cost, quality, time, and flexibility in manufacturing and service operations. 4 seminars.

**GSB 537. Corporate Governance in Ethical Organizations. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Coverage of mechanisms, at the firm level, that contribute to more effective corporate governance and ethical climate at publicly traded corporations. Topics include role of boards of directors, audit committees, structures and systems that affect ethical climate in organizations. 4 lectures.

**GSB 538. Emerging Issues in Business. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Focus on one or more developing, cutting-edge issues facing contemporary managers within a specific business discipline. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 seminars.

**GSB 539. Graduate Internship in Business. 2-8 units.**

CR/NC

Prerequisite: OCOB graduate standing and formal petition with approval from the Associate Dean.

Correlation of experience and academic knowledge. Placement in a supervised business or public organization. A formal written proposal must be accepted by the Associate Dean of OCOB Graduate Programs before work begins. Credit/No Credit grading only.

**GSB 555. Negotiation. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Theory and practice of negotiation in a variety of professional and managerial contexts (e.g., business acquisitions, compensation, business disputes, transfer pricing, inter- and intra-organizational) and in one-on-one, group, and team-based arrangements. Includes impact of culture, ethics, dispute resolution, coalitions and use of creativity to develop integrative solutions. 4 seminars.

**GSB 556. Entrepreneurship and New Venture Management. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Exploration of entrepreneurship with emphasis on the formation and management of new business ventures. Analysis of typical operating problems of these firms and application of appropriate techniques for their solution. 4 seminars.

**GSB 562. Seminar in General Management and Strategy. 4 units.**

Corequisite: OCOB graduate standing and GSB 511, GSB 513, GSB 523, GSB 531, GSB 533 and either GSB 512 or IME 503; and either GSB 524 or GSB 573; and either GSB 534 or IME 580, or approval from the Associate Dean.

Application of interdisciplinary skills to business and corporate strategy formulation and implementation. Analysis of interdependence between external environments and internal systems. Focus on responsibilities, tasks, and skills of general managers. Case studies, group problem solving. Integrating course of MBA core curriculum. Course satisfies comprehensive examination requirement. 4 seminars.

**GSB 563. International Business Tour. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Business tour exposure to different management systems and their operating environments. Pre-trip and on-the-road meetings, readings, case studies and discussions. Tours of firms, government offices, ministries, etc; interviews of managers and government officials. Conducted in English. Passport required. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 2 seminars, 2 activities.

**GSB 564. Entrepreneurial Finance. 4 units.**

Prerequisite: GSB 531 and OCOB graduate standing or approval from the Associate Dean.

The process of financing new and fast-growing firms. Preparation of pro forma financial statements for a new venture. Readings on the venture capital process, from seed capital through the initial public offering (IPO). Valuation of firms seeking venture capital, and those planning their IPO. Valuing convertible securities. Real options valuation. 4 lectures.

**GSB 569. Managing Technology in the International Legal Environment. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Practical legal decisions required to conduct business for or with high technology companies. Methods to protect high technology developments in international markets, including copyrights, patents, trade secrets, trademarks and contracts. 4 seminars.

**GSB 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Directed group study of selected topics for advanced students. Total credit limited to 8 units. The Schedule of Classes will list title selected. 1-4 seminars.

**GSB 573. Marketing Research. 4 units.**

Prerequisite: OCOB graduate standing; and GSB 512 or IME 503 or approval from the Associate Dean.

Preparation to become competent users and creators of marketing research information. Focus on collecting customer information as well as analyzing, interpreting and presenting information to be used in executive decision making. 4 lectures.

**GSB 577. Advanced Quantitative Business Analysis. 4 units.**

Prerequisite: GSB 512 and OCOB graduate standing or approval from the Associate Dean.

The necessary conceptual framework of operations research techniques for solving key problems encountered while managing an enterprise. Concepts of linear programming, simulations, network models, inventory models, PERT/CPM, and forecasting techniques. 3 seminars, 1 laboratory.

**GSB 578. International Business Management. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Managerial concepts and techniques appropriate for analysis and decision making within international businesses. Environmental and organizational factors influencing multinational operations. Assessing international market opportunities and entry modes. Complexities of multinational management strategy, structure and systems. 4 seminars.

**GSB 579. Manufacturing Strategy. 4 units.**

Prerequisite: GSB 534 and OCOB graduate standing or approval from the Associate Dean.

Strategic role of manufacturing in the overall corporate competitive strategy. Matching manufacturing capabilities and marketing needs, capacity planning, matching process technology with product requirements. Developing flexible capabilities, central to developing and implementing an effective manufacturing strategy. 4 seminars.

**GSB 583. Management of Human Resources. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

An overview of the major functional and support activities in the personnel/human resource field, including strategic human resource planning, job analysis, recruitment, selection, performance appraisal, compensation, employee rights, and employee safety and health. 4 seminars.

**GSB 584. Corporate Financial Policy. 4 units.**

Prerequisite: GSB 531 and OCOB graduate standing or approval from the Associate Dean.

An overview of the factors that affect corporate financial decisions, including firms' financing, investment and hedging policies. Factors included: taxes, transaction costs, contracting (between managers and shareholders, and between shareholders and other claimholders such as bondholders), and asymmetric information. 3 seminars, 1 activity.

**GSB 585. Investment Portfolio Management. 4 units.**

Prerequisite: GSB 531 and OCOB graduate standing or approval from the Associate Dean.

The application of financial theory to the problems of investment management. Topics cover the valuation of basic financial instruments, portfolio optimization, risk management, asset allocation, the CAPM, and market efficiency. Required use of optimization software and writing spreadsheet programs. 4 seminars.

**GSB 587. International Financial Management. 4 units.**

Prerequisite: GSB 531 and OCOB graduate standing or approval from the Associate Dean.

The international aspects of corporate finance and investing. Balance of payments, foreign exchange with emphasis on exchange rate determination, exchange risk, hedging, and interest arbitrage, international money and capital markets, international financing, and international banking. 4 seminars.

**GSB 589. Accounting Policy. 4 units.**

Prerequisite: GSB 511 and OCOB graduate standing or approval from the Associate Dean.

Role of management in establishing and directing accounting policy. Coverage includes the impact of management decisions on external reporting and taxes and the impact of financial reporting requirements on management decisions. 4 seminars.

**GSB 595. Managing Change. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

The knowledge and the elementary skills/competencies needed to intervene in an organization in order to improve its effectiveness. Design and use of action to improve organizational effectiveness. 4 seminars.

**GSB 596. Economic Forecasting. 4 units.**

Prerequisite: GSB 512, GSB 523 and OCOB graduate standing or approval from the Associate Dean.

Applications to business planning of selected economic forecasting techniques. Classical time series analysis, Box-Jenkins (ARIMA) models, leading indicators and input-output analysis. 3 seminars, 1 laboratory.

**GSB 597. Seminar in Selected Economic Problems. 4 units.**

Prerequisite: GSB 523 and OCOB graduate standing or approval from the Associate Dean.

Selected economic problems analyzed at an advanced level in a particular field, such as international trade, public finance, urban, industrial organization or transportation. 4 seminars.

## Graphic Communication (GRC)

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## Graphic Communication Courses

### **GRC 101. Introduction to Graphic Communication. 3 units.**

Graphic communication history, theory, processes, applications, and practices. New technologies that affect day-to-day communication including traditional and digital printing and publishing, and non-print imaging including Internet applications. Overview of design technology, web and digital media, printing and imaging management, graphics for packaging, industry segments. 3 lectures.

### **GRC 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor; Graphic Communication majors only.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

### **GRC 201. Digital Publishing System. 3 units.**

Prerequisite: Graphic Communication majors only.

Introduction to web and print publishing systems including hardware, software, design considerations, and file formats. Overview of output technologies, networking, and digital publishing standards. 2 lectures, 1 laboratory.

### **GRC 202. Digital Photography. 3 units.**

Prerequisite: GRC 101 and either GRC 201 or GRC 377; Graphic Communication majors only.

Digital photography for print and web, including lighting, exposure, composition, photo-retouching, equipment, color management, and output. 2 lectures, 1 laboratory.

### **GRC 203. Digital File Preparation and Workflow. 3 units.**

Prerequisite: GRC 202 or ART 184; Graphic Communication majors only.

Terminology and techniques used in digital workflow systems for print and web. Workflow options, including automation, proofing, and output systems. Digital file delivery and transfer. 2 lectures, 1 laboratory.

### **GRC 204. Introduction to Contemporary Print Management and Manufacturing. 4 units.**

Prerequisite: GRC 101; Graphic Communication majors only.

Survey of management fundamentals and components relevant to graphic communication manufacturing, production, operations, and quality. Introduction to management theory and contemporary management trends and practices in the graphic communication industry. Course may be offered in classroom-based or online format. 4 lectures.

### **GRC 211. Substrates, Inks and Toners. 4 units.**

Prerequisite: GRC 101; Graphic Communication majors only.

Technical aspects of paper, other substrates, inks, toners, and other printable materials used in the printing and packaging industries. Manufacture, application and interaction of these materials in relation to particular processes and end use requirements. Hands-on testing of materials in relation to quality, properties, and performance. 3 lectures, 1 laboratory.

### **GRC 212. Substrates, Inks and Toners: Theory. 3 units.**

Prerequisite: GRC 101 and GRC minors only.

Technical aspects of paper, other substrates, inks, toners and other printable materials used in the printing and packaging industries. Manufacture, application, and interaction of these materials in relation to particular processes and end use requirements. Credit not allowed for GRC majors. 3 lectures.

### **GRC 218. Digital Typography. 4 units.**

Prerequisite: GRC 202 and GRC 203; Graphic Communication majors only.

Application of typography using current software tools for print and web. In-depth study of communication principles and visual organization. Font technology and management for the creative, print and web publishing industries. 3 lectures, 1 laboratory.

### **GRC 260. Introduction to Research Methods in Graphic Communication. 3 units.**

Prerequisite: GRC 101; Graphic Communication majors only.

Introduction to research methods for preparing scholarly and defensible papers and projects, and in conducting qualitative and quantitative evaluations, testing and research in graphic communication. Methods covered include the scientific method, historical research, descriptive research, questionnaires, interviewing, content analysis, and case studies. Rules for conducting and reporting research are addressed. 2 lectures, 1 activity.

### **GRC 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor; Graphic Communication majors only.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

### **GRC 316. Flexographic Printing Technology. 3 units.**

Prerequisite: GRC 211; Graphic Communication majors only.

Flexographic printing technology for flexible packaging, label printing, folding and corrugated cartons. Optimization of file preparation, plate imaging, and equipment settings. Specification and management of automated workflows. 2 lectures, 1 laboratory.

### **GRC 320. Managing Quality in Graphic Communication. 4 units.**

Prerequisite: GRC 328 and STAT 217; Graphic Communication majors only.

Theory and practices of quality management in the graphic communication industry. Quantifying customer expectations, specifications, standard operating procedures, SPC tools, and employee empowerment. Principles of Lean Management, Six Sigma, ISO, and Malcolm Baldrige. 3 lectures, 1 laboratory.

### **GRC 322. Advanced Digital Typography. 3 units.**

Prerequisite: GRC 218; Graphic Communication majors only.

Advanced typographic principles relating to print and electronic media. Page layout and font management with consideration for electronic media. Applied problems focusing on typographic design, typographic application and file preparation. 2 lectures, 1 laboratory.

**GRC 324. Binding, Finishing and Distribution Processes. 3 units.**

Prerequisite: GRC 101; Graphic Communication majors only.

Imposition techniques, cutting, and folding. Stitch, case and perfect binding techniques and applications. Operational and aesthetic uses of die cutting, scoring, creasing, foil stamping and embossing techniques. Fulfillment and mailing operations. Applications of computers to the management and technical function of binding; finishing and distribution. 2 lectures, 1 laboratory.

**GRC 325. Binding and Finishing Processes: Theory. 2 units.**

Prerequisite: GRC 101 and GRC minors only.

Imposition techniques, cutting and folding. Stitch, case and perfect binding techniques and applications. Operational and aesthetic uses of die cutting, scoring, creasing, foil stamping and embossing techniques. Fulfillment and mailing operations. Applications of computers to the management and technical function of binding; finishing and distribution. Credit not allowed for GRC majors. 2 lectures.

**GRC 328. Sheetfed Printing Technology. 4 units.**

Prerequisite: GRC 211 or GRC 212 and Graphic Communication majors only.

Theory, practice and application of sheetfed printing and plate technology for commercial, book, advertising, catalog, packaging and reprographic segments of the printing industry. Press configurations, materials, computerized press controls, workflow, pressroom management, coating and quality control. Plate types, quality and new technologies for sheetfed printing. 3 lectures, 1 laboratory.

**GRC 329. Web Offset and Gravure Printing Technologies. 3 units.**

Prerequisite: GRC 328; Graphic Communication majors only.

Introduction to web offset and gravure printing for newspapers, packaging, magazines, books, catalogs and commercial products. Application of technology to the management and production of web offset and gravure printing. Preparation and use of gravure cylinders. 2 lectures, 1 laboratory.

**GRC 331. Color Management and Quality Analysis. 4 units.**

Prerequisite: Completion of GE B3 and either GRC 202 or ART 182; Graphic Communication majors only.

The physics, psychology, measurement, analysis and management of color for print and electronic documents. Practical application of color correction, color proofing, and production workflows that ensure the best possible color reproduction. 3 lectures, 1 activity.

**GRC 337. Consumer Packaging. 3 units.**

Prerequisite: GRC 203.

Problem-solving strategies for package printing that integrate concepts from marketing, design and technology. Package manufacturing, function, quality, visual appeal, and economics are addressed. 2 lectures, 1 laboratory.

**GRC 338. Digital Content Management and Variable Data Publishing. 4 units.**

Prerequisite: GRC 202, GRC 203 and GRC 218; Graphic Communication majors only.

Digital content management for print, web, and personalized communication. File management, database principles, archiving, document formats, variable data publishing, groupware, and repurposing content. Technical and creative problem-solving for content management in print and web publishing. 3 lectures, 1 laboratory.

**GRC 339. Web Design and Production. 4 units.**

Prerequisite: GRC 338; Graphic Communication majors only.

Advanced design and production techniques for web development. Current software applications and technologies for user interface design, site structure and information architecture. 3 lectures, 1 laboratory.

**GRC 357. Specialty Printing Technologies. 3 units.**

Prerequisite: GRC 202; Graphic Communication majors only.

Specialty printing and imaging technologies used in fabric decorating, decals for marketing, industrial, and functional printing, security printing and various forms of packaging. Printing on various materials using special processes including screen printing, pad printing, sublimation printing, digital imaging, and post print finishing. 2 lectures, 1 laboratory.

**GRC 361. Marketing and Sales Management for Print and Digital Media. 4 units.**

Prerequisite: GRC 101 and GRC 204; Graphic Communication majors only.

Identification and development of target markets for products and services in the graphic communication industry. Deployment of strategies in pricing, promotion and distribution management. Application of customer relationship management techniques for personal selling, forecasting and planning. 3 lectures, 1 laboratory.

**GRC 377. Web and Print Publishing. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of Area B.

Web and print publishing technology and its impact on society. The technologies of digital photography, typography, graphics, layout, and design for print and web publishing including decision-making considerations. The application of scientific and mathematical principles to web and print publishing technologies. 3 lectures, 1 laboratory. Fulfills GE Area F except for Graphic Communication majors.

**GRC 388. Sustainable Communication Media. 4 units.**

Prerequisite: Junior standing and completion of Area B; Graphic Communication majors only.

Sustainable communication media and its impact on society, including advertising, printing, publishing and packaging. Production, procurement, and supply-chain perspectives. Scientific and quantitative approaches to continuously improving media for businesses, products or services. Media's environmental, social and economic performance. 4 lectures.

**GRC 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor; Graphic Communication majors only.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.



**GRC 402. Digital Printing and Emerging Technologies in Graphic Communication. 3 units.**

Prerequisite: GRC 218; Graphic Communication majors only.

Study of the theory, technology, economics and application of digital printing processes. Preparation and color management of files for digital printing and digital print workflows. Emerging graphic communication technologies affecting the methods of production and distribution of print and electronic media. Exploration of technological changes in graphic communication. 2 lectures, 1 activity.

**GRC 403. Estimating for Print and Digital Media. 4 units.**

Prerequisite: GRC 328; Graphic Communication majors only.

Estimating the cost of various print and digital products and services. Development of cost rates and production standards. Cost estimating methods for Print on Demand, VDP, sheetfed lithography, web development, and wide-format output. Analysis of material, labor and other cost factors. 3 lectures, 1 laboratory.

**GRC 411. Strategic Trends and Profitability Issues in Print and Digital Media. 4 units.**

Prerequisite: GRC 403 and senior standing; Graphic Communication majors only.

Graphic communication industry market trends and strategic positioning. Strategies for successfully positioning a business. Cost paradigms and business practices for graphic communication companies. Company analysis using financial ratios and case studies. Innovative management practices in the graphic communication industry. 3 lectures, 1 activity.

**GRC 421. Production Management for Print and Digital Media. 4 units.**

Prerequisite: GRC 320; Graphic Communication majors only.

Application of management principles and production control methodologies for print and digitally-imaged products. Organization and financial analysis, decision-making, equipment and inventory planning, resource optimization, and the application of practiced and newly innovative contemporary world-class techniques for improving profitability in the graphic communication industry. 3 lectures, 1 activity.

**GRC 422. Human Resource Management Issues for Print and Digital Media. 4 units.**

Prerequisite: GRC 403 and senior standing; Graphic Communication majors only.

Human resource management integrated into the success of graphic communication companies. A comprehensive management approach is utilized emphasizing employee development, training, promotion, and motivation. Conflict management, facilitation skills, team building empowerment, leadership, ethical and legal issues in the graphic communication industry. 3 lectures, 1 laboratory.

**GRC 429. Digital Media. 3 units.**

Prerequisite: GRC 338; Graphic Communication majors only.

Current digital media technology and production including audio, video, e-books, and animation. Industry standards, digital rights management, file formats, and publishing options for digital media. Legal, ethical, and business issues surrounding digital media. 2 lectures, 1 laboratory.

**GRC 431. Printing Plant Layout Analysis. 3 units.**

Prerequisite: GRC 421; Graphic Communication majors only.

Elements of printing plant site selections, equipment planning, inventory planning, and workflow optimization. Design and layout of printing plants for effective space utilization. Organization of plant services. 2 lectures, 1 activity.

**GRC 432. Imaging Systems Management. 4 units.**

Prerequisite: GRC 338.

Management issues associated with the introduction and use of computerized electronic prepress systems. Strategic, technical, marketing, financial, production, operational, and personnel aspects of color prepress work in a capital-intensive environment. 4 lectures.

**GRC 439. Book Design Technology. 4 units.**

Prerequisite: Senior standing, GRC 402; Graphic Communication majors only.

Advanced creative problem-solving strategies associated with the technologies used in book design and production. Advanced techniques in page layout, design, typography, type specification and image manipulation as they relate to output technology. Content, format and distribution of print and electronic books. 3 lectures, 1 laboratory.

**GRC 440. Magazine Design Technology. 4 units.**

Prerequisite: Senior standing, GRC 402; Graphic Communication majors only.

Concept development of magazine and publication design technology. Design and technical considerations as they relate to output technology. Application of organizational structures such as grids, formatting and sequential design. Advanced techniques in typography and image manipulation. Content, format and distribution of print and electronic magazines. 3 lectures, 1 laboratory.

**GRC 451. Management Topics in Graphic Communication. 3 units.**

Prerequisite: GRC 101 and GRC 201; Graphic Communication majors only.

Current trends and practices in select graphic communication management topics. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures.

**GRC 452. Emerging Technologies in Graphic Communication. 3 units.**

Prerequisite: GRC 101 and GRC 201; Graphic Communication majors only.

Current trends and practices in select graphic communication emerging digital topics. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures.

**GRC 453. Design Reproduction Topics in Graphic Communication. 3 units.**

Prerequisite: GRC 101 and GRC 201; Graphic Communication majors only.

Current trends and practices in select graphic communication design reproduction topics. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures.



**GRC 460. Research Methods in Graphic Communication. 2 units.**

Prerequisite: Senior standing and STAT 217; Graphic Communication majors only.

Research methods for preparing scholarly papers including senior projects. Qualitative and quantitative research in graphic communication. Statistical, historical, and descriptive methods including questionnaires, interviewing, and sampling. 1 lecture, 1 activity.

**GRC 461. Senior Project. 3 units.**

Prerequisite: GRC 460; Graphic Communication majors only.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in formal report. Minimum 90 hours total time.

**GRC 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: GRC 101 and GRC 201 and Graphic Communication majors only.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**GRC 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor; Graphic Communication majors only.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**GRC 472. Applied Graphic Communication Practices. 2 units.**

Prerequisite: GRC 101; Graphic Communication majors only.

Application of theories and practices to University Graphic Systems as they apply to commercial printing, publication printing, digital media and graphic communication industries. Major credit limited to 4 units; total credit limited to 18 units. 2 lectures.

**GRC 473. Applied Graphic Communication Management Practices. 2 units.**

Prerequisite: GRC 472 and consent of instructor; Graphic Communication majors only.

Management theories and practices in the graphic communication industry. Application of theories and practices to University Graphic Systems as they apply to commercial printing, publication printing, digital media, marketing, sales, customer service, and production cost centers. Major credit limited to 6 units; total credit limited to 18 units. 2 lectures.

**GRC 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor; Graphic Communication majors only.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 12 units. Credit/No Credit grading only.

**GRC 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor; Graphic Communication majors only.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters.

Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 12 units. Credit/No Credit grading only.

**GRC 500. Special Problems in Graphic Communication for Graduate Students. 2 units.**

Prerequisite: Graduate standing and consent of instructor.

Investigation, research, studies of problems in the graphic communication industry. Repeated course over four quarters working with University Graphic Systems, the Graphic Communication Institute at Cal Poly, and with individual faculty. Total credit limited to 8 units.

**GRC 501. Survey of Functional Printing. 2 units.**

Prerequisite: Consent of Printed Electronics and Functional Imaging Graduate Coordinator.

Foundations for emerging functional printing fields including printed electronics, active packaging, and security printing. Emphasis on processes, materials, electrical characterization, sensing, barrier properties, and anti-counterfeiting. Focus on applications including lighting, displays, novel electronics, energy harvesting, energy storage, sensors, scavengers, and brand security. Course offered online only. 2 lectures.

**GRC 502. Orientation to Functional Printing. 2 units.**

Corequisite: GRC 501 and admission to the MS Printed Electronics and Functional Imaging program. Recommended: GRC 211, GRC 316, GRC 329, and GRC 359.

Orientation and laboratory exploration for printed electronics, active packaging, and security printing. Introduction to curricula, lab activities, research opportunities, and the use of equipment. Active participation in laboratory experiments related to processes and materials. 1 lecture, 1 laboratory.

**GRC 510. Materials for Functional Printing. 4 units.**

Corequisite: GRC 501.

Study of functional materials including substrates, coatings, and inks. Focus on barrier and heat-stable substrates as well as conductive, semi-conductive, dielectric, transparent conductors, forensic, sensor, and other functional inks and coatings. Emphasis on rheology, morphology, sintering and annealing. Course offered online only. 4 lectures.

**GRC 512. Printing and Coating Technologies. 4 units.**

Corequisite: GRC 501.

Study of functional printing and coating technologies, including screen printing, flexography, gravure, ink jet, offset, slot die, blade coating and conventional deposition techniques. Course offered online only. 4 lectures.

**GRC 514. Optical and Electrical Patterning. 4 units.**

Corequisite: GRC 501.

Imaging technologies and processes for security, electronic, and active packaging printing. Focus on creating and evaluating images for applications in product security and electrical fabrication. Course offered online only. 4 lectures.

**GRC 520. Functional Printing Product and Business Development. 4 units.**

Prerequisite: GRC 512 or GRC 514.

Principles of business and product development for electronic and functional applications. Focus on intellectual property rights, capital funding, entrepreneurship, and management of a technology business. Course offered online only. 4 lectures.

**GRC 530. Functional Printing Workflows. 4 units.**

Prerequisite: GRC 502, GRC 512, and GRC 514.

Evaluation of advanced imaging technologies for functional printing applications. Imaging characteristics for ink/substrate combinations, focusing on print process attributes. Compensation for print characteristics. Enabling automated workflow technologies to improve throughput and minimize errors. 2 lectures, 2 laboratories.

**GRC 551. Current Trends in Printed Electronics. 4 units.**

Corequisite: GRC 502.

Current trends and practices in select printed electronics topics. Open to graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 laboratory.

**GRC 552. Current Trends in Active Packaging. 4 units.**

Corequisite: GRC 502.

Current trends and practices in select active packaging topics. Open to graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 laboratory.

**GRC 553. Current Trends in Security and Anti-Counterfeiting. 4 units.**

Corequisite: GRC 502.

Current trends and practices in select security and anti-counterfeiting topics. Open to graduate students. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 laboratory.

**GRC 560. Research Methods in Printed Electronics and Functional Imaging. 2 units.**

Corequisite: GRC 530.

Methods for conducting qualitative and quantitative evaluations, testing, and experimentation as well as writing investigative, scholarly research papers and theses in functional printing. Topics include qualitative research, descriptive research, experimental design, statistical analysis, writing styles, and publishing options. 1 lecture, 1 activity.

**GRC 595. Cooperative Education Experience. 8-12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 12 units. Credit/No Credit grading only.

**GRC 596. Research Project in Printed Electronics and Functional Imaging. 3 units.**

Prerequisite: GRC 560.

Comprehensive research project in printed electronics and functional imaging. Communication of the results and findings of scholarly work in written report and by oral presentation.

## History (HIST)

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### History Courses

**HIST 100. Introduction to the Study of History. 2 units.**

Introduction to the study of history, focusing on methods, topics, skills in the History major at Cal Poly, and internship and career opportunities. To be taken in the first year of study at Cal Poly. 2 seminars.

**HIST 110. Western Civilization: Ancient to Renaissance. 4 units.**

Beginnings of western civilization from the river valley societies of the Middle East, circa 3,000 BCE to the Renaissance in Western Europe to 1550 CE. Political, economic, social, intellectual, and artistic development of that period. 4 lectures.

**HIST 111. Western Civilization: Reformation to the Present. 4 units.**

Development of western civilization from 1550 CE to the present. Comparison of liberal modernization of the West with the conservative modernization in Central, East and Southeast Europe. Political, economic, social, intellectual, and artistic developments of that period. Particular attention to understanding dynamics that produce pluralistic mass societies such as Great Britain and France, and authoritarian mass societies such as Nazi Germany and the Soviet Union. 4 lectures.

**HIST 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 4 units per quarter.

**HIST 201. United States History to 1865. 4 units.**

GE Area D1; USCP

Survey of the first half of U.S. history, including: contact and settlement, American Revolution, slavery, westward expansion, early California, Civil War, and California and U.S. Constitutions. Particular attention to how race, class, and gender shaped changing definitions of freedom and equality. Not open to students with credit in HIST 207. 4 lectures. Fulfills D1 and USCP.

**HIST 202. United States History Since 1865. 4 units.**

GE Area D1; USCP

Survey of the second half of U.S. history, including reconstruction, industrialization, the regulatory state, foreign affairs, and the remaking of citizenship rights and society. Particular attention to how race, class, and gender shaped changing definitions of freedom and equality. Not open to students with credit in HIST 207. 4 lectures. Fulfills GE Area D1 and USCP.

**HIST 206. American Cultures. 4 units.**

GE Area D1; USCP

The social, cultural, constitutional, and political history of African American, Asian American, Native American, European American, and Latino/a men and women. Not open to students with credit in HIST 201 or HIST 202. 4 lectures. Fulfills GE D1 and USCP.

**HIST 207. Freedom and Equality in American History. 4 units.**

GE Area D1; USCP

The multiple and conflicting ways in which various Americans (defined in terms of race, class and gender) have struggled to formulate and promote their own understandings of freedom and equality, from the pre-conquest era to the present. 4 lectures. Not open to students with credit in HIST 201 or HIST 202. Crosslisted as HIST/HNRS 207. Fulfills GE D1 and USCP.

**HIST 208. Survey of California History. 4 units.**

USCP

Survey of California history from the pre-Columbian period to the present. Native American culture, Spanish imperialism, the Mexican War, gold rush, immigration, dominance of the Southern Pacific Railroad, progressivism, growth of Los Angeles, and California's impact on national and world economy and politics. 4 lectures. Fulfills USCP.

**HIST 210. World History I. 4 units.**

GE Area D3

Global history from the beginnings of organized agriculture to the Industrial Revolution. Focus on causation, using geography and cultural creation to highlight economic, political, social, and intellectual developments of the major civilizations of earth. Priority given to Liberal Studies majors. 4 lectures. Fulfills GE D3.

**HIST 213. Modern Political Economy. 4 units.**

GE Area D2

The relationship between states and economies in the modern period. Themes of modernization, industrialization, and colonial expansion. The major theories of political economy, especially liberalism and socialism. 4 lectures. Crosslisted as HIST/HNRS 213. Fulfills GE D2.

**HIST 214. Political Economy of Latin America and the Middle East. 4 units.**

GE Area D2

Comparative examination of socio-economic structures of the Middle East and Latin America in the framework of global economy. Analysis of the historical context of integration of these two regions in the international economic system and the local reactions to the effects of global forces on national structures. 4 lectures. Fulfills GE D2.

**HIST 216. Comparative Social Movements. 4 units.**

GE Area D3

History of global social movements from the late nineteenth century to the present. May include, but not limited to: socialism, nationalism, feminism, fascism and communism, pacifism, life reform, gay liberation, indigenous peoples' movements, and environmentalism. Includes a service learning component. 4 lectures. Fulfills GE D3.

**HIST 221. World History, Beginnings to 1000. 4 units.**

GE Area D3

History of world societies in comparative global perspective. Cross-cultural exchange, interaction, and conflict in the making of the world to 1000, concentrating on the rise of earliest human communities, growth of states, economic, political, and cultural transformations. 4 lectures. Fulfills GE D3.

**HIST 222. World History, 1000 - 1800. 4 units.**

GE Area D3

History of world societies in comparative global perspective. Cross-cultural exchange, interaction, and conflict in the making of the world to 1800, concentrating on the global interaction and integration, cultural and ecological exchange, economic, political, and cultural transformations. 4 lectures. Fulfills GE D3.

**HIST 223. World History, 1800 - Present. 4 units.**

GE Area D3

Comparative history of Western and non-Western societies in global perspective. Cross-cultural exchange, interaction, and conflict in the making of the modern world, with focus on the economic, political, and cultural transformations that facilitated and emerged from imperialism. 4 lectures. Crosslisted as HIST/HNRS 223. Fulfills GE D3.

**HIST 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**HIST 300. Junior Seminar. 4 units.**

Prerequisite: Completion of GE Area A and one course from Area D2 or D3. Recommended: Junior standing.

Historical analysis of selected problems and topics for undergraduates. Seminar format, intense discussion of readings and issues. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 seminars.

**HIST 303. Research and Writing Seminar in History. 5 units.**

Prerequisite: History major or minor, completion of GE Areas A1 and A3, or consent of instructor.

Designed to develop student's ability to research and write an interpretive paper on a specific topic. Seminar participants practice the skills of library research, historical and historiographical analysis, and writing and revising. Paper in lieu of final examination. The Schedule of Classes will list topic selected. 4 lectures and research project.

**HIST 304. Historiography. 4 units.**

Prerequisite: HIST 303; History major.

Theoretical approaches used to study the past, including scholarship on history and memory, the influence of interdisciplinary studies, the significance of race and gender as categories of analysis, and the place of history and the historian in contemporary society. 3 seminar meetings and research project.

**HIST 306. The Witch-Hunt in Europe, 1400-1800. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D3. Recommended: Junior standing.

A history of the development of witchcraft ideas, persecutions, and skepticism in the western world from 1400 to 1800, focusing on the legal, economic, social, and intellectual currents that produced, fired, and eventually ended the phenomenon. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 307. European Thought 1800-2000. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from D1, D2 or D3. Recommended: Junior standing.

Intellectual and cultural history of Europe from the nineteenth century to the present. Liberalism, radical thought, feminism, evolutionary theory, psycho-analysis, structuralism, existentialism, and postmodernism. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 308. The Trans-Atlantic Slave Trade. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from D2 or D3. Recommended: Junior standing.

The African, Islam and Euro-American dimensions of the trans-Atlantic slave trade, with focus on its varying roots, organization and impact on cross-cultural and global levels. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 309. Cultures of West Africa and the African Diaspora. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from Area D2 or D3. Recommended: Junior standing.

The cultures of West African and the African Diaspora, with special attention to the intersection of Animist, Islamic and Western cultures, and the survival of African cultures in the Americas as manifested in the artistic, religious, literary, and other humanistic legacies of the African Diaspora. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 310. East Asian Culture and Civilization. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from GE Area D2 or D3. Recommended: Junior standing.

The pre-modern and modern histories of China and Japan. Focus on the traditional era, the transition to modernity, cultural uniqueness within East Asian civilization, and western images of Asia. 4 lectures. Crosslisted as HIST 310/HNRS 312. Fulfills GE D5 except for History majors.

**HIST 314. Middle East. 4 units.**

Prerequisite: Junior standing.

Political, social, and economic development of the Middle Eastern countries in the context of regional history and international politics since the birth of Islam. Particular attention to the resurgence of religious movements and their connection with nationalism and anti-colonialism in the region. 3 lectures and research project.

**HIST 316. Modern East Asia. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from Area D2 or D3. Recommended: Junior standing.

Modern histories of China, Japan and Korea: great disruptions of modernity that have transformed these societies, common characteristics of modernity in East Asia, great differences between Chinese, Japanese and Korean histories, and the mutually constitutive nature of these East Asian histories. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 317. The Lure of the Sea. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course in from Area D1, D2 or D3. Recommended: Junior standing.

The history of the sea, people who travel across it, live alongside or in the midst of it, or simply seek it out. Topics include imperialism, maritime commerce, port cities, littoral societies, piracy, tourism, popular culture. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 318. The City in the Modern World. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from Area D1, D2 or D3. Recommended: Junior standing.

Comparative history of social, economic, political, and cultural changes in urban life during the nineteenth and twentieth centuries. Topics may include but are not limited to: commerce and labor; disease and death; conservation and preservation; gender and sexuality; race and ethnicity. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 319. Modern South and Southeast Asia. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from Area D2 or D3. Recommended: Junior standing.

Modern histories of South and Southeast Asia: traditional empires and cultures, spread of modern capitalism, Western and Japanese colonialism, decolonization and independence, ethnic and religious tensions, roles in contemporary economy and geopolitics. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 320. Colonial and Revolutionary America. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

Settlement and evolution of British America, background to the imperial dispute, events leading to the Revolution, Articles of Confederation, Constitution, the national economy, roles of and impact on African-Americans, women, Native Americans and Loyalists. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 321. Civil War America. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

The experiences of nineteenth-century Americans. Focus on industrialization, antebellum reform, slavery, the Civil War battlefield and homefront, Reconstruction, and the creation of a New South. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 322. Modern America. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

American history since 1900. Focus on domestic and foreign policy interactions, struggle of disenfranchised groups for social and political equality, and changes in culture and identity. 4 lectures. Crosslisted as HIST 322/HNRS 323. Fulfills GE D5 except for History majors.

**HIST 323. Versions of the Past: Novels, Comics and Movies. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

An introduction to historical novels, comics, movies, memoirs and autobiographies as forms of historical representation in the contemporary U.S. Exploration of the vision of American history that each work presents and the truth-claims made for that particular vision. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 324. The Historical Novel in the United States, 1960s to the Present. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

An introduction to the historical novel as it has developed in the United States since the 1960s. Exploration of how historical novels typically represent the past and the ways in which they change our notion of what counts as 'history.' 4 lectures. Crosslisted as HIST/HNRS 324. Fulfills GE D5 except for History majors.

**HIST 334. Modern Europe, 1789-1914. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two courses from Area D1, D2 or D3. Recommended: Junior standing and HIST 111.

Europe's 'long nineteenth century' reveals continuity and dramatic changes in politics, social structures and identities, forms of cultural expression, and scientific and technological knowledge. Topics include the French and Industrial revolutions; liberalism; nationalism; socialism; modernism; imperialism; and World War I. 4 lectures. Crosslisted as HIST/HNRS 334. Fulfills GE D5 except for History majors.

**HIST 335. Modern Europe, 1914-Present. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two courses from Area D1, D2 or D3. Recommended: Junior standing and HIST 111.

Examination of twentieth-century European history. Topics include: First World War, World Economic Crisis, communism, fascism, mass culture, shifting gender roles, Second World War, Cold War, Velvet Revolution, and the European Union. 4 lectures. Crosslisted as HIST/HNRS 335. Fulfills GE D5 except for History majors.

**HIST 336. Britain at War: The British, the Americans and the Struggle for Freedom, 1939-1945. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1 and one course from D2 or D3. Recommended: Junior standing.

Historical examination of Great Britain's challenge to its sovereignty and freedom by the regime of Nazi Germany from 1939-1945. An account of how Britain formed an alliance with the United States, and how that partnership forged a successful campaign that culminated in the survival of Britain and destruction of the Nazi regime. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 339. Colonial Latin America. 4 units.**

Prerequisite: Junior standing.

Survey of Latin American history in the colonial period from 1492 to the early nineteenth century. Special attention to the indigenous cultures, the Iberian civilization, and the evolving relationship between them. 3 lectures and research project.

**HIST 340. Modern Latin America. 4 units.**

Prerequisite: Junior standing.

Social and political history of South America, Mexico, and Cuba during the nineteenth and twentieth centuries. Historical development of economic structure and socio-political and cultural institutions in the region. 3 lectures and research project.

**HIST 341. Modern Central America. 4 units.**

Prerequisite: Junior standing.

Political, social, and economic development of Central American countries in the context of regional history and international politics during the nineteenth and twentieth Centuries. 3 lectures and research project.

**HIST 350. The Scientific Revolution, c. 1500-1800. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two lower-division Area D courses. Recommended: One or more courses in GE Area B.

History of the intellectual, social, and cultural changes in the early modern period known as the 'Scientific Revolution.' Main topics include the Copernican Revolution, mechanical philosophy, natural history, and the social and material practices of early modern science. 4 lectures. Fulfills GE D5 except for History majors.

**HIST 354. History of Network Technology. 4 units.**

GE Area F

Prerequisite: Completion of one course from GE Area B. Recommended: Junior standing.

History of computer network technology from the Cold War to the present. Origins of the Internet, development of TCP/IP, growth of network democracy, encryption, race and gender in cyberspace, Usenet and hypertext. 4 lectures. Fulfills GE Area F.

**HIST 359. Living in a Material World. 4 units.**

GE Area F

Prerequisite: Completion of one course from GE Area B. Recommended: Junior standing.

Evolution of materials (ceramics, metals, polymers, composites, semiconductors) in the context of history. Traces the link between historical and technological developments enabled by materials from the Stone Age to the Electronic Age. 4 lectures. Crosslisted as HIST/MATE 359. Fulfills GE Area F.



**HIST 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 4 units per quarter.

**HIST 401. Early America. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Age of exploration. European powers in eastern North America. English settlements, development of the English colonies, with emphasis on Virginia and Massachusetts. Proprietary interests, growth of internal control, and colonial conflicts. 3 lectures and research project.

**HIST 402. American Revolution and the New Nation. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Background to the imperial dispute, events leading to the Revolution, Articles of Confederation, Constitution, impact on the national economy, women, African-Americans, Loyalists, Native Americans. The Schedule of Classes will list topic selected. 3 lectures and research project.

**HIST 404. The Era of Civil War and Reconstruction. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Exploration of the different patterns of life in the United States, in order to comprehend the emergence of sectionalism, the violent struggle of the Civil War, and the readjustments of the Reconstruction years. Emphasis on the experiences of ordinary Americans. 3 lectures and research project.

**HIST 405. African-American History to 1865. 4 units.**

Prerequisite: HIST 303 or graduate standing.

History of African Americans from the colonial period to the Civil War, roughly 1619-1865. The slave trade, slavery in the colonies, plantation slavery, the Black West, and free Black culture and institutions. 3 lectures and research project.

**HIST 406. African-American History from 1865. 4 units.**

USCP

Prerequisite: HIST 303 or graduate standing.

History of African-Americans from the Civil War to the present. Reconstruction, racial segregation, the Harlem Renaissance, the Great Migration, the Civil Rights Movement, Black Feminism and Black Power. 3 lectures and research project. Fulfills USCP.

**HIST 408. The Age of Roosevelt: Depression and World War, 1929-50. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Principle forces affecting the nation's political, social and economic life during the Age of Franklin Roosevelt. Included are the politics of the New Deal, government regulation of the economy and response to the Depression, the rise of the modern presidency, racial and ethnic conflict, the politics of class and gender, the home front at war and post-war tension. 3 lectures and research project.

**HIST 409. Vietnam War at Home and Abroad. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Interaction of revolutionary Vietnamese nationalism with U.S. foreign policy. Analysis of the conduct of the war. Assessment of the impact of the war on U.S. society. 3 lectures and research project.

**HIST 410. Recent America Since 1950: Shattering of the American Consensus. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Political, social and economic forces that have shaped American life since 1950. Subjects included are the Red Scare, suburbanization, the civil rights movement, the Great Society, the politics and culture of protest, recasting the welfare state, and de-industrialization. Emphasis on racial, ethnic and gender issues in the collapse of the American Consensus. 3 lectures and research project.

**HIST 411. History of United States Foreign Relations. 4 units.**

Prerequisite: HIST 303 or graduate standing.

History of American foreign policy from 1900 to the present. Emergence of the United States as a world power early in the century, the retreat following the Great War, Franklin Roosevelt's diplomacy leading to and through the Second World War, atomic diplomacy and the Cold War, four decades of Containment and the search for a new post-Cold War strategy. 3 lectures and research project.

**HIST 412. American Presidency. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Examination of the American presidency with emphasis on its role in American society since the beginning of the twentieth century. From the era of congressional government through the Imperial Presidency of the post-World War II period, and beyond, using presidential biography as a historical source. 3 lectures and research project.

**HIST 414. The Fall of Imperial China. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

History of China's last dynasty, the Qing (1644-1912). Origins of Manchus, High Qing era of expansion and prosperity, creation of uniquely Manchu dynasty, new contact with Western imperialism, internal rebellions, modern reform policies, and revolution. 3 lectures and research project.

**HIST 416. Modern Japan. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

Japan's development as a modern state (1800-2000 CE). Themes include Japan's engagement with modernity and nationalism, the emperor system, Japanese imperialist expansion, and postwar reconstruction of Japanese society. 3 lectures and research project.

**HIST 417. 20th Century China. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

Chinese history in the twentieth century: the fall of the Qing Dynasty and founding of Republic of China in 1912, problems of imperialism and modernity, Chinese Communist Party and People's Republic of China since 1949. 3 lectures and research project.

**HIST 418. Chinese Film and History. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

Examination of 20th century Chinese history through the use of Chinese feature films. Films (with English subtitles) serve as main texts for understanding the tremendous changes in modern Chinese history, and the evolving relationships between film and Chinese society. 4 lectures.

**HIST 419. Modern Southeast Asia. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

Modern history of mainland and maritime Southeast Asia, focusing on the development of political institutions and changing political and cultural identities. Early empires, expansion of capitalism, colonial rule and wars through era of independence. 3 lectures and research project.

**HIST 420. History of Modern South Asia. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

History of modern South Asia from the beginnings of British colonization to independence. Themes include relations between religious groups, the economic impact of British colonialism, political development, the role of indigenous nationalist movements, and the shape of independence. 3 lectures and research project.

**HIST 421. The History of Prostitution. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

Comparative history of prostitution from antiquity to present. Analysis of prostitution from social, cultural, political, gendered and economic perspectives. 4 lectures.

**HIST 422. Japanese Postwar Film and History. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing. Recommended GE D5: HIST 316, HUM 310.

Relationships between film and postwar Japanese society; recurring themes and images that link the diverse body of postwar Japanese film. Films (with English subtitles) serve as main texts for understanding of the tremendous changes in recent Japanese history. 3 lectures, 1 activity.

**HIST 423. The History of Vietnam. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

The history of Vietnam and the influences on its national identities, including migration, cultural adaptations, temporality and territoriality, foreign influences, and racial formations within and outside of the borders of today's Vietnam. 3 lectures and research project.

**HIST 424. Organizing and Teaching History. 4 units.**

Prerequisite: Admission to teacher education program or valid teaching credential, or consent of instructor.

Organization, selection, presentation, application, and interpretation of subject matter in history in secondary schools. 4 seminars.

**HIST 425. Social Sciences Teaching Practicum. 1 unit.**  
CR/NC

Prerequisite: HIST 424. Concurrent: EDUC 469 or EDUC 479.

Supervised practicum for part-time and full-time student teachers in the Social Science Credential Program. Teaching techniques and strategies useful for addressing a wide range of issues that arise in grades 6-12 social science classrooms. Credit/No Credit grading only. Total credit limited to 4 units.

**HIST 426. Imperial Russia. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Political, social, intellectual and economic roots of Russian Absolutism. Emergence of Russia as an imperial power, reform, reaction and revolution - 1689-1914. 3 lectures and research project.

**HIST 427. Soviet Russia. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Transformation of Russian autocracy from tsarist to Bolshevik under the impact of World War I and the Revolution of 1917. The formative force of Marxism-Leninism; Civil War; the 'experimental' 20s; forced collectivization and industrialization; the Purges; 'engineering' a new Soviet Woman and Man for a new communist world; War: Second and Cold. 3 lectures and research project.

**HIST 429. Precolonial African History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Survey of African history from earliest times. Ancient African civilizations, Moslem penetration, the rise of indigenous kingdoms and the continuous impact of Atlantic slave trade. 3 lectures and research project.

**HIST 430. Modern African History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Survey of African in the 19th and 20th centuries including European colonialism, African resistance, the rise of African nationalism and problems since independence. 3 lectures and research project.

**HIST 432. United States Environmental History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Consideration of major themes in human interactions with the environment from the colonial period to the present. Major topics include: changing subsistence systems; the environmental impact of industrialization; conservation and sustainability; and the rise of modern environmental movements. 3 lectures and a research project.

**HIST 433. History of the American West, Southwest Borderlands, and California. 4 units.**

Prerequisite: Completion of GE Area D5 or HIST 303 (may be taken concurrently).

Historiographical and chronological survey since European contact. Emphasis on the frontier and borderlands concepts, Native America, the Hispanic Southwest, US expansion and conquest, industrial capitalism, inter-societal and transnational economies, immigration, public memory, and racial identity formation. 3 lectures and a research project.

**HIST 434. American Women's History to 1870. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Female ideology and experience from the colonial period through the American Civil War. Use of a variety of sources, including women's own writing, in order to understand the history of women as it both reflects and shapes American culture and society. 3 lectures and research project. Crosslisted as HIST/WGS 434.

**HIST 435. American Women's History from 1870. 4 units.**  
USCP

Prerequisite: HIST 303 or graduate standing.

The female past in the modern period of U.S. history. Considers how transformations in gender roles are reflective of other significant changes in American culture and society. Emphasis on class, race, and ethnic variations in women's experience. 3 lectures and research project. Crosslisted as HIST/WGS 435. Fulfills USCP.

**HIST 436. History of American Thought. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Thought and culture in America since the Puritans. 3 lectures and research project.

**HIST 437. Nazi Germany. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Background of German Romantic Nationalism; national unification and defeat in World War I; the failure of Weimar Democracy and political radicalization; the Nazi political, economic, and social revolution 1933-1939. 3 lectures and research project.

**HIST 438. History of American Agriculture. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Agricultural development with emphasis upon economic, political and social implications. 3 lectures and research project.

**HIST 440. Topics and Issues in the History of the United States. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Selected topics and issues in United States history. Descriptive subtitles assigned to each course. The Schedule of Classes will list topic selected. May be repeated to 8 units. 3 lectures and a research project.

**HIST 441. Topics and Issues in European History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Selected topics and issues in European history. Descriptive subtitles assigned to each course. The Schedule of Classes will list topic selected. May be repeated to 8 units. 3 lectures and research project.

**HIST 442. Topics and Issues in Latin American History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Selected topics and issues in Latin American history. Descriptive subtitles will be assigned to each course. The Schedule of Classes will list topic selected. May be repeated to 8 units. 3 lectures and research project.

**HIST 443. Topics and Issues in Asian History. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5 or graduate standing.

Selected topics and issues in Asian history. Descriptive subtitles will be assigned to each course. The Schedule of Classes will list topic selected. May be repeated to 8 units. 3 lectures and research project.

**HIST 444. Topics and Issues in African History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Selected topics and issues in African history. Descriptive subtitles will be assigned to each course. The Schedule of Classes will list topic selected. May be repeated to 8 units. 3 lectures and research project.

**HIST 445. Topics and Issues in Comparative History. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Selected topics and issues in comparative history. Descriptive subtitles will be assigned to each course. The Schedule of Classes will list topic selected. May be repeated to 8 units. 3 lectures and research project.

**HIST 447. Early Modern Britain. 4 units.**

Prerequisite: HIST 303 or graduate standing.

History of the British Isles from the end of the Medieval epoch to the era of the American revolution, from Richard III to George III. 3 lectures and research project.

**HIST 448. Modern Britain: Industry, Empire and War. 4 units.**

Prerequisite: HIST 303 or graduate standing.

History of the British Isles from the loss of the American colonies through the era of the World Wars and the dissolution of the British Empire. 3 lectures and research project.

**HIST 449. The Holocaust and its Representations. 4 units.**

Prerequisite: Completion of GE Area C4 or D5, or HIST 303 (may be taken concurrently) or graduate standing.

Overview of debates and controversies about artistic representation of the Holocaust. Focus on theoretical and philosophical texts at core of Holocaust Studies; examination of primary sources: poetry, theater, autobiography, film. Emphasis on questions of trauma, authenticity, memory, ethics of remembering. 4 lectures.

**HIST 451. Medieval Europe. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Medieval Europe from the fall of Rome to the plague (400-1350 CE), with topics including the Barbarian Kingdoms, the early Church, Charlemagne, medieval art and Gothic architecture, Church fathers and Scholasticism, medieval philosophy, agricultural and commercial revolutions, and the Great Plague. 3 lectures and research project.

**HIST 452. Renaissance and Reformation Europe. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Europe from 1348 to 1620 CE, with topics including the urban milieu, Renaissance philosophy and artistic expression, the new prince, the educational revolution, the Renaissance Church, Martin Luther, Jean Calvin, and the monumental economic, social, and political changes of the sixteenth century. 3 lectures and research project.

**HIST 453. Religious Wars and Absolutism. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Europe from 1559 to 1715 CE, focusing on the Catholic-Protestant conflict, the rise of the Absolutist state (especially Louis XIV), the 'Crisis of the Seventeenth Century,' the Thirty Years War, the English Civil War and Cromwell, and the Newtonian Paradigm. 3 lectures and research project.

**HIST 454. The Age of Revolution and Napoleon. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Europe from the death of Louis XIV (1715) to the settlements of the Congress of Vienna (1815). International politics, continental and global warfare, the Enlightenment, 'Enlightened Absolutism,' the French and Industrial Revolutions, and Napoleon. Political, intellectual, economic, and social developments in the eighteenth century. 3 lectures and research project.

**HIST 455. Europe in the Age of Reaction and Revolution, 1815-1871. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Reaction to the French Revolution. Industrialization. Liberal socialist and nationalist revolts against the conservative order of 1815. 3 lectures and research project.

**HIST 456. Europe in the Age of Imperialism and War, 1871-1919. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Maturation of industrialization, socialism and nationalism. Imperialist competition of nation states for world hegemony. Explosion of the First World War. 3 lectures and research project.

**HIST 457. Europe in the Age of Fascism. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Democracy in crisis and the fascist alternatives. Second World War and the recovery of Europe in a bipolar world to the fall of the Berlin Wall, German reunification and the disintegration of Yugoslavia. 3 lectures and research project.

**HIST 458. Gender and Sexuality in Modern Europe. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

Social, economic, political, and cultural effects of changing gender systems in modern Europe, particularly but not exclusively with regard to sex and sexuality. 3 lectures and research project.

**HIST 459. Imperialism and Postcolonial Studies. 4 units.**

Prerequisite: HIST 303 or completion of GE Area D5, or graduate standing.

The history of imperialism and postcolonial studies and the influences of social, economic, and political impact of the empire system on indigenous people, cultures, economy, and politics. 3 lectures and research project.

**HIST 460. Senior Project I. 2 units.**

Prerequisite: HIST 303; HIST 304; senior standing or consent of instructor; and History major.

Completion of paper or creative project under faculty supervision. Must be historical in nature, investigate a question of significance, include an historiographical analysis, and make an argument based on primary and secondary sources. Schedule of Classes will list topic area selected. Take HIST 461 during a subsequent quarter.

**HIST 461. Senior Project II. 2 units.**

Prerequisite: HIST 303, HIST 304; HIST 460; senior standing or consent of instructor; and History major.

Completion of paper or creative project begun in HIST 460 under faculty supervision. Schedule of Classes will list topic area selected.

**HIST 467. History Internship. 4-12 units.**

CR/NC

Prerequisite: Junior standing, completion of HIST 303 with grade of B or better and consent of internship coordinator.

Supervised work experience using skills of the discipline of history in a public agency ranging from 12 to 36 hours per week. Interns work directly under the supervision of an employee of the agency and are subject to the professional responsibilities typical of the state. Total credit limited to 12 units. Credit/No Credit grading only.

**HIST 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: HIST 303 or graduate standing.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**HIST 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 12 units. Credit/No Credit grading only.

**HIST 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 24 units. Credit/No Credit grading only.

**HIST 500. Special Problems for Graduate Students. 1-4 units.**

Prerequisite: Graduate standing in History.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units.

**HIST 504. Graduate Study in History. 4 units.**

Prerequisite: Graduate standing in History.

Weekly reading and discussion course on practical methods and theoretical approaches to the study and writing of history. 4 seminars.

**HIST 505. Graduate Seminar in United States History. 4 units.**

Prerequisite: Graduate standing in History.

Intensive study of selected topics in United States history. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**HIST 506. Graduate Seminar in European History. 4 units.**

Prerequisite: Graduate standing in History.

Intensive study of selected topics in modern European history. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**HIST 507. Graduate Seminar in East Asian History. 4 units.**

Prerequisite: Graduate standing in History.

Intensive study of selected topics in East Asian history. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**HIST 508. Graduate Seminar in Latin American History. 4 units.**

Prerequisite: Graduate standing in History.

Intensive study of selected topics in Latin American history. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.



**HIST 509. Graduate Seminar in African History. 4 units.**

Prerequisite: Graduate standing in History.

Intensive study of selected topics in African history. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**HIST 510. Graduate Seminar in Comparative History. 4 units.**

Prerequisite: Graduate standing in History.

Intensive study of selective topics in comparative history. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

**HIST 512. Supervised Reading for Comprehensive Exams. 2 units.**

Prerequisite: HIST 504 and 12 units of graduate study.

Directed supervision of reading for MA comprehensive exams. Regular consultation between advisor and student. Total credit limited to 4 units.

**HIST 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**HIST 599. Thesis. 3 units.**

Prerequisite: Graduate standing in History.

Directed supervision of MA thesis. Regular consultation between advisor and student. Course to be taken three times over three separate quarters; total credit limited to 9 units.

## Honors (HNRS)

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### Honors Courses

**HNRS 100. Orientation to the University Honors Program. 2 units.**

CR/NC

Introduction to the Honors Program and overview of the University. Topics include the role of higher education, development of academic skills, career advising, and guest speakers from the Cal Poly community. For University Honors Program students only. Credit/No Credit grading only. 1 lecture, 1 activity.

**HNRS 101. Public Speaking. 4 units.**

GE Area A2

Introduction to the principles of public speaking. Practical experience in the development, presentation, and critical analysis of speeches to inform, to persuade, and to actuate. Not open to students with credit in COMS 102. 4 lectures. Crosslisted as COMS/HNRS 101. Fulfills GE A2.

**HNRS 102. Principles of Oral Communication. 4 units.**

GE Area A2

Introduction to the fundamentals and principles which underlie effective oral communication. Practical experience in various types of speaking situations: informative speaking, persuasive speaking, and panel discussion. Not open to students with credit in COMS 101. 4 lectures. Crosslisted as COMS/HNRS 102. Fulfills GE A2.

**HNRS 112. Race, Culture and Politics in the United States. 4 units.**

GE Area D1; USCP

Introductory and interdisciplinary study of the ways that race and ethnicity are created by both historical processes and American institutional formation - specifically social, political, economic, legal and cultural institutions. Special attention paid to the interlocking systems of race, class, gender and sexuality. 4 lectures. Crosslisted as ES/HNRS 112. Fulfills GE D1 and USCP.

**HNRS 131. General Physics I. 4 units.**

GE Area B4; GE Area B3

Prerequisite: MATH 141 with grade C- or better and MATH 142 or MATH 182 (or concurrent enrollment); for ME and AERO students only. Recommended: High School Physics.

Fundamental principles of mechanics. Vectors, particle kinematics. Equilibrium of a rigid body. Work and energy, linear momentum, rotational kinematics and dynamics. Primarily for engineering students, and for students majoring in the physical sciences. Not open to students with credit in PHYS 141. 3 lectures, 1 laboratory. Crosslisted as HNRS/PHYS 131. Fulfills GE B3 & B4.

**HNRS 132. General Physics II. 4 units.**

GE Area B3; GE Area B4

Prerequisite: PHYS 131 or HNRS 131 or PHYS 141.

Oscillations, waves in elastic media, sound waves. Temperature, heat and the first law of thermodynamics. Kinetic theory of matter, second law of thermodynamics. Geometrical and physical optics. 3 lectures, 1 laboratory. Crosslisted as HNRS/PHYS 132. Fulfills GE B3 & B4.

**HNRS 134. General Physics IA. 4 units.**

GE Area B3

Prerequisite: MATH 141 with grade C- or better and MATH 142 or MATH 182 (or concurrent enrollment). Recommended: High School Physics.

Fundamental principles of mechanics. Vectors, particle kinematics. Equilibrium of a rigid body. Work and energy, linear momentum, rotational kinematics and dynamics. Primarily for engineering and science students. Not open to students with credit in PHYS 131. 4 lectures. Crosslisted as HNRS 134/PHYS 141. Fulfills GE B3.

**HNRS 141. Calculus I. 4 units.**

GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination, or MATH 118 and high school trigonometry, or MATH 119.

Limits, continuity, differentiation. Introduction to integration. 4 lectures. Crosslisted as HNRS/MATH 141. Fulfills GE B1.

**HNRS 142. Calculus II. 4 units.**

GE Area B1

Prerequisite: MATH 141 with a grade of C- or better or consent of instructor.

Techniques of integration, applications to physics, transcendental functions. 4 lectures. Crosslisted as HNRS/MATH 142. Fulfills GE B1.

**HNRS 143. Calculus III. 4 units.**

GE Area B1

Prerequisite: MATH 142 with a grade of C- or better or consent of instructor.

Infinite sequences and series, vector algebra, curves. 4 lectures. Crosslisted as HNRS/MATH 143. Fulfills GE B1.



**HNRS 145. Reasoning, Argumentation, and Writing. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor. Recommended: Completion of GE Area A2.

The principles of reasoning in argumentation. Examination of rhetorical principles and responsible rhetorical behavior. Application of these principles to written and oral communications. Effective use of research methods and sources. 4 lectures. Crosslisted as COMS/ENGL/HNRS 145. Fulfills GE A3.

**HNRS 148. Reasoning, Argumentation and Professional Writing. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor. Recommended: Completion of GE Area A2.

The principles of reasoning in professional writing. Discussion and application of rhetorical principles, both oral and written, in professional environments. Study of methods, resources and common formats used in corporate or research writing. 4 lectures. Crosslisted as ENGL/HNRS 148. Fulfills GE A3.

**HNRS 149. Technical Writing for Engineers. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor; for Engineering students only. Recommended: Completion of GE Area A2.

The principles of technical writing. Discussion and application of rhetorical principles in technical environments. Study of methods, resources and common formats used in corporate or research writing. 4 lectures. Crosslisted as ENGL/HNRS 149. Fulfills GE A3.

**HNRS 200. Special Problems for Undergraduates. 1-2 units.**

CR/NC

Prerequisite: Consent of instructor and Honors Program.

Individual investigation, research, projects, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter. Credit/No Credit grading only.

**HNRS 201. Survey of Economics. 4 units.**

GE Area D2

Basic principles of microeconomics and macroeconomics. Emphasis on applications to current national and global economic issues. For majors requiring one quarter of economics. Not open to students having previous credit in ECON 222 or equivalent. 4 lectures. Crosslisted as ECON/HNRS 201. Fulfills GE D2.

**HNRS 207. Freedom and Equality in American History. 4 units.**

GE Area D1; USCP

The multiple and conflicting ways in which various Americans (defined in terms of race, class and gender) have struggled to formulate and promote their own understandings of freedom and equality, from the pre-conquest era to the present. 4 lectures. Not open to students with credit in HIST 201 or HIST 202. Crosslisted as HIST/HNRS 207. Fulfills GE D1 and USCP.

**HNRS 212. Global Origins of United States Cultures. 4 units.**

GE Area D3; USCP

How the global dispersal of Europeans, Asians, and Africans, the hemispheric dispersal of Latin Americans, and the forced internal migration of Native Americans have contributed to American cultural heritage and the struggles for ethnic, class and gender equality, and justice. 4 lectures. Crosslisted as ES/HNRS 212. Fulfills GE D3 and USCP.

**HNRS 213. Modern Political Economy. 4 units.**

GE Area D2

The relationship between states and economies in the modern period. Themes of modernization, industrialization, and colonial expansion. The major theories of political economy, especially liberalism and socialism. 4 lectures. Crosslisted as HIST/HNRS 213. Fulfills GE D2.

**HNRS 216. Comparative Social Movements. 4 units.**

GE Area D3

History of global social movements from the late nineteenth century to the present. May include, but not limited to: socialism, nationalism, feminism, fascism and communism, pacifism, life reform, gay liberation, indigenous peoples' movements, and environmentalism. Includes a service learning component. 4 lectures. Fulfills GE D3.

**HNRS 223. World History, 1800 - Present. 4 units.**

GE Area D3

Comparative history of Western and non-Western societies in global perspective. Cross-cultural exchange, interaction, and conflict in the making of the modern world, with focus on the economic, political, and cultural transformations that facilitated and emerged from imperialism. 4 lectures. Crosslisted as HIST/HNRS 223. Fulfills GE D3.

**HNRS 230. Philosophical Classics: Knowledge and Reality. 4 units.**

GE Area C2

Prerequisite: Completion of GE Area A.

Critical examination of primary philosophical texts, from the ancient and modern periods, with focus on the nature of reality and the sources and limits of human knowledge. 4 lectures. Crosslisted as HNRS/PHIL 230. Fulfills GE C2.

**HNRS 231. Philosophical Classics: Ethics and Political Philosophy. 4 units.**

GE Area C2

Prerequisite: Completion of GE Area A.

Readings from primary philosophical texts, from the ancient and modern periods, with focus on the identification, evaluation and contemporary relevance of the central ethical and political themes and arguments presented in them. 4 lectures. Crosslisted as HNRS/PHIL 231. Fulfills GE C2.

**HNRS 232. Masterworks of British Literature from the Late 18th Century to the Present. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Broadly surveys Romantic, Victorian, Modern, and Contemporary British literature in an historical-cultural context. Investigates works from several genres and a variety of national and cultural voices. May include such writers as Wordsworth, Wollstonecraft, Dickens, G. Eliot, Wilde, Woolf, Yeats, and Gordimer. 4 lectures. Crosslisted as ENGL 231/HNRS 232. Fulfills GE C1.

**HNRS 241. Calculus IV. 4 units.**

Prerequisite: MATH 143.

Partial derivatives, multiple integrals, introduction to vector analysis. 4 lectures. Crosslisted as HNRS/MATH 241.

**HNRS 244. Linear Analysis I. 4 units.**

Prerequisite: MATH 143.

Separable and linear ordinary differential equations with selected applications; numerical and analytical solutions. Linear algebra: vectors in n-space, matrices, linear transformations, eigenvalues, eigenvectors, diagonalization; applications to the study of systems of linear differential equations. 4 lectures. Crosslisted as HNRS/MATH 244.

**HNRS 251. Great Books I: Introduction to Classical Literature. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A.

Examination of the ancient epics and classical literature of Mesopotamia, Greece, and Rome. May include such readings as The Epic of Gilgamesh, the Iliad, the Odyssey, Genesis, Exodus, Antigone, the Symposium, the Aeneid, and Marcus Aurelius's Meditations. 4 lectures. Crosslisted as ENGL/HNRS 251. Fulfills GE C1.

**HNRS 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**HNRS 299. Honors Group Seminar. 1 unit.**

CR/NC

Students in the Honors Program are required to take at least eight courses for honors credit before graduation. Taking an Honors course may not be possible due to scheduling conflicts or unavailability of courses. This course allows students to engage in honors-level work in a standard, non-honors course on a group basis. Credit/No Credit grading only. Total credit limited to 4 units; repeatable in same term. Must achieve a B or better in the related standard course. 1 seminar.

**HNRS 302. The Learn By Doing Lab Teaching Practicum. 2 units.**

CR/NC

Prerequisite: Completion of GE Area B and consent of instructor.

Early teaching experience in an informal science/technology/engineering/mathematics (STEM) teaching and learning environment. Principles of inquiry-driven STEM education, lesson design, implementation and assessment. Intended for undergraduates exploring STEM teaching as a career. Total credit limited to 4 units. Credit/No Credit grading only. 1 seminar, 1 laboratory. Crosslisted as ENGR 322/SCM 302/HNRS 302.

**HNRS 303. Economics of Poverty, Discrimination and Immigration. 4 units.**

GE Area D5; USCP

Prerequisite: Junior standing; completion of GE Areas A, D1, and either ECON 221 and ECON 222, or ECON 201.

Economic analysis of the cause, extent and impact of poverty, discrimination and immigration and of the policies designed to address these socioeconomic issues. Emphasis on the experience of African-Americans, Latinos, and women in the United States. 4 lectures. Crosslisted as ECON/HNRS 303. Fulfills GE D5 except for Economics majors. Fulfills USCP.

**HNRS 304. Values and Technology. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course from Area C. Recommended: Junior standing.

Humanistic investigation into the theoretical and practical applications of technology with specific reference to the social effects of technological change. For all majors. Non-technical. 4 lectures. Crosslisted as HNRS 304/HUM 303. Fulfills GE C4.

**HNRS 310. Air and Space. 4 units.**

GE Area F

Prerequisite: Junior standing and Completion of GE Area B.

Technological innovations that have led to modern aircraft and spacecraft as viewed from an historical perspective. Development of aerodynamics, propulsion systems, light-weight structures, and control systems. How aviation has affected, and been affected by, history. Impact of aviation on society, including civil and military aircraft/spacecraft. Federal regulation of aviation, including air traffic control and airlines. Future developments in air and space technology. 4 lectures. Crosslisted as AERO/HNRS 310. Fulfills GE Area F.

**HNRS 311. Computers for Poets. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

How computers and computer devices work. Introduction to software systems and applications. How computers connect with various media including images, speech and data. How information is encoded and transmitted across networks. Relationship between the computer and human information processing. 4 lectures. Crosslisted as CSC 310/HNRS 311. Fulfills GE Area F.

**HNRS 312. East Asian Culture and Civilization. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from GE Area D2 or D3. Recommended: Junior standing.

The pre-modern and modern histories of China and Japan. Focus on the traditional era, the transition to modernity, cultural uniqueness within East Asian civilization, and western images of Asia. 4 lectures. Crosslisted as HIST 310/HNRS 312. Fulfills GE D5 except for History majors.

**HNRS 319. Natural Resource Ecology, Theories and Applications. 4 units.**

GE Area B5

Prerequisite: Completion of GE Area B2.

Scope and nature of 'ecology' in modern society, including resource terminology and classifications systems; dynamics of natural systems (energy exchange and cycles); man's role as a principle agent of change; environmental impacts; historical perspective including people (ethnicity); and the future environment. 3 lectures, 1 laboratory. Crosslisted as HNRS/NR 319. Fulfills GE B5.

**HNRS 320. Values, Media, and Culture. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course from Area C. Recommended: Junior standing.

Contemporary popular culture and its relationship to the great art and literature of the past. Discussion of television, films, advertising, best sellers, popular magazines, children's stories, comics, and the great tradition of literature. 4 lectures. Crosslisted as HNRS/HUM 320. Fulfills GE C4.

**HNRS 321. Undergraduate Research Methods and Practice. 4 units.**

Prerequisite: Completion of GE Areas A and B1, and consent of instructor.

Research methods and tools for sciences and humanities, including formulating a research question, designing a study, using the scientific method to conduct and analyze surveys, and analyzing data. Emphasis on working in interdisciplinary research teams. Total credit limited to 8 units. 2 lectures, 2 activities. Crosslisted as HNRS/UNIV 321.

**HNRS 322. Leadership and Project Management. 2 units.**

Prerequisite: Junior standing in an engineering program or consent of instructor.

Theory and practice in leadership and project management skills for engineering design teams. Basic issues related to, and tools used for, managing projects and concepts comprising project management. Emphasis on situations requiring resolutions and management decisions by groups representing various elements of an enterprise. 2 lectures. Crosslisted as HNRS/IME/MATE 322.

**HNRS 323. Modern America. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

American history since 1900. Focus on domestic and foreign policy interactions, struggle of disenfranchised groups for social and political equality, and changes in culture and identity. 4 lectures. Crosslisted as HIST 322/HNRS 323. Fulfills GE D5 except for History majors.

**HNRS 324. The Historical Novel in the United States, 1960s to the Present. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D1. Recommended: Junior standing.

An introduction to the historical novel as it has developed in the United States since the 1960s. Exploration of how historical novels typically represent the past and the ways in which they change our notion of what counts as 'history.' 4 lectures. Crosslisted as HIST/HNRS 324. Fulfills GE D5 except for History majors.

**HNRS 332. British Literature in the Age of Enlightenment: 1660-1798. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth exploration of the dominant themes and preoccupations of the Age of Enlightenment. Historical and cultural contexts of canonical and non-canonical literature emphasized to illustrate 18th century Britons' views of themselves and their changing world. May include such writers as Dryden, Behn, Defoe, Swift, Pope, and Johnson. 4 lectures. Fulfills GE C4 except for English majors. Crosslisted as ENGL/HNRS 332. Fulfills GWR for students with junior standing (90 units).

**HNRS 333. British Literature in the Age of Romanticism: 1798-1832. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth exploration of the literature of the British Romantic period. Cultural, historical, and philosophic contexts will also be examined in both canonical and non-canonical works. May include such writers as Blake, Wordsworth, Keats, and Wollstonecraft. 4 lectures. Fulfills GE C4 except for English majors. Crosslisted as ENGL/HNRS 333. Fulfills GWR for students with junior standing (90 units).

**HNRS 334. Modern Europe, 1789-1914. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two courses from Area D1, D2 or D3. Recommended: Junior standing and HIST 111.

Europe's 'long nineteenth century' reveals continuity and dramatic changes in politics, social structures and identities, forms of cultural expression, and scientific and technological knowledge. Topics include the French and Industrial revolutions; liberalism; nationalism; socialism; modernism; imperialism; and World War I. 4 lectures. Crosslisted as HIST/HNRS 334. Fulfills GE D5 except for History majors.

**HNRS 340. Sexuality Studies. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from lower division Area D. Recommended: Junior standing.

Sexuality in a cultural and historical context. Changing definitions of human subjectivity. The cultural and social regimes that control and create sexuality (including the 'invention' of homo/heterosexuality and the social, legal and political systems that define sexual ab/normality). Contemporary issues of sexual orientation and topics of sexuality in relation to gender and race. 4 seminars. Fulfills GE D5. Crosslisted as WGS/HNRS 340.

**HNRS 342. The Literary Sources of the American Character: 1914-1956. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The writers of the modern period and those of the early post-modern age, including writers marked by stylistic innovation and a willingness to challenge traditionally accepted standards. May include such writers as Hemingway, Fitzgerald, Stein, Hughes. 4 lectures. Crosslisted as ENGL/HNRS 342. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units).

**HNRS 343. Multiple Voices of Contemporary American Literature. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

In-depth study of American fiction, poetry, and drama written since 1956. How contemporary literature examines enduring American themes and breaks new ground with the inclusion of diverse voices. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units). Crosslisted as ENGL/HNRS 343.

**HNRS 347. African American Literature. 4 units.**

GE Area C4; GWR; USCP

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

The writings of African Americans from the end of the eighteenth century to the present. Individual works and literary trends among African Americans of various periods and contexts: intellectual, political, and cultural. 4 lectures. Fulfills GE C4 except for English majors. Fulfills USCP. Fulfills GWR for students with junior standing (90 units). Crosslisted as ENGL/HNRS 347.

**HNRS 375. Technology and the Environment: A Seminar on Contemporary Issues. 4 units.**

Prerequisite: Completion of GE Area A and two courses from Areas D1, D2, D3.

Interdisciplinary exploration of significant environmental issues (local, regional, national, or global) where technology is a major cause and/or offers a possible solution. 4 seminars. Honors Program membership or nomination by CRP department head. Crosslisted as CRP/HNRS 375.

**HNRS 380. Literary Themes. 4 units.**

GE Area C4; GWR

Prerequisite: Completion of GE Areas A and C1. Recommended: Junior standing.

Literature selected according to a particular theme. Emphasis on critical interpretation, aesthetic appreciation, and historical and cultural contexts. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for English majors. Fulfills GWR for students with junior standing (90 units). Crosslisted as ENGL/HNRS 380.

**HNRS 391. Appropriate Technology for the World's People: Development. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Area A, and two courses from GE D1-D4.

A broad overview of international development and appropriate design for sustainability. Besides traditional classroom work, students work in teams to address problems with technical solutions. Collaboration with mentors from the university, private sector, and nonprofits serves to provide diverse background and project mentorship. 4 lectures. Crosslisted as HNRS/UNIV 391. Fulfills GE D5.

**HNRS 392. Appropriate Technology for the World's People: Design. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B, or graduate standing. Recommended: UNIV 391, GE Area D2, and GE Area D3.

Addresses the needs of international impoverished communities with technological solutions, which are inexpensive, ecologically sustainable, and socially appropriate. Group study of target communities, and design and construction of an appropriate technology prototype. Not open to students with credit in UNIV 492. 3 lectures, 1 laboratory. Crosslisted as HNRS/UNIV 392. Fulfills GE Area F.

**HNRS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of Honors Program Director.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**HNRS 411. New Media Arts I. 4 units.**

Prerequisite: Completion of GE Area A; Junior standing.

Advanced-level presentation of new media theory, design and practice. Topics covered include, but are not limited to, interactivity theory, user-centered system design, cognitive psychology, media analysis, and basic web design theory. Total credit limited to 8 units. 4 lectures. Crosslisted as ENGL/HNRS 411.

**HNRS 412. New Media Arts II. 4 units.**

Prerequisite: ENGL 411 or consent of instructor.

Advanced level of work with the primary technologies and design/critique theories currently at use in the professional creation of new media works. Lectures and readings expand upon material presented in ENGL 411. 4 lectures. Crosslisted as ENGL/HNRS 412.

**HNRS 424. Design of Museum Displays of Science, Engineering and Technology. 4 units.**

Prerequisite: GE Area B.

The design and creation of educational museum displays that highlight science, engineering, and technology. Projects done by multidisciplinary teams and for clients in the community. Emphasis on design, teamwork, service learning and project management. 3 lectures, 1 laboratory. Crosslisted as HNRS/UNIV 424.

**HNRS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**HNRS 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**HNRS 475. Sustainable Forest and Environmental Practices. 12 units.**

Prerequisite: Completion of GE Area B and consent of instructor.  
Recommended: Junior or senior standing.

Typical modules related to sustainable forest management, ecosystem sampling and inventory methods, photo interpretation, hydrologic resources, road condition, project impact analysis, best management practices. Topics covered vary from term to term depending on the priority for learning modules. Residency at Swanton Pacific and extended field trips required. 8 lectures, 4 activities. Crosslisted as HNRS/NR 475.

**HNRS 490. President's Seminar: Science, Society and the University. 1-4 units.**

CR/NC

Prerequisite: Senior standing, GPA of at least 3.0, or consent of instructor.

Development of higher education in the United States; the role of science and research in the University; and the response of higher education to changing economic, political and social demands. Credit/No Credit grading only. 1-4 seminars. Crosslisted as HNRS/HUM 490.

**HNRS 492. Appropriate Technology for the World's People: Design. 4 units.**

Prerequisite: Junior standing and completion of GE Area B, or graduate standing. Recommended: UNIV 391, GE Area D2, and GE Area D3.

Addresses the needs of international impoverished communities with techno-logical solutions, which are inexpensive, ecologically sustainable, and socially appropriate. Group study of target communities, and design and construction of an appropriate technology prototype. Seminar paper required. Not open to students with credit in UNIV/HNRS 392. 3 lectures, 1 laboratory.

**HNRS 499. Honors Group Seminar. 1 unit.**

CR/NC

Students in the Honors Program are required to take at least eight courses for honors credit before graduation. Taking an Honors course may not be possible due to scheduling conflicts or unavailability of courses. This course allows students to engage in honors-level work in a standard, non-honors course on a group basis. Credit/No Credit grading only. Total credit limited to 4 units, repeatable in same term. Must achieve a B or better in the related standard course. 1 seminar.

## **Honors Contract (HNRC)**

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## **Honors Contract Courses**

**HNRC 199. Honors Contract. 0 unit.**

CR/NC

Prerequisite: Student must be in good standing in the Honors Program, and have permission of the Director.

Students in the Honors Program are required to take at least eight courses for honors credit before graduation. Taking an Honors course may not be possible due to scheduling conflicts or unavailability of courses. In these cases and with the permission of the Director of the Honors Program, the student may enter into a 'Contract' to engage in honors-level work in a class on an individual basis. Credit/No Credit grading only. Students can register for a maximum of 2 Honors Contracts; repeatable in same term.

**HNRC 200. Honors Leadership Experience. 0 unit.**

CR/NC

Prerequisite: Student must be in good standing in the Honors Program, and have permission of the Director.

The Honors Program encourages its students to develop leadership skills through serving on the Honors Board, chairing Honors Committees, or by participating in other approved leadership activities. To receive Honors credit for these activities, students must also participate in a number of formal leadership-training seminars/workshops, and contribute their insights to the Honors and greater Cal Poly communities. Credit/No Credit grading only. Total credit limited to two courses.

**HNRC 399. Honors Contract. 0 unit.**

CR/NC

Prerequisite: Student must be in good standing in the Honors Program, and have permission of the Director.

Students in the Honors Program are required to take at least eight courses for honors credit before graduation. Taking an Honors course may not be possible due to scheduling conflicts or unavailability of courses. In these cases and with the permission of the Director of the Honors Program, the student may enter into a 'Contract' to engage in honors-level work in a class on an individual basis. Credit/No Credit grading only. Students can register for a maximum of 2 Honors Contracts; repeatable in same term.

**HNRC 400. Honors Professional, Social and Global Experience. 0 unit.**

CR/NC

Prerequisite: Student must be in good standing in the Honors Program, and have permission of the Director.

The Honors Program encourages its students to enhance their academic coursework by broadening their professional, social and global perspectives through professional internships/co-ops, participation in community projects and study abroad experience. To receive Honors credit, students must also reflect on these experiences and contribute their insights through presentations (oral and/or written) to the Honors and greater Cal Poly communities. Credit/No Credit grading only. Total credit limited to two courses, repeatable in the same term.

## **Horticulture and Crop Science (HCS)**

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## Horticulture and Crop Science Courses

### **HCS 110. Orientation to Horticulture and Crop Science. 2 units.** CR/NC

Understand the depth and breadth of horticulture, field crops, and plant protection careers. Examination of curricula within the department. Introduction to both student and professional organizations. Emphasis on curriculum and career planning. Required of all Horticulture and Crop Science students. Credit/No Credit grading only. 1 lecture, 1 activity.

### **HCS 120. Principles of Horticulture and Crop Science. 4 units.**

Introduction to horticulture and crop science. Basic plant processes, classification, anatomy, physiology, and biotechnology. Effect of environment on plants and how we control it. Introduction to plant growth including propagation, media, irrigation, nutrition, management, harvest, and post harvest handling. People's use of plants. Field trip required. 3 lectures, 1 laboratory.

### **HCS 124. Plant Propagation. 4 units.**

Prerequisite: BOT 121 and HCS 120.

Plant propagation practices with emphasis on understanding why practices are used, how they work, and how they are applied in commercial horticulture. Field trip required. 3 lectures, 1 laboratory.

### **HCS 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total graduation credit limited to 4 units, with a maximum of 4 units per quarter. Report required.

### **HCS 231. Commercial Seed Production. 4 units.**

Prerequisite: HCS 120 or VGSC 230.

Production of field and vegetable seed. Seed technology, germination, quality control, seed enhancement, storage and handling of seed, and seed laws. Field trip to a seed conditioning/seed enhancement facility required. 3 lectures, 1 laboratory.

### **HCS 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

### **HCS 304. Plant Breeding. 4 units.**

Prerequisite: HCS 120 or BOT 121.

Principles and techniques used to develop new plant varieties. Sexual reproduction, inheritance, selection and biotechnology methods useful in breeding of plants. Field trip required. 3 lectures, 1 laboratory.

### **HCS 327. Abiotic Plant Problems. 3 units.**

Prerequisite: HCS 124, CHEM 111, SS 121.

Diagnosis of physiological disorders associated with environmental and nutritional factors. Particular emphasis on the systematic inquiry process. Case histories, multimedia use. 2 lectures, 1 laboratory.

### **HCS 329. Plants, Food, and Biotechnology. 4 units.**

GE Area F

Prerequisite: Completion of one of the following: BIO 111, BIO 114, BIO 161, BOT 121, or HCS 120. Recommended: Junior standing.

Agriculture as applied biology and its impact on civilization. Application of technology to increase the efficiency of food production. Genetics and biotechnology; culminating in an assessment of genetically engineered foods, the myths, the controversy, the science. Not open to CRSC or FRSC majors. 3 lectures, 1 laboratory. Crosslisted as BOT/HCS 329. Fulfills GE Area F.

### **HCS 339. Internship in Horticulture and Crop Science. 1-12 units.** CR/NC

Prerequisite: Consent of instructor.

Selected Horticulture and Crop Science students will spend up to 12 weeks with an approved agricultural/horticultural firm engaged in production or related business. Time will be spent applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Degree credit limited to 6 units. Credit/No Credit grading only.

### **HCS 340. Principles of Greenhouse Environment. 4 units.**

Prerequisite: EHS 245.

Analysis of problems and practices affecting the contemporary commercial horticulturist. Analysis and operation of greenhouses and related equipment stressing the effect of environment on plant growth. Field trip required. 3 lectures, 1 laboratory.

### **HCS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total degree credit limited to 4 units, with a maximum of 4 units per quarter. Report required.

### **HCS 410. Crop Physiology. 4 units.**

Prerequisite: BIO 263 or HCS 120; BOT 121 or BIO 162; and CHEM 216, CHEM 312 or CHEM 316.

Ecological and physiological interactions associated with the production of crop plants. Physiological and biochemical processes that elucidate the mechanism of whole plant performance and responses to the environment. 3 lectures, 1 laboratory.

### **HCS 421. Postharvest Technology of Horticultural Crops. 4 units.**

Prerequisite: Junior standing.

Respiration, ethylene, ripening and senescence; modified atmosphere packaging, controlled atmosphere storage, packinghouses and transportation; survey of postharvest techniques to maximize commodity shelf-life. Field trip required. 3 lectures, 1 laboratory.

### **HCS 461. Senior Project I. 2 units.**

Prerequisite: Junior standing and completion of GE Area A1 and consent of instructor.

Selection of a project under faculty advisor approval. Initial research and data gathering period for project information. Projects typical of problems which graduates must solve in their fields of study or employment. Project results are presented in a formal written report completed in HCS 462. Contract drawn up with approval of advisor. Minimum 60 hours.

**HCS 462. Senior Project II. 2 units.**

Prerequisite: Consent of instructor.

Continuation of Senior Project development. Write-up of rough draft and formal draft of project. Completion of formal written report under advisor supervision. Minimum 60 hours.

**HCS 463. Senior Seminar. 1 unit.**

Prerequisite: Senior standing.

Oral presentations by students on their senior projects, critical thinking assignment. Preparation for entry into the business world. Guest speakers. 1 activity.

**HCS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**HCS 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**HCS 500. Individual Study in Horticulture and Crop Science. 1-6 units.**

Prerequisite: Consent of instructor.

Advanced independent study planned and completed under the direction of a member of the Horticulture and Crop Science faculty. Total credit limited to 6 units; may be repeated in same term.

**HCS 511. Ecological Biometrics. 4 units.**

Prerequisite: STAT 218 or STAT 512, or consent of instructor.

General survey of current analytical methodology available to ecological researchers to evaluate effects and assess the underlying mechanisms that drive natural and cultivated ecosystems. Methodology includes general linear models, ordination, survival analysis, multivariate analyses, and computer simulations. Student research used as a basis for instruction. Total credit limited to 8 units. 3 seminars, 1 activity. Crosslisted as HCS/PPSC 511.

**HCS 539. Graduate Internship in Horticulture and Crop Science. 1-9 units.**

Prerequisite: Consent of instructor.

Application of theory to the solution of problems of agricultural production or related business in the fields of horticulture and crop science. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**HCS 570. Selected Topics in Horticulture and Crop Science. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 12 units; may be repeated in same term. 1-4 seminars.

**HCS 571. Selected Topics Laboratory in Horticulture and Crop Science. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 12 units; may be repeated in same term. 1-4 laboratories.

**HCS 575. Postharvest Instrumentation and Experimentation. 3 units.**

Prerequisite: STAT 218 and senior or graduate standing.

Hands-on instruction in the instrumentation available to conduct postharvest research, including discussions of the scientific methods and typical postharvest studies. Implementation and dissemination of a personalized postharvest experiment required, both as a slide presentation and a poster. Independent research. 3 laboratories.

## Humanities (HUM)

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### Humanities Courses

**HUM 240. Introduction to Media Arts and Technologies. 4 units.**

Prerequisite: Completion of GE C3. Recommended: TH 210.

The intimate connection between the desire for artistic expression and current technologies that can assist that expression. Examination of technologies for theater, sound, cinema, gaming, and embodied media. Guest speakers with expertise. 4 lectures.

**HUM 302. Human Values in Agriculture. 4 units.**

GE Area F

Prerequisite: Completion of one course from GE Area B.

Recommended: Junior standing.

Technical aspects of controversial agricultural issues. Identification of value conflicts, comparison of potential impacts, and use of relevant ethical principles. Weighing risks and benefits to resolve the issue. Extensive participation and interaction making oral presentations, role playing, and arguing in public forums. 3 lectures, 1 activity. Fulfills GE Area F.

**HUM 303. Values and Technology. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course from Area C.

Recommended: Junior standing.

Humanistic investigation into the theoretical and practical applications of technology with specific reference to the social effects of technological change. For all majors. Non-technical. 4 lectures. Crosslisted as HNRS 304/HUM 303. Fulfills GE C4.

**HUM 310. Humanities in World Cultures. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course from Area C.

Recommended: Junior standing.

Interdisciplinary examination of the humanities in a selected culture. Special focus on the arts, literature, philosophy and language in that culture. The Schedule of Classes will list topic selected. Repeatable to 12 units with different course titles. 4 lectures. Fulfills GE C4.

**HUM 312. Humanities in Chicano/a Culture. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Area A and one course from Area C.

Recommended: Junior standing.

Interdisciplinary examination of humanities in Chicano culture. Special focus on the arts, literature, social situations, and the monolingual and bilingual language aspects in Chicano culture. 4 lectures. Fulfills GE C4 and USCP.

**HUM 315. Critical Issues in Latin American Studies. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two courses in lower division Area D (D2 and D3 recommended). Recommended: Junior standing.

An interdisciplinary approach to selected topics and issues that address how social, economic, political, and cultural forces have shaped the challenges that face contemporary Latin America. Descriptive subtitles assigned to each course. The Schedule of Classes will list topic selected. Total credit limited to 12 units; repeatable in same term. 4 lectures. Fulfills GE D5.

**HUM 316. London: From Roman Colony to World Capital. 4 units.**

GE Area D5

Prerequisite: Enrollment in London Study; completion of GE Area A; completion of two courses in GE Area D or consent of instructor. Corequisite: Enrollment in HUM 319. Recommended: Junior standing.

Selective examination of the historical and cultural legacy of London within the development of Western civilization as well as its influence on the submission and eventual emergence of the non-Western world in the twentieth century. An analytical and interpretive study of how London shaped the social, economic, political and legal institutions of Western society. 4 lectures. Fulfills GE D5.

**HUM 317. Latin American Studies: Activities. 2 units.**

CR/NC

Prerequisite: Limited to Study Abroad Programs in Latin America. Corequisite: Enrollment in a 300-level course offered as part of a Study Abroad Program in Latin America.

Examination and/or experience of Latin American culture, politics, and socioeconomic development via participant observation in Latin America. A field exploration of archeological sites, ecosystems, historic and contemporary public places, and venues of popular culture in Latin America. Credit/No Credit grading only. 2 activities.

**HUM 318. Culture of Spain: Activities. 2 units.**

CR/NC

Prerequisite: Limited to Valladolid, Spain Fall program. Corequisite: HUM 310.

Examination and experience of Spanish culture via participant observation in Spain. An introductory exploration of the development of Spanish architecture, art, literature, music, theatre and popular culture as experienced in Valladolid, Spain. Credit/No Credit grading only. 2 activities.

**HUM 319. London Activities. 2 units.**

CR/NC

Prerequisite: Limited to London Study students.

Analytical and interpretive survey of the principal center of the English speaking world. The development of London from Roman administrative capital to modern cultural, financial and political colossus. Credit/No Credit grading only. 2 activities.

**HUM 320. Values, Media, and Culture. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course from Area C.

Recommended: Junior standing.

Contemporary popular culture and its relationship to the great art and literature of the past. Discussion of television, films, advertising, best sellers, popular magazines, children's stories, comics, and the great tradition of literature. 4 lectures. Crosslisted as HNRS/HUM 320. Fulfills GE C4.

**HUM 330. Cal Poly Land: Nature, Technology, and Society. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Scientific investigation of the natural features of the Cal Poly landscape and their transformations by land management technology. Analysis of the environmental, economic, social, and political effects of agriculture, resource extraction, and construction technology on that landscape. Emphasis on the educational, land-use, and long term planning issues of technology presented by this case study. 4 lectures. Crosslisted as AG/HUM/UNIV 330. Fulfills GE Area F.

**HUM 340. Media Arts and Technologies: Storytelling. 4 units.**

Prerequisite: HUM 240 and permission of Media Arts and Technologies minor coordinator.

Creation of expressive technology-based pre-production works for standard television and film presentation to interactive technological environments. Pre-production script work, storyboarding, flow chart design, collaborative story creation, audience testing, and basic animatic construction. Visiting professionals work with students directly in collaborative workshops. 3 lectures, 1 activity.

**HUM 341. Media Arts and Technologies: Cinematic Process. 4 units.**

Prerequisite: HUM 340 and permission of Media Arts and Technologies minor coordinator.

Cinematic production including adapting a narrative for different presentation formats, storyboarding, lighting, sound recording, cinematography and editing. Production of short works designed as foundational pieces that can be built upon individually or in teams in independent study. Visiting professionals run collaborative production workshops. 2 lectures, 2 activities.

**HUM 350. The Global Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary investigation of how human activities impact the Earth's environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/ historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 4 lectures. Crosslisted as AG/ EDES/ENGR/ HUM/SCM/UNIV 350. Fulfills GE Area F.

**HUM 361. Modernism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one class from Area C.

Recommended: Junior standing.

Interdisciplinary survey of the eighteenth, nineteenth and twentieth-century concepts and cultural movements known as modernism throughout Europe, North America and Latin America. Disciplines may include architecture, art, drama, literature, music, philosophy, and photography. 4 lectures. Crosslisted as HUM/UNIV 361. Fulfills GE C4.

**HUM 400. Independent Study Project. 1-2 units.**

Prerequisite: Junior or senior standing and consent of instructor.

Independent study project focusing more than one discipline on a problem in the Humanities. May involve travel and/or independent research. Bibliography and study plan submitted in advance. 1-2 activities.

**HUM 450. Summer Internship in London. 12 units.**

CR/NC

Prerequisite: Junior standing and consent of the Director of London Study.

Extensive work experience in London. Administration, orientation, and supervision of independent work by the service provider. Intensive two-week orientation, eight-week full-time work assignment. Evaluation by instructor, internship supervisor, and employer. Credit/No Credit grading only. 4 lectures, 8 units of independent study.

**HUM 451. Latin American Studies Internship. 4-12 units.**

Prerequisite: Junior standing or consent of instructor.

Supervised work experience in a private, governmental, or non-governmental organization working in Latin America or on a critical issue related to Latin America. Student engagement in all duties and responsibilities of employees and interns engaged in comparable work. 30 hours of work experience per unit of credit. Total credit limited to 12 units. Credit/No Credit grading only.

**HUM 470. Selected Advanced Topics. 2-4 units.**

Prerequisite: Completion of GE Area A and junior standing.

Focused interdisciplinary study of a problem in the Humanities combining the insight and expertise of more than one discipline, such as history, literature, religious studies, philosophy, fine arts and the sciences. Class Schedule will list topic selected. 2-4 lectures.

**HUM 480. Latin American Studies Field Work. 4-12 units.**

CR/NC

Prerequisite: Junior standing and consent of instructor.

Supervised field work on a faculty-led research project in Latin America or on a domestic project addressing a critical issue related to Latin America. Total credit limited to 12 units. Credit/No Credit grading only.

**HUM 490. President's Seminar: Science, Society and the University. 1-4 units.**

CR/NC

Prerequisite: Senior standing, GPA of at least 3.0, or consent of instructor.

Development of higher education in the United States; the role of science and research in the University; and the response of higher education to changing economic, political and social demands. Credit/No Credit grading only. 1-4 seminars. Crosslisted as HNRS/HUM 490.

## Industrial Technology (IT)

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### Industrial Technology Courses

**IT 137. Electrical/Electronic Systems. 4 units.**

Introduction to electrical and electronic circuit fundamentals. Essential information for technical managers regarding the universal law, theory, principles, application and troubleshooting of AC and DC circuits and devices. Familiarity with concepts used extensively in manufacturing/production and countless electronic products. Understanding of inductance, capacitance, resistance, integrated circuit components and the relationship they have with each other. Strategic decision and problem solving skills developed using electricity/electronics as the environment. 3 lectures, 1 laboratory.

**IT 150. Electrical and Mechanical Power Systems. 4 units.**

Introduction to traditional and alternative power systems. Includes power transmissions and end-use systems such as mechanical, thermal, fluid, and electrical systems with economics, safety, conservation, design and maintenance considerations. Includes introduction to electrical and electronic circuit fundamentals, essential for technical managers. 3 lectures, 1 laboratory.

**IT 233. Product Design with CAD. 4 units.**

Fundamental theory and practice of technical design communication and management of information systems. The basic application of 2-D and 3-D computer-aided design (CAD) and fundamental skills in communication of product design and their impact on the industrial organization. 2 lectures, 2 activities.

**IT 260. Manufacturing Processes and Materials. 4 units.**

Prerequisite: Sophomore standing.

Manufacturing processes with emphasis on shaping metallic products. Precision measuring, technical drawings, safety and equipment use as they apply to metal machining, welding, casting and sheet metal fabrication. Includes study of common industrial materials. 3 lectures, 1 laboratory.

**IT 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**IT 300. Symposium Organization. 2 units.**

CR/NC

Prerequisite: Completion of Area A or equivalent.

Managing the development of a technical information symposium from concept through symposium presentation. Organization of facilities, speakers, dinner meeting, professional meetings, industrial displays, food services, personnel, finances, and advertising. Credit/No Credit grading only. Total credit limited to 6 units. 2 seminars.

**IT 303. Lean Six Sigma Green Belt. 4 units.**

Prerequisite: STAT 217, STAT 218, STAT 251, or any 300 or 400 level statistics course.

Development of a comprehensive set of skills to effectively function as a lean six sigma leader. Discussion and problem workout sessions covering the lean six sigma green belt body of knowledge including problem definition, measurement, analysis, improvement, and control, as well as the team leadership skills necessary to complete projects. 4 lectures.

**IT 311. Industrial Safety and Quality Program Leadership. 4 units.**

Prerequisite: IT 150 and junior standing.

Effective program development and leadership required to implement safety and quality process improvement in industry. Application of industrial leadership, knowledge, skills and methods to develop and implement total safety and quality management programs. Class safety/quality process project includes the oral presentation. 3 lectures, 1 activity. Formerly IT 411.

**IT 326. Product Evaluation. 4 units.**

Prerequisite: Completion of GE Area B3 via a college course in physics (PHYS), or PSC 101.

Value engineering, product dissection and the study of reverse product engineering as they relate to product design for manufacturing; improved product quality; reduced usage of energy and materials; material recycling and reuse; product design and development, proving value to the customer and society. 3 lectures, 1 laboratory.

**IT 329. Industrial Materials. 4 units.**

Prerequisite: CHEM 110 or CHEM 111 or equivalent, and junior standing.

Structure, properties, applications and limitations of select industrial materials to include ferrous and nonferrous metals, ceramics, glasses, composites, and organic materials. Materials testing and material selection. 3 lectures, 1 activity.

**IT 330. Packaging Fundamentals. 4 units.**

GE Area F

Prerequisite: Junior standing; completion of GE Area B3 via a course in physics (PHYS), Honors Contract physics (HNRS), or physical science (PSC).

Overview of packaging. Historical development, functions, and materials. Processes and technology employed to protect goods through the supply chain. Container types, package design, development, research and testing. Economic and international importance and perspective as an industrial activity. Packaging and the environment, and laws affecting packaging. 3 lectures, 1 laboratory. Fulfills GE Area F.

**IT 341. Packaging Polymers and Processing. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B3.

Recommended: CHEM 110 or CHEM 111.

Cultural, social and economic implications of plastics in a worldwide environment. Study of physical and chemical properties of plastic materials, processing techniques, recycling, laws and regulations. Evaluation of current materials and technologies to reduce waste, improve reuse and recycling plastics. Applied laboratory experiences with common industry processes emphasizes relationships among processing, structure, and properties. Application of laboratory experiences to understand consumer interaction to specifications. 3 lectures, 1 laboratory. Fulfills GE Area F.

**IT 371. Decision Making in Supply Chain, Services, and Project Management. 4 units.**

Prerequisite: A grade of C- or better, or consent of instructor, in: MATH 141 or MATH 221, and STAT 217 or STAT 218 or STAT 252.

Introduction to supply chain, services, and project management decision making using information technology tools. Application of flowchart, project management network and spreadsheet software to process improvement, project planning, forecasting, and inventory management planning and control in manufacturing and service industries. Understanding current practices for decision making in manufacturing and service operations and project management. 4 lectures.

**IT 390. Industrial Automation. 4 units.**

Prerequisite: IT 233 and IT 260.

Automated manufacturing systems, including computer numerical control (CNC), robotics, computer-integrated manufacturing, assembly and packaging. Hands-on activities in manual/automatic programming/operation of CNC machines, robots and programmable logic controllers. 2 lectures, 2 activities. Formerly IT 445.

**IT 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**IT 402. Developing and Presenting New Enterprise Strategies. 4 units.**

Prerequisite: COMS 101 or COMS 102, BUS 346.

Taking a new industrial enterprise from concept to successful launch. The planning and management of a successful product-based start-up to include the integration of: product development; manufacturability and costs of production; manufacturing/outsourcing decisions; market channel selection; supply chain and distribution alternatives; inventory investment and scheduling to meet estimated demand. Successful new enterprises and application to a class project case study. Special emphasis on skills associated with developing effective technical presentations. 2 lectures, 2 activities.



**IT 403. Quality Systems Management. 4 units.**

Prerequisite: IT 341 or IT 371 and STAT 217, or STAT 218, or STAT 251; Business majors must have formally declared their concentration to enroll.

Quality assurance as viewed from a systems perspective that includes cost, time, and process elements. Lean thinking applied as a problem solving approach to achieve continuous process improvement through the elimination of waste and the reduction of variability. 4 lectures.

**IT 406. Industrial Sales. 4 units.**

Prerequisite: BUS 346.

Development of the technical competencies required in industrial selling and purchasing through the application of value stream mapping techniques and the philosophies and tool sets encompassing the discipline of process management as it relates to sales, marketing and customer service in Industrial settings. Includes guest speakers and team-based projects with local business organizations, individual and team product presentations, with written proposals. 3 lectures, 1 activity.

**IT 407. Applied Business Operations. 4 units.**

Prerequisite: IT 233, IT 260, IT 311, IT 326 and BUS 346.

An integrative experience replicating a manufacturer's business/production systems, including the design, fabrication, processing, quality control, resource management, cost-control, marketing, sales and packaging functions. Focus of instruction methodology on the development of the student's comfort with ambiguity and change inherent in business/production systems. Builds upon the foundational concepts developed throughout the Industrial Technology curriculum. 2 lectures, 2 laboratories.

**IT 408. Paper and Paperboard Packaging. 4 units.**

Prerequisite: IT 330.

Physical and chemical properties, manufacture, conversion and use of paper, paperboard, corrugated board and related components. Design, use and evaluation of packages made from these materials. Survey of tests and procedures for paper based packaging materials and packaging products following ASTM, TAPPI, and ISO standards. 2 lectures, 2 activities.

**IT 409. Packaging Machinery and Processes. 4 units.**

Prerequisite: IT 330.

Integrated study of packaging machinery and processes from a practical and operational viewpoint. Understanding basic processes and interrelationship between packaging machinery and type of product, production layout and efficiency, material handling and distribution equipment, quality control and ancillary systems. 3 lectures, 1 activity.

**IT 410. Operations Planning and Control. 4 units.**

Prerequisite: IT 341 or IT 371 and BUS 391.

Linking supply chain operations to deliver value to the end customer. Contrasting of advanced manufacturing concepts, such as pull systems, sales and operations planning, mixed model manufacturing, level production, and theory of constraints to traditional materials requirements planning systems. 3 lectures, 1 activity.

**IT 415. Supply Chain and Logistics. 4 units.**

Prerequisite: IT 303, IT 326, IT 330, IT 341, or IT 371.

Key concepts, tools, and approaches for making effective supply chain and logistics decisions in support of business goals. Practical management issues and applications are the focus rather than theoretical, mathematical optimization. Business cases and simulations are used to illustrate and explore best practices. 4 lectures.

**IT 419. Cooperative Education/Internship. 2-12 units.**

CR/NC

Prerequisite: Approval of area chair, junior standing, and a CPSLO cumulative GPA of at least 2.5 without being on academic probation.

Work experience in business, industry, government and other areas of student career interest. Periodic written progress reports, final report, and evaluation by work supervisor required. Credit/No Credit grading. Major credit limited to 4 units; total credit limited to 12 units.

**IT 428. Commercialization of New Technologies. 4 units.**

Prerequisite: IT 326 or BUS 342 or BUS 346 and BUS 212 or BUS 214.

Concepts, frameworks, and experiences necessary to understand the business potential of technology innovations and determine if one or more sustainable market opportunities can be identified to exploit them. Hands-on exercises and real new inventions to illustrate concepts. 4 lectures.

**IT 435. Packaging Development. 4 units.**

Prerequisite: IT 330 and IT 233.

The development of industrial and consumer goods packaging from concept to marketplace. Interplay of package design for marketing, production and distribution. Development of the package function for optimal market and consumer performance. Case studies of domestic and international package/product successes and failures with critical examination of performance, economic and social factors. Class project for analysis and solution. 3 lectures, 1 activity.

**IT 451. Facility Equipment and Systems. 4 units.**

Prerequisite: IT 150 or consent of instructor.

Develop an understanding of how major mechanical equipment and systems are incorporated in the utility and production support systems of a modern industrial facility. Includes field trips to industrial/commercial facilities. 4 lectures.

**IT 454. Facilities Development. 4 units.**

Prerequisite: IT 451 or consent of instructor.

Construction and maintenance of physical facilities and equipment as related to plant layout/design, regulatory and environmental compliance, safety/security, energy conservation, and process improvement. 4 lectures.

**IT 457. Radio Frequency Identification in Supply Chain Management. 4 units.**

Prerequisite: PHYS 121 or PHYS 122, MATH 141 or MATH 221.

An overview of Radio Frequency Identification (RFID) technology from the managerial standpoint. Developing simple RFID solutions using development kits. 2 lectures, 2 laboratories.

**IT 461. Senior Project I. 2 units.**

Prerequisite: Consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems graduates must solve in their field of employment. Project results presented in a formal report, and must be completed in two quarters. Minimum 120 hours total time.

**IT 462. Senior Project II. 2 units.**

Prerequisite: Consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems graduates must solve in their field of employment. Project results presented in a formal report, and must be completed in two quarters. Minimum 120 hours total time.

**IT 464. Applied Industrial Technology Senior Project Seminar. 4 units.**

Prerequisite: Senior standing.

Selection and analysis of industrial and technological problems and opportunities in directed individual or group-based projects. Problems typical to those which graduates could encounter in their fields of employment. Formal report required. 4 seminars.

**IT 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study and seminars in selected topics in industrial technology. Open to undergraduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 lectures.

**IT 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**IT 475. Packaging Performance Testing. 4 units.**

Prerequisite: IT 330.

Survey of tests and procedures for packaging materials and packaging products following ASTM and ISTA standards. The testing procedures include tests for shock, vibration, drop and impact as prescribed for shipment by truck, rail, sea, and air. Hands-on product/package testing for quality control. 2 lectures, 2 laboratories.

**IT 500. Individual Study. 1-6 units.**

Prerequisite: OCOB graduate standing and formal petition with approval from the Associate Dean.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Maximum of 6 units may be applied to degree requirements.

**IT 531. Lean Six Sigma Value Chain Management. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Familiarization with the Lean Six Sigma process improvement methodology and practice using Six Sigma Black Belt tools. A Six Sigma Black Belt is an individual skilled in applying basic and advanced process improvement and project management methods in order to complete projects that will result in significant, sustainable improvements within an organization. 2 lectures, 2 laboratories.

**IT 532. Technology Entrepreneurship. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

An understanding of the technology entrepreneurship processes by which new and innovative technologies are developed, embodied in products and/or services, brought to market, financed, and yield significant company growth. Focus on the technology startup experience, which has become a critical ingredient in national competitiveness as well as the career path of many former IT students. 2 lectures, 2 laboratories.

**IT 533. Industrial Processes and Materials. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Survey of emerging industrial processes and materials, and enterprise management implications of alternatives. Integrative problems such as concurrent engineering, material and process selection. 2 lectures, 2 laboratories.

**IT 534. Advanced Packaging Dynamics for Distribution. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

The latest technologies and techniques utilized to protect a product from common and singular distribution hazards. Distribution hazards, product fragility, cushion performance, structural package design and the ASTM, ISTA and military packaging regulations and testing protocols. Distribution environment measurement using data recorders and simulation of the captured data in a packaging dynamics lab. 2 lectures, 2 laboratories.

**IT 545. Product Conceptualization and Execution Using Rapid Prototyping. 4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Product development using current solid modeling and rapid prototyping technologies. Comprehensive simulation of the product development life cycle from initial concept to completed prototype. Applications of three-dimensional solid modeling and rapid prototyping to follow a product from concept to completion. 2 lectures, 2 laboratories.

**IT 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Directed group study of selected topics for advanced students. Open to undergraduate students. The Schedule of Classes will list title selected. Total credit limited to 16 units. 1-4 seminars.

**IT 571. Selected Advanced Topics Laboratory. 1-4 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Directed group laboratory study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 16 units. 1-4 laboratories.

**IT 591. Applied Industry Project I. 2 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Initiation, completion and presentation of an individual project, involving research, allowing an opportunity to apply knowledge, skills, and competencies to address a significant business issue in the field of industrial technology, preferably in connection with the student's employment. As part of IT 591 a formal written project proposal must be accepted and approved by the Industrial Technology Area Chair before work begins.

**IT 592. Applied Industry Project II. 3 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Initiation, completion and presentation of an individual project, involving research, allowing an opportunity to apply knowledge, skills, and competencies to address a significant business issue in the field of industrial technology, preferably in connection with the student's employment. As part of IT 591 a formal written project proposal must be accepted and approved by the Industrial Technology Area Chair before work begins.

**IT 594. Business and Technology Project I. 3 units.**

Prerequisite: Graduate standing in the Master of Science in Business and Technology program or approval from the Associate Dean.

Development of a comprehensive applied research project proposal, including problem statement, literature review, questions and hypotheses, research design and methodology, procedures, research sample, proposed data collection and analyses. The project proposal must be accepted and approved by the Industrial Technology Area Chair.

**IT 595. Business and Technology Project II. 3 units.**

Prerequisite or corequisite: Satisfactory completion of IT 594 and Graduate standing in the Master of Science in Business and Technology program or approval from the Associate Dean.

Execution of the comprehensive applied research project proposal developed in IT 594. Included by illustration: securing a study sample, developing data collection instruments and procedures, completing data collection, and preparing the project data set for statistical or qualitative analyses.

**IT 596. Business and Technology Project III. 3 units.**

Prerequisite or corequisite: Satisfactory completion of IT 595 and Graduate standing in the Master of Science in Business and Technology program or approval from the Associate Dean.

Completion of the applied research project executed in IT 595. Included by illustration: final analyses, developing data displays, writing the final discussion chapter, editing project report and making an oral presentation to IT faculty.

**IT 599. Industrial and Technical Studies Thesis. 3 units.**

Prerequisite: OCOB graduate standing or approval from the Associate Dean.

Completion of a thesis involving individual research that is significant to the field of industrial and technical systems. A formal written proposal must be accepted by the Associate Dean of OCOB Graduate Programs before work begins. Course satisfies culminating experience requirement through the completion of the comprehensive thesis. Total credit limited to 9 units.

## Industrial and Manufacturing Engineering (IME)

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### Industrial and Manufacturing Engineering Courses

**IME 101. Introduction to Industrial and Manufacturing Engineering. 1 unit.**

Introduction of major topics in industrial and manufacturing engineering. Time management, study skills and class scheduling necessary for academic success. University services. Professional ethics. Career opportunities review. 1 laboratory.

**IME 130. Technical Foundations. 2 units.**  
CR/NC

Introduction to visualization, sketching, and drafting. Basic hand-tools, shop practices, and materials. Clearances and fits, threads and fasteners. Safety. Open to all majors. Credit/No Credit grading only. 1 lecture, 1 laboratory.

**IME 140. Graphics Communication and Modeling. 2 units.**

Introduction to computer-aided drafting and modeling of solid objects. Visualization and sketching for engineers. Communication of design information to manufacturing using pictorials, orthographic projection, section views, and auxiliary views. Manufacturing tolerances. 1 lecture, 1 laboratory.

**IME 141. Manufacturing Processes: Net Shape. 1 unit.**

Metal casting as a net shape process in manufacturing. Properties of molding materials and methods of casting. Introduction to rapid prototyping. Pattern and casting design principles. 1 laboratory.

**IME 142. Manufacturing Processes: Materials Joining. 2 units.**

Theory and application of metal cutting and welding processes. Includes shielded metal arc, flux cored arc, submerged arc, gas metal arc, gas tungsten arc, brazing, resistance, and oxy-acetylene processes. Bonding theory, joint design, codes and testing. Introduction to adhesive bonding. Open to all majors. 1 lecture, 1 laboratory.

**IME 143. Manufacturing Processes: Material Removal. 2 units.**

Uses, capabilities, and theoretical and operational characteristics of lathe and milling machine tools, including conventional, automatic and numerical control. Cutting tool characteristics, machining parameters, quality control, and production methods. Design considerations for manufacturing. Introduction to robotics and automation. Open to all majors. 1 lecture, 1 laboratory.

**IME 144. Introduction to Design and Manufacturing. 4 units.**

Recommended: IME 140, ME 151, or equivalent.

Supplemental review of visualization, sketching, and drafting fundamentals. Computer-aided solid modeling of parts and assemblies. Introduction to conventional machining processes on lathes and mills, computer numerical control, quality control, production methods, and design for manufacturing. Open to all majors. 2 lectures, 2 laboratories.

**IME 156. Basic Electronics Manufacturing. 2 units.**

Practical electronics manufacturing knowledge expanded through concepts such as CAD/CAM design, Design for Manufacture (DFM), documentation requirements, prototyping and production planning. Hands-on techniques learned for project planning, soldering, automation, hand tool usage and production methods. 1 lecture, 1 laboratory.

**IME 157. Electronics Manufacturing. 4 units.**

Printed circuit board assembly; printed circuit board fabrication process; electronics packaging; overview of semiconductor manufacturing; design, documentation and fabrication of electronic units with emphasis on CAD/CAM. Open to all majors. 2 lectures, 2 laboratories.

**IME 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**IME 223. Process Improvement Fundamentals. 4 units.**

Prerequisite: MATH 141. Recommended: IME 101.

Principles of work simplification and motion analysis. Recording of work flow and methods. Process improvement through work measurement and standards, time study, synthetic data, predetermined time systems and work sampling. Allowances and performance rating, productivity measures. Introduction to lean manufacturing principles. Client based project. 3 lectures, 1 laboratory.

**IME 239. Industrial Costs and Controls. 3 units.**

Prerequisite: IME 223.

Estimation of manufacturing costs for production planning, cost analysis, and cost control. Planning, budgeting and control processes. Costs, accounting data and analysis of variances for managerial control, inventory valuation and decision making. Techniques of forecasting, pricing, cost estimating and cost reduction. 3 lectures.

**IME 240. Additional Engineering Laboratory. 1-2 units.**

Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 or 2 laboratories.

**IME 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**IME 301. Operations Research I. 4 units.**

Prerequisite: MATH 244.

Systems modeling methodology, mathematical model formulations, linear programming, graphical and simplex methods. Duality and sensitivity analysis. Transportation, transshipment and assignment models. Introduction to goal programming and elastic constraints. Computer applications. 3 lectures, 1 activity.

**IME 303. Project Organization and Management. 4 units.**

Prerequisite: Junior standing, IME 314 or equivalent.

Design and implementation of a major industrial/business systems project. Project planning considerations. Motivational and influence techniques used in project management. Scheduling techniques with risk assessment. Resource leveling and management under constraints. Reducing project duration. Monitoring progress with earned value analysis. Project audit and closure. Planning and implementation of a project. Application of project management software. 3 lectures, 1 laboratory.

**IME 312. Data Management and System Design. 4 units.**

Prerequisite: CSC 232.

Design and management of industrial databases and reporting systems. Relationships of financial accounting databases and production systems. Efficient data entry and reports, queries, macro function, and Internet based database applications. 3 lectures, 1 laboratory.

**IME 313. Introduction to Information Systems Engineering. 4 units.**

Prerequisite: CSC 232.

Practical approach to use of modern information technologies related to industrial and manufacturing engineering. Use of networking and application software, including theory and practice. 3 lectures, 1 laboratory.

**IME 314. Engineering Economics. 3 units.**

Prerequisite: MATH 241.

Economic analysis of engineering decisions. Determining rates of return on investments. Effects of inflation, depreciation and income taxes. Sensitivity, uncertainty, and risk analysis. Application of basic principles and tools of analysis using case studies. 3 lectures.

**IME 319. Human Factors Engineering. 3 units.**

Prerequisite: PSY 201 or PSY 202 or consent of instructor, and junior standing.

Analysis of factors influencing the efficiency of human work. Data on the physical and mental capacities of persons, the physical environment, work organization, and the problem of aging. Design of machines, operations, human computer interface and work environment to match human capacities and limitations, including the handicapped. Multidisciplinary team project. 3 lectures.

**IME 320. Human Factors and Technology. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B requirements.

Analysis of cognitive, sensory and physical limitations and capabilities of operators and users of technology, both hardware and software, in working and living environments. Analysis of pertinent databases for a proactive approach to designing user-centered industrial products / systems, consumer products, and work environment. 4 lectures. Fulfills GE Area F.

**IME 322. Leadership and Project Management. 2 units.**

Prerequisite: Junior standing in an engineering program or consent of instructor.

Theory and practice in leadership and project management skills for engineering design teams. Basic issues related to, and tools used for, managing projects and concepts comprising project management. Emphasis on situations requiring resolutions and management decisions by groups representing various elements of an enterprise. 2 lectures. Crosslisted as HNRS/IME/MATE 322.

**IME 326. Engineering Test Design and Analysis. 4 units.**

Prerequisite: STAT 321 with a grade of C- or better.

Data gathering and statistical testing applied to industrial engineering and manufacturing fields. Experimental methods for product and process evaluation and comparisons; interpretation of engineering data. Engineering experimental design, linear and nonlinear regression, ANOVA, and multifactor ANOVA. Utilization of existing computer software. 4 lectures.

**IME 327. Test Design and Analysis in Manufacturing Engineering. 4 units.**

Prerequisite: ME 236 or STAT 312 or STAT 321.

Sampling and descriptive statistics. Central limit theorem. Hypothesis testing for means and variances. Analysis of variance (ANOVA) and factorial design. Applications in engineering design, reliability manufacturing, and inspection. Design projects. 3 lectures, 1 laboratory.

**IME 330. Fundamentals of Manufacturing Engineering. 4 units.**

Prerequisite: IME 141 or IT 341; IME 142; CE 204; MATE 210; MATE 215; IME 144 or IME 143 and ME 251.

Engineering analysis of manufacturing processes for casting, molding, forming, joining, and machining. Design for manufacturability and estimation of production costs. Process design strategies. Setup and operation of processing equipment; inspection methods. Field trip to manufacturing center. 3 lectures, 1 laboratory.

**IME 335. Computer-Aided Manufacturing I. 4 units.**

Prerequisite: MATH 244; IME 144 or IME 143 and ME 251; and CSC 101, CSC 231, CSC 232 or CSC 234.

Use of the computer to communicate design information to manufacturing. Computer Numerical Control (CNC) programming. Use of CAD/CAM software. Overview of manufacturing systems in an automated environment, including cellular manufacturing and computer-aided process planning. 3 lectures, 1 laboratory.

**IME 336. Computer-Aided Manufacturing II. 4 units.**

Prerequisite: IME 335, ME 212, MATH 244, or consent of instructor.

Advanced Computer Numerical Control (CNC) programming and machine tool control. Machining center operation. Parametric representation of curves and surfaces. Computation of tool paths. Product and process design for CNC machining. CNC machine tool dynamics. Introduction to flexible manufacturing systems and robotics. Design and fabrication projects. 3 lectures, 1 laboratory.

**IME 342. Manufacturing Systems Integration. 4 units.**

Prerequisite: MATH 241 and IME 223 or consent of instructor.

Recommended: STAT 321.

Analysis and design tools for production planning, control, and simulation of manufacturing systems. Use of systems modeling software. Overview of ergonomics and facilities design. 3 lectures, 1 laboratory.

**IME 351. Advanced Material Removal Process Design. 4 units.**

Prerequisite: IME 241 or IME 330, MATE 210 and MATE 215, and CE 204.

Advanced turning and milling processes; grinding and non-traditional processes. Thread and gear manufacturing, producibility, machinability, part and tool materials, cutting fluids, and tool life testing. Finishes and measurement of surface roughness. Process design projects. 2 lectures, 2 laboratories.

**IME 356. Manufacturing Automation. 4 units.**

Prerequisite: EE 321.

Computers in the factory automation environment. Basic control theory including feedback. Programming and use of programmable logic controllers (PLC), human-machine interface (HMI), and industrial control systems. Interfacing of electro-mechanical systems; analog and digital inputs, output; programmable controllers. Computer process control. 3 lectures, 1 laboratory.

**IME 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limit to 4 units.

**IME 401. Sales Engineering. 2 units.**

Prerequisite: Senior standing in engineering, or consent of instructor.

Concepts and principles of engineering in sales. Role of the professional engineer in the analysis, design, development, production, and final application of a product or system required by the buyer. 2 seminars.

**IME 405. Operations Research II. 4 units.**

Prerequisite: IME 301, STAT 321 or consent of instructor.

Stochastic decision analysis. Queuing models, inventory models and analysis. Markov processes. Computer aided modeling and case studies. 3 lectures, 1 activity.

**IME 407. Operations Research III. 4 units.**

Prerequisite: IME 301 or consent of instructor.

Systems modeling and solution of large scale problems using advanced operations research methods. Integer and goal programming. Application of nonlinear, quadratic, dynamic programming concepts. Case studies of systems modeling including software aided analysis. 3 lectures, 1 activity.

**IME 408. Systems Engineering. 3 units.**

Prerequisite: IME 326, IME 405, CSC 232.

Systems, subsystems, static, dynamic, closed and open systems. Systems design requirements. Performance measures. Process control modeling and analysis, transform methods, linear systems analysis, digital, adaptive and steady state optimal control. Optimal search strategies. Manufacturing, maintenance, replacement and engineering applications. 3 lectures.



**IME 409. Economic Decision Systems. 3 units.**

Prerequisite: IME 239, IME 314, and IME 405, or consent of instructor.

Economic evaluation of information for complex decisions. Analysis of risks and uncertainties. Bayes theory and models. Decision theory, sequential decisions, and value of information applied to financial evaluation and control. Major project justification procedures. 3 lectures.

**IME 410. Production Planning and Control Systems. 4 units.**

Prerequisite: IME 342 or IME 405.

Building blocks of manufacturing resource planning (MRP II). Demand forecasting, production planning, master scheduling development. BOM and inventory files. MRP computations and operational challenges. Capacity analysis and production control in push and pull systems. Enterprise Resource Planning (ERP). Principles of JIT and lean manufacturing. Not open to students with credit in IME 580. 3 lectures, 1 laboratory.

**IME 411. Production Systems Analysis. 3 units.**

Prerequisite: IME 410, or equivalent.

Systems analysis for production control. Design of computer integrated planning and control systems for scheduling manufacturing orders, monitoring operating costs and control system performance evaluation. Development of computer-aided decision making framework. Interactive decision making using simulation modeling. 2 lectures, 1 laboratory.

**IME 416. Automation of Industrial Systems. 3 units.**

Prerequisite: IME 356, ME 305 or equivalent.

Automation in manufacturing and warehousing. Economic selection of automation systems. Projects in automation. 2 lectures, 1 laboratory.

**IME 417. Supply Chain and Logistics Management. 4 units.**

Prerequisite: IME 342, or IME 410 or consent of instructor.

Overview of key logistics and supply chain management concepts. Models and solution methods for the design, control, operation, and management of supply chains. Techniques that are used to analyze supply chains. Team projects in partnership with industry sponsors. 4 lectures.

**IME 418. Product-Process Design. 4 units.**

Prerequisite: Senior standing in engineering or graduate standing. Recommended: IME 341 or IME 450 (formerly IME 341).

Innovation for product development, engineering management of new product development and manufacturing competitiveness. Concurrent engineering. Study of manufacturability constraints in terms of prototyping, designing, testing, pre-production support, processing, quality, delivery, and customer satisfaction. Industrial design projects. Examination of relevant environmental and ethical problems. 3 lectures, 1 laboratory.

**IME 420. Simulation. 4 units.**

Prerequisite: IME 326; IME 405, or consent of instructor.

Design and analysis of manufacturing and service systems by simulation. System modeling. Random number and function generators, programming, and characteristics of simulation languages. Design projects using real world problems. Introduction to rule-based expert systems. 3 lectures, 1 laboratory.

**IME 421. Manufacturing Organizations. 3 units.**

Prerequisite: Junior standing; PSY 201, PSY 202, or KINE 250 or consent of instructor. Recommended: IME 314.

Theory and principles for manufacturing organizations. Competitive advantage. Strategic planning and operations management for organizations and teams in a rapidly changing environment. Engineering management concepts and practices. Team-based projects and cases. 3 seminars.

**IME 427. Design of Experiments. 4 units.**

Prerequisite: IME 326 or IME 327 or IME 503 or STAT 312.

Experimental design principles. Simple comparative experiments. One-way ANOVA. Randomized block design. Factorial designs and the 2k factorial design. Fractional factorial designs. Response surface methodology. Design projects using real world problems. 3 lectures, 1 laboratory.

**IME 428. Engineering Metrology. 4 units.**

Prerequisite: IME 143 or IME 144; and IME 326, IME 327, IME 503 or STAT 312.

Measurement of attributes and variables; standards, accuracy and precision; mechanical, electronic and optical/laser measurement systems. Contact and non-contact measurement; straightness, flatness and squareness; GDT (Geometric Dimensioning and Tolerancing); CMM (Coordinate Measurement Machines); surface roughness; metrology for electronic products. 3 lectures, 1 laboratory.

**IME 429. Ergonomics Laboratory. 1 unit.**

Prerequisite: IME 319, IME 326.

Investigation of various physiological, sensory, and cognitive capabilities and limitations of people in work and living environments through laboratory data collection, design of experiments and statistical analysis. 1 laboratory.

**IME 430. Quality Engineering. 4 units.**

Prerequisite: IME 326, IME 327, IME 503, STAT 302 or STAT 312.

Quality history and philosophies. Cost of quality. Quality control tools. Statistical control charts for variables and attributes. Process capability. Measurement system analysis. Acceptance sampling. Reliability and life testing methods. Quality improvement tools: Quality Function Deployment, Failure Modes and Effects Analysis, Six Sigma, quality standards and systems. 4 lectures.

**IME 431. Supplier Quality Engineering. 4 units.**

Prerequisite: IME 430.

Customer-supplier partnership. Functions of Supplier Quality Engineering. Supplier selection, development, process qualification, concurrent engineering, value engineering. Process characterization, repeatability, consistency, process control. Quality system standards. Supplier survey, audit, rating, measurement of quality, delivery performance and certification. Customer service, corrective action approaches. 3 lectures, 1 laboratory.

**IME 433. Advanced Work Measurement. 3 units.**

Prerequisite: IME 223, IME 326 or equivalent.

Predetermined time systems. Time formulas. Standard data systems. Use of statistical methods. Standard data systems applied to clerical, manufacturing, and micro assembly. Developing and maintaining computerized systems. Course will be administered with project orientation. 2 lectures, 1 laboratory.

**IME 435. Reliability for Design and Testing. 3 units.**

Prerequisite: IME 326, IME 327, IME 503 or STAT 312.

Reliability concepts and mathematical models, mechanical device reliability, electrical device reliability, systems reliability and maintainability, reliability data, assurance program elements. Not open to students with credit in IME 542. Course may be offered in classroom-based or online format. 3 lectures.

**IME 437. Advanced Human Factors Engineering. 3 units.**

Prerequisite: IME 319 and either IME 326 or IME 503.

Team-based approach to human factors assessment of consumer and industrial products, systems, and information technology. Team building principles and techniques in human factors analysis. Usability analysis and ergonomics auditing through experimental methods. 2 lectures, 1 laboratory.

**IME 441. Engineering Supervision I. 1 unit.**

Prerequisite: Consent of instructor.

Theory and principles of supervision. Application of fundamental concepts and techniques of supervision provided by assignment in engineering laboratories. 1 laboratory each.

**IME 442. Engineering Supervision II. 1 unit.**

Prerequisite: Consent of instructor.

Theory and principles of supervision. Application of fundamental concepts and techniques of supervision provided by assignment in engineering laboratories. 1 laboratory each.

**IME 443. Facilities Planning and Design. 4 units.**

Prerequisite: IME 144, IME 223, IME 405 or IME 342, IME 314, or equivalent. Recommended: IME 319, IME 420.

Design concepts and input requirements in planning and design of new or renovation of existing manufacturing systems. Product, process, and flow and activity analysis techniques. Flow lines and buffering techniques. Computer-aided layout design and evaluation. Design of handling systems. Math models of location problems. Multidisciplinary team project. 3 lectures, 1 laboratory.

**IME 450. Manufacturing Process and Tool Engineering. 4 units.**

Prerequisite: MATH 244, IME 330. Recommended: IME 335.

Engineering design of fixtures and tools for manufacturing processes. Interpretation of engineering design specifications. Analysis of cost, quality, productivity, and safety in tool design. Mechanical analysis of tool design. Detailed process design for net shape production and component design for manufacture. Process and tool design projects. 3 lectures, 1 laboratory.

**IME 455. Manufacturing Design and Implementation I. 3 units.**

Prerequisite: IME 418.

A mix of industry and in-house structured group projects. Projects progress through a complete cycle from design through implementation. Application of project management methods. Examination of relevant economical and safety issues. 3 laboratories.

**IME 457. Advanced Electronic Manufacturing. 4 units.**

Prerequisite: EE 201, IME 156 or IME 157.

Design and fabrication of commercial electronic products; PCB layout design, bill of material analysis and component purchasing, production planning and scheduling, programming automated surface-mount assembly line, marketing of products. Multidisciplinary project teams exposed to real-world challenges of electronics manufacturers. 2 lectures, 2 laboratories.

**IME 458. Microelectronics and Electronics Packaging. 4 units.**

Prerequisite: EE 112 or EE 201. Recommended: MATE 210.

Materials, processes, and reliability of microelectronics and electronics packaging, surface mount assembly and printed circuit board fabrication. Organic substrates and ceramic substrates. Mechanical design, thermal, and electrical considerations in electronic packaging. Design for manufacturability. Overview of optoelectronics packaging and other emerging technologies in microelectronics and electronic packaging. Project on design and manufacture of an electronic device. 3 lectures, 1 laboratory. Crosslisted as CPE 488/IME 458/MATE 458.

**IME 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**IME 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**IME 481. Senior Project Design Laboratory I. 2 units.**

Prerequisite: Senior standing in major and consent of instructor.

Culminating design project typical of problems faced in professional practice. Individual or group projects typically involve system design, modeling, analysis and testing. Project method includes costs, planning, scheduling, appropriate research methodology and formal reports. 2 laboratories.

**IME 482. Senior Project Design Laboratory II. 3 units.**

Prerequisite: IME 481.

Continuation of IME 481. Involves research methodology: problem statement, method, results, analysis, synthesis, project design, construction (when feasible), and evaluation/conclusions. Project results presented in thesis-like formal reports suitable for reference library and formal oral presentations. 3 laboratories.

**IME 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**IME 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**IME 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**IME 500. Individual Study. 1-4 units.**

Prerequisite: Consent of department chair and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to students who have demonstrated ability to do independent work.

**IME 501. Graduate Survey I. 4 units.**

Prerequisite: Graduate standing.

Survey of traditional industrial engineering applications in industrial systems, work methods, measurements and analysis. Facilities design, automation and logistics of industrial operations. Human factors and cost estimation of industrial applications. 3 seminars, 1 activity.

**IME 503. Applied Statistical Methods in Engineering. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Application of hypothesis testing, regression models, and ANOVA models to forecasting, process optimization, cost estimation, work measurement, inventory control, scheduling, and ergonomics. Probability distributions of process outputs in industries and service systems such as Normal, exponential, Uniform, Hypergeometric, Binomial, and Poisson. Applications in queuing, reliability, Markov chains. Expectations for random variables. Measures of central tendency and variation. Population and a random sample. Central limit theorem and its application in simulation of processes. 3 lectures, 1 laboratory.

**IME 507. Graduate Seminar. 2 units.**

Prerequisite: Graduate standing or consent of instructor.

Selected topics of interest to industrial engineering, integrated technology management, and engineering management graduate students. Class Schedule will list topic selected. Total credit limited to 4 units, with a maximum of 2 units per quarter. 1 seminar, 1 laboratory.

**IME 510. Systems Engineering I. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Project management. Scheduling and budgeting. Queuing theory. Process control and life-cycle cost analysis. Contracts and negotiation. 4 lectures. Crosslisted as AERO/IME 510.

**IME 511. Systems Engineering II. 4 units.**

Prerequisite: AERO 510 or IME 510, graduate standing or consent of instructor.

Risk management. Design strategies to meet system/mission requirements. Design for supportability, manufacturability, reliability, etc. Quality function development and quality control concepts. 4 lectures. Crosslisted as AERO/IME 511.

**IME 520. Advanced Information Systems for Operations. 4 units.**

Prerequisite: IME 410 or consent of instructor.

Advanced information systems (IS) applications in manufacturing and service operations. Introduction of common IS applications, such as manufacturing execution systems; reporting systems; capacity planning systems; scheduling systems; and customer inquiry systems. Industry-specific analysis of IS requirements and availability. 4 seminars.

**IME 526. Advanced Topics in Manufacturing System Design. 4 units.**

Prerequisite: IME 410 or equivalent.

Modeling and analysis of manufacturing systems. Advanced topics in manufacturing system design to support development of complex systems: Virtual Reality, discrete event simulation, system architectures, systems integration, scheduling and control of manufacturing systems. Total credit limited to 12 units. 3 seminars, 1 laboratory.

**IME 541. Advanced Operations Research. 4 units.**

Prerequisite: Graduate standing and consent of instructor.

Operations Research approach to model building. Linear programming and sensitivity analysis. Network flow models. Integer programming, large scale linear programming. Goal programming and multi-attribute decision making. Dynamic programming. Nonlinear programming and search methods. Applications in model building and computer solutions in planning, resource allocation, scheduling, and other industrial and service operations. 3 lectures, 1 laboratory.

**IME 542. Advanced Reliability Engineering. 4 units.**

Prerequisite: IME 326, IME 327, IME 503 or STAT 312.

Reliability terminology and bathtub curve. Failure distributions: Exponential, Lognormal, and Weibull. Probability plotting. Reliability of systems. Maintainability and availability. Reliability in design; Load-strength analysis; Failure modes and effects analysis; Fault tree analysis. Reliability testing; Reliability management. Not open to students with credit in IME 435. 3 lectures, 1 laboratory.

**IME 543. Advanced Human Factors. 4 units.**

Prerequisite: IME 319; IME 326 and graduate standing.

Theory and application of man-machine relations and system design. Concepts of mathematical models, human information input channels, decision making based on capability of human operator. 3 seminars, 1 laboratory.

**IME 544. Advanced Topics in Engineering Economy. 4 units.**

Prerequisite: Undergraduate course in engineering economy.

Review of interest calculations and comparison of economic alternatives. Replacement analysis. Capital planning and budgeting. Mathematical programming and capital budgeting. Utility theory. Decision making under risk and uncertainty. Application of simulation in risk modeling. Benefit-cost analysis. Multi-attribute decision making. Analytic hierarchy process. 3 lectures, 1 activity.

**IME 545. Advanced Topics in Simulation. 4 units.**

Prerequisite: IME 420 and graduate standing.

Validation of simulation models. Statistical techniques for variance reduction. Experimental design and optimization. Comparison of attributes of simulation languages. Review of current manufacturing and service industry applications. Case studies. 3 lectures, 1 laboratory.

**IME 556. Technological Project Management. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Projects in industrial organizations and enterprises. Emerging technologies and project management. Relationship to strategic plans and managing change in organizations. Formulating, selecting, structuring, and planning projects. Project organization and control. Overcoming barriers. Application of project management software. 3 seminars, 1 laboratory.

**IME 557. Technological Assessment and Planning. 4 units.**

Prerequisite: IME 503 or equivalent, and graduate standing.

Assessing likely future technological environments, speed of change in competitive environments, relationship to business, strategic, and technology plans of firms. Past, present and technological evolution and operational changes. Technological and competitive impact assessment and business/technology strategy development. Use of case studies and company experiences. 4 seminars.

**IME 559. Engineering Research and Development. 4 units.**

Prerequisite: IME 314 or equivalent and graduate standing.

Principles, approaches and practices for effective engineering innovation, design, research and development (R&D) in business and industry. Relationship of R&D with corporate strategy and technology base. R&D objectives through implementation. Integration of creativity, evaluation, design, and ongoing operations. Case studies. 4 seminars.

**IME 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing and/or consent of instructor.

Directed group study of selected topics for advanced students. Open to graduate students and selected seniors. Topic lists will be provided with class schedule outlines. 1-4 seminars.

**IME 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**IME 577. Engineering Entrepreneurship. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

The special requirements of entrepreneurship in a high-tech environment. Guest lectures, focused seminar topics, a business plan project, and case studies provide the tools to evaluate and pursue technology-based business opportunities. 4 lectures.

**IME 580. Manufacturing Systems. 4 units.**

Prerequisite: Graduate standing.

Modern approaches in production and inventory planning and control to support large-scale manufacturing systems, material requirements planning (MRP I), manufacturing resource planning (MRP II), and just-in-time (JIT) manufacturing systems. Enterprise resource planning (ERP) and integration with financials. Information requirements, operational issues, and policy matters. Not open if credit in IME 410. 4 seminars.

**IME 591. Integrated Product Development I. 4 units.**

Prerequisite: Graduate standing.

Team taught course addressing: product opportunity identification, customer needs analysis, concept definition, requirements definition, product-process analysis, product specification, design/process description, prototyping, project management, packaging, product promotion/introduction, and manufacturing ramp-up. Team projects in partnership with industry sponsors, field-trips and formal presentations. 3 seminars, 1 laboratory for each.

**IME 594. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

**IME 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. A fully-developed formal report and evaluation by work supervisor required. Credit/No Credit grading only.

**IME 596. Team Project/Internship. 1-10 units.**

Prerequisite: Advanced graduate standing, completion of, or concurrent enrollment in, engineering courses in specialization, and consent of participating faculty.

Integrative learning experience through internship and team project with industrial organization. Requires advanced study and focuses on industrial unstructured problem or opportunity requiring integration across disciplines. Team project involves student, faculty, and sponsoring firm representative(s) in a collaborative learning environment, and culminates in comprehensive written report. Total credit limited to 10 units, normally taken over 2 quarters.

**IME 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis.

## **Interdisciplinary Studies (IS)**

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## Interdisciplinary Studies Courses

### IS 101. Interdisciplinary Studies. 4 units.

Introduction to collaborative interdisciplinary inquiry. Topics include: Scholarly knowledge production and bibliographic finding tools, University role in knowledge dissemination and creation, and information search and evaluation processes. 'Learn-by-doing' disciplinary investigation and interdisciplinary analysis and synthesis. 4 lectures.

### IS 301. Critical Issues Seminar. 4 units.

Prerequisite: Admission to the Adult Degree Program (Bachelor of Arts in Interdisciplinary Studies) prior to enrolling in this seminar.

Discussion-oriented seminar focusing on ethics and effective interdisciplinary decision-making in the contemporary world. Examination of ethical and other issues facing society through current public debates, as well as great intellectual traditions that have shaped the past. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 seminars.

### IS 302. Analytical Skills Seminar. 4 units.

Prerequisite: Admission to the Adult Degree Program (Bachelor of Arts in Interdisciplinary Studies) prior to enrolling in this class, IS 101 and IS 301 or consent of instructor.

Improvement of abilities to collect data, analyze information, frame questions, reach and defend logical conclusions. Emphasis on applying methods of data analysis to a variety of contemporary interdisciplinary issues. 4 seminars.

### IS 352. Organizational Leadership. 4 units.

Prerequisite: Completion of GE Area A, or junior standing or consent of instructor.

An interdisciplinary study of the definitions, theories, skills, and styles of organizational leadership in contemporary society. Strategies for managing human capital and an understanding of the relationship between attributes of good leadership and organizational change. Emphasis on developing an understanding of leadership in diverse organizations. 4 lectures.

### IS 450. Advanced Investigation Seminar. 4 units.

Prerequisite: Admission to Adult Degree Program (Bachelor of Arts in Interdisciplinary Studies), IS 301 and IS 302 with a minimum grade of C-.

In-depth interdisciplinary investigation into a narrowly defined issue of personal and/or professional interest. Identification of topic and examination from a variety of standpoints (e.g., cultural, environmental, religious, political, or economic). 4 seminars.

### IS 453. Special Topics in Organizational Leadership. 4 units.

Prerequisite: Completion of GE Area A, or junior standing, or consent of instructor.

Directed interdisciplinary analysis of selected contemporary issues or topics in organizational leadership. Topics may be examined from local, national or international perspectives. Total credit limited to 8 units. 4 seminars.

### IS 460. Capstone Project. 4 units.

Prerequisite: Senior standing, IS 301, IS 302, IS 450 with a minimum grade of C-.

Selection and completion of a summative project or report under the supervision of a faculty member. Investigation of the topic from an inter-disciplinary approach.

## Italian (ITAL)

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### Italian Courses

#### ITAL 101. Elementary Italian I. 4 units.

Beginning Italian. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. 3 lectures, 1 activity.

#### ITAL 102. Elementary Italian II. 4 units.

Prerequisite: ITAL 101 or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

#### ITAL 103. Elementary Italian III. 4 units.

Prerequisite: ITAL 102 or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

#### ITAL 201. Intermediate Italian I. 4 units.

GE Area C5

Prerequisite: ITAL 103 or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Italian within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5.

## Japanese (JPNS)

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### Japanese Courses

#### JPNS 101. Elementary Japanese I. 4 units.

Beginning Japanese. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, basic conversation, and introduction to Japanese culture. 3 lectures, 1 activity.

#### JPNS 102. Elementary Japanese II. 4 units.

Prerequisite: JPNS 101 or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, basic conversation, and introduction to Japanese culture. To be taken in numerical sequence. 3 lectures, 1 activity.

#### JPNS 103. Elementary Japanese III. 4 units.

Prerequisite: JPNS 102 or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, basic conversation, and introduction to Japanese culture. To be taken in numerical sequence. 3 lectures, 1 activity.



**JPNS 201. Intermediate Japanese I. 4 units.**

GE Area C5

Prerequisite: JPNS 103 or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Japanese within an intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity. Fulfills GE C5.

## Journalism (JOUR)

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### Journalism Courses

**JOUR 101. Introduction to Mass Media and Visual Communication. 2 units.**

Introduction to the history, theory and practices in mass media. Overview of traditional and digital technologies. Understanding of media literacy and critical information consumption.

**JOUR 201. Journalism History. 4 units.**

Survey of historical influences in the development of today's journalism. Contributions of women and minorities to American mass media. Rise of technology in the communication industry. 4 lectures.

**JOUR 203. News Reporting and Writing. 4 units.**

Introduction to the fundamental techniques of reporting and writing news articles from print and online perspectives. Extensive laboratory and field practices in gathering and evaluating information. Writing basic news stories under close supervision. 3 lectures, 1 laboratory.

**JOUR 205. Agricultural Communications. 4 units.**

Survey of the media of agricultural communication. Newspaper farm pages and sections, general and specialized agricultural magazines. Radio and TV farm broadcasts. Digital media sources. Public and private agencies involved in agricultural communication. Role of California minorities in agriculture. Writing on agriculture-related issues. 3 lectures, 1 activity.

**JOUR 219. Multicultural Society and the Mass Media. 4 units.**  
USCP

The role of the mass media in a democratic multicultural society. Portrayal and stereotyping of ethnic minorities by different mass media forms throughout U.S. history. The growing impact of minorities in the United States. Achievement and goals of current American ethnic media, with special attention to Latinos/as and African-Americans. 4 lectures. Fulfills USCP.

**JOUR 233. Editing. 4 units.**

Prerequisite: JOUR 203.

Editing for print and online publications. Using the Associated Press style. Writing headlines and captions. Repurposing various media content for the web and other formats. Ethical issues for the editor. 3 lectures, 1 laboratory.

**JOUR 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**JOUR 285. Intro to Multimedia Journalism. 4 units.**

Prerequisite: JOUR 203.

Introduction to the social, editorial and technical issues surrounding the Web as a new form of communication. Fundamentals of gathering, writing and publishing content for the Web that includes using photographs, sound, pictures and video to tell a story. 3 lectures, 1 laboratory.

**JOUR 302. Mass Media Law. 4 units.**

Prerequisite: JOUR 203 or consent of instructor.

Legal basis for freedom of expression. Court decisions resolving conflicts between First Amendment and right to fair trial, privacy, reputation. Source confidentiality, freedom of information, contempt, copyright. Federal and state laws and regulations affecting mass media reporters, editors, publishers, news directors. 4 lectures.

**JOUR 303. Multimedia Reporting and Production. 4 units.**

Prerequisite: JOUR 285 or consent of instructor.

Advanced exploration of the concepts and technologies associated with on-line communication. Advanced application of multimedia reporting skills and web-based audio and video production techniques from inception to editing and online publishing. 3 lectures, 1 laboratory.

**JOUR 304. Public Affairs Reporting. 4 units.**

Prerequisite: JOUR 233 or JOUR 342 or consent of instructor.

Experience leading to advanced skills in reporting and writing stories about contemporary issues, government and courts. Field and laboratory assignments in beat reporting, public meeting coverage, writing style, investigative techniques and online journalism research. 3 lectures, 1 laboratory.

**JOUR 312. Public Relations. 4 units.**

Prerequisite: Sophomore standing.

Overview of the history, growth and ongoing development of public relations as an information management function in a multicultural environment. Public relations practices used in commercial and non-profit sectors, and firsthand application of public relations skills. 4 lectures.

**JOUR 331. Contemporary Advertising. 4 units.**

Prerequisite: Completion of GE Area A3.

Principles of advertising, copy, layout, and production for print and broadcast media. Economic, political, and social function of advertising in a free market society. Advertising ethics. Social responsibility of advertising in a multicultural environment. Emerging advertising technologies. Advertising on the Internet. 4 lectures.

**JOUR 333. Broadcast News. 4 units.**

Prerequisite: Completion of GE Area A3.

Beginning broadcast news writing and reporting for radio and television. Emphasis on developing news judgment and producing radio newscasts. Introduction to television studio equipment and procedures. Lab experience includes writing and reporting live on-air for KCPR. 3 lectures, 1 laboratory.

**JOUR 342. Public Relations Writing and Editing. 4 units.**

Prerequisite: JOUR 312 or consent of instructor.

Theory, strategic planning and practice in writing persuasive public relations copy for diverse internal and external audiences. Emphasis on gathering information, preparing news releases, newsletters and other communications vehicles. Analysis of various media case studies. 4 lectures.

**JOUR 346. Broadcast Announcing and Production. 4 units.**

Prerequisite: JOUR 203. Recommended: JOUR 285.

Develop on-air skills in the performance of voice-overs, stand-ups, hosting and the production of televised public service announcements. Emphasis on the effective use of audio and non-linear video editing techniques as well as broadcast writing. 3 lectures, 1 activity.

**JOUR 348. Electronic News Gathering. 4 units.**

Prerequisite: JOUR 203 and JOUR 333 or consent of instructor.

Instruction on electronic news gathering (ENG) that includes advanced news writing, field reporting and editing for broadcast. Emphasis on developing research techniques, interviewing skills, responsible and effective non-linear video editing, compelling use of natural sound and professional on-air delivery. 3 lectures, 1 laboratory.

**JOUR 352. Advanced Newspaper Reporting Practicum: Mustang Daily. 4 units.**

Prerequisite: JOUR 304.

Reporting lab for students holding editorial positions on Mustang Daily. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**JOUR 353. Advanced Broadcast Journalism Practicum. 4 units.**

Prerequisite: JOUR 333 and JOUR 346 or JOUR 348.

Senior-level course synthesizing the diverse skills and experiences developed through the broadcast journalism curriculum. Students produce a live 30-minute CPTV newscast per week, or a one-hour KCPR segment that incorporates news, information, talk and entertainment. Emphasis on news producing, reporting and announcing skills. Total credit limited to 8 units. 3 lectures, 1 laboratory.

**JOUR 390. Visual Communication for the Mass Media. 4 units.**

Prerequisite: JOUR 203 or consent of instructor.

Theory and application of visual communication in today's print, broadcast and public relations media. Extensive experience in visual and text manipulation for effective information communication. 3 lectures, 1 laboratory.

**JOUR 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**JOUR 401. Global Communication. 4 units.**

Prerequisite: JOUR 203 and junior standing or consent of instructor.

Global communications facilities and operations; world transmission of information; survey of world wire services and international print and electronic media. Analysis of press operations under varying government ideologies, including third world countries. 4 seminars.

**JOUR 402. Journalism Ethics. 4 units.**

Prerequisite: JOUR 203 or consent of instructor.

Current issues revolving around the social responsibility of the mass media. Role of the public, government, and media in considerations of media accountability. Professional behavior in media organizations. 4 seminars.

**JOUR 407. Feature Writing. 4 units.**

Prerequisite: JOUR 203.

Practice in researching, interviewing and the writing and marketing of both long and short form nonfiction articles for various media outlets. Analysis of similar work in current distribution. 4 lectures.

**JOUR 410. Advanced Multimedia. 4 units.**

Prerequisite: JOUR 203.

Exploration of multimedia platforms for newsgathering and reporting. Information gathering and contextual manipulation from mass media, governmental and corporate databases. 3 lectures, 1 laboratory.

**JOUR 413. Public Relations Campaigns. 4 units.**

Prerequisite: JOUR 312 and JOUR 342.

Development of skills needed to plan and conduct internal and external public relations campaigns for corporate and non-profit organizations. Includes goal setting, management of resources, budgeting, creation of campaign communications, and outcomes analysis. 4 lectures.

**JOUR 415. Advanced Public Relations Practice: CCPR. 4 units.**

Prerequisite: JOUR 413.

Proposing, creating, managing, and implementing public relations campaigns for community-based clients on behalf of the student-run firm, Central Coast PRspectives. 3 lectures, 1 laboratory.

**JOUR 444. Media Internship. 3 units.**

CR/NC

Prerequisite: JOUR 352, JOUR 353, or JOUR 413; and internship coordinator approval.

Application of techniques on daily basis with media under supervision of department faculty. Credit/No Credit grading only.

**JOUR 460. Senior Project. 3 units.**

Prerequisite: Consent of instructor; Journalism majors only.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 90 hours total time.

**JOUR 462. Advanced Media Practicum. 3 units.**

Prerequisite: Consent of instructor.

Advanced principles of journalism convergence utilizing Mustang Media platforms. Capstone experience publishing across multiple media using journalistic writing, video, audio, and graphics. 1 lecture, 2 laboratories.

**JOUR 470. Selected Advanced Topics. 2-4 units.**

Prerequisite: Consent of instructor; junior standing.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 2-4 lectures.

**JOUR 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

## Kinesiology (KINE)

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### Kinesiology Courses

**KINE 100. Physical Activity for Students with Disabilities. 1 unit.**

CR/NC

Prerequisite: Consent of instructor.

Basic instruction in the development of skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 104. Badminton. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 108. Basketball. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 109. Bowling. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 110. Cycling. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 111. Fencing. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 112. Intermediate Bowling. 1 unit.**

CR/NC

Prerequisite: KINE 109.

Basic instruction and the development of skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses nor more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 116. Aerobic Exercise. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 121. Golf. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 122. Golf, Int.-Adv.. 1 unit.**

CR/NC

Prerequisite: KINE 121.

Basic instruction and the development of skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses nor more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 125. Jogging. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 129. Stretch, Flex and Relax. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 131. Physical Conditioning. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 132. Beginning Racquetball. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 133. Racquetball, Int. - Adv.. 1 unit.**

CR/NC

Prerequisite: KINE 132.

Basic instruction and the development of skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses nor more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 137. Self-Defense. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 138. Karate. 1 unit.**

CR/NC

Basic instruction and the development of skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses nor more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 3 units. Credit/No Credit grading only. 1 laboratory.

**KINE 139. Soccer. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 140. Ultimate Disc. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 142. Softball. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 143. Swimming for Non-Swimmers. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 147. Swim Conditioning. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 148. Tennis, Beg.. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.



**KINE 149. Tennis, Int. - Adv.. 1 unit.**

CR/NC

Prerequisite: KINE 148.

Basic instruction and the development of skill, knowledge of rules, background and analysis of techniques, and desirable attitudes toward physical fitness and participation in physical activities. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses nor more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 151. Volleyball. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 154. Weight Training. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 156. Aqua-Aerobics. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 176. Fitness Walking. 1 unit.**

CR/NC

Basic instruction in skill development, knowledge, and desirable attitudes toward physical activity. Enrollment is open to all students. Total limited to 12 units of credit earned in basic instructional KINE courses (KINE 100-176) for non-majors. The following restrictions apply to KINE 100-176: 1) no more than two different activity courses or more than one section of an individual activity course may be taken for credit in any one quarter, 2) a student may not enroll simultaneously in the same quarter for a beginning, intermediate and/or advanced activity course, and 3) any level of an activity course can be repeated only once for credit. Total credit limited to 2 units. Credit/No Credit grading only. 1 activity.

**KINE 180. Orientation to Kinesiology. 3 units.**

CR/NC

Prerequisite: Kinesiology majors only.

Designed to acquaint the student with disciplinary and professional perspectives in Kinesiology and the Kinesiology program at Cal Poly. Credit/No Credit grading only. 3 lectures.

**KINE 181. First Aid/CPR/AED. 1 unit.**

CR/NC

An American Red Cross certification course in Standard First Aid, CPR, and AED (Automated External Defibrillation). Skills and knowledge necessary in the treatment of life-threatening emergencies, other injuries, and sudden illnesses. Red Cross First Aid/CPR/AED certifications issued upon successful completion of certification requirements. Credit/No Credit grading only. 1 activity.

**KINE 208. Golf. 1 unit.**

Beginning to intermediate golf skills, rules, and etiquette including a combination of skill instruction and course play. Leadership activity assigned. 1 activity.

**KINE 210. Tennis. 1 unit.**

Beginning to intermediate tennis skills, etiquette, rules, and equipment. Singles and doubles play. Leadership activity assigned. 1 activity.

**KINE 212. Racquetball. 1 unit.**

Beginning to intermediate racquetball skills. Rules, regulations, basic strokes and shots, strategies and tournament play. Leadership activity assigned. 1 activity.

**KINE 213. Basketball. 1 unit.**

Beginning to intermediate basketball skills. Skill development, knowledge of rules, advanced strategies for playing basketball. Leadership activity assigned. 1 activity.

**KINE 214. Volleyball. 1 unit.**

Beginning to intermediate volleyball skills. Basic fundamentals, rules, regulations, strategies, skill development and games. Leadership activity assigned. 1 activity.

**KINE 216. Wrestling. 1 unit.**

Beginning to intermediate skills. Basic fundamentals of wrestling, rules and regulations. Leadership activity assigned. 1 activity.

**KINE 221. Combatives / Self-Defense. 1 unit.**

Beginner skills emphasizing offensive and defensive techniques for self-protection. 1 activity.

**KINE 223. Cross Country and Track Events. 1 unit.**

Beginning to intermediate skills in performance and analysis. Knowledge of rules and strategies. Development of skills and knowledge relating to performance, training, and scoring for cross-country and track running events. Leadership activity assigned. 1 activity.

**KINE 224. Field Events. 1 unit.**

Intermediate skills in performance and analysis. Knowledge of rules and strategies. Development of skills relating to performance, training, and scoring track field events. Leadership activity assigned. 1 activity.

**KINE 226. Soccer. 1 unit.**

Development of beginning and intermediate skills. Rules, regulations and game play. Leadership activity assigned. 1 activity.

**KINE 228. Cooperative Games and Activities. 1 unit.**

Introduction of a variety of cooperative games. Non-traditional movement experiences designed to enhance social, cognitive, and physical development. Leadership activity assigned. 1 activity.

**KINE 229. Badminton. 1 unit.**

Beginning and intermediate skills. Rules, regulations and strategies for competition. Leadership activity assigned. 1 activity.

**KINE 230. Aquatic Fitness Activities. 1 unit.**

Aquatic based resistance and cardiovascular activities for individual and group settings. Stroke development also included for front crawl, backstroke, breaststroke, butterfly, elementary backstroke and sidestroke. Must be able to swim 25 yards non-stop in order to participate. Leadership activity assigned. 1 laboratory.

**KINE 231. Leading Group Fitness Activities. 2 units.**

Prerequisite: KINE 230.

Aerobic fitness activities appropriate for large and small group exercise sessions. Development of instructional competency in the basic components of aerobic exercise, and leadership skills associated with the delivery of these activities. Emphasis on warm-up, cardiovascular fitness, heart-rate monitoring, dance choreography, elements of higher risk stretching and relaxation protocols, and equipment, and muscle conditioning. 2 activities.

**KINE 241. Understanding Fitness and Training. 1 unit.**

Prerequisite: Consent of instructor.

Introduction to physiological principles and factors which provide the basis for the development and maintenance of optimal physical fitness. 1 lecture.

**KINE 250. Healthy Living. 4 units.**

GE Area D4

Personal health with emphasis on healthful behavioral practices including physical fitness, nutrition, psychosocial well-being, alcohol and other drugs, intentional and unintentional injury, reproductive health, infectious and non-infectious diseases. 4 lectures. Not open to students with credit in KINE 255 or Liberal Studies majors. Fulfills GE D4.

**KINE 255. Personal Health: A Multicultural Approach. 4 units.**

GE Area D4; USCP

Personal health with special emphasis on multicultural practices. Not open to students with credit in KINE 250. 4 lectures. Fulfills GE D4 and USCP.

**KINE 260. Women's Health Issues. 4 units.**

GE Area D4; USCP

Introduction to major health issues that affect women disproportionately or differently from men. Topics include female sexual health and reproduction, exercise and eating behaviors, substance abuse, mental health and stress, and violence against women. 4 lectures. Fulfills GE D4 and USCP.

**KINE 265. Introduction to Community and Public Health. 4 units.**

Prerequisite: KINE 250 or KINE 255 or KINE 260. Recommended: STAT 217 or STAT 218.

Introduction to community health issues and core functions of public health. Social-ecological, behavioral, and policy influences on community health and health disparities. Health Promotion in community/public health settings. 4 lectures.

**KINE 266. Introduction to Psycho/Social Aspects of Physical Activity. 4 units.**

Recommended: Completion of GE Area A.

Psychological and sociological effects of physical activity on individuals and groups in American society. 4 lectures.

**KINE 275. Sports Officiating. 2 units.**

Designed to provide knowledge, understanding, appreciation of officiating in general, and the development of skills in officiating. 1 lecture, 1 activity.

**KINE 276. Athletic Coaching Theory. 3 units.**

Basic concepts, methods, practices, strategies and philosophies as they apply to competitive athletics. 3 lectures.

**KINE 277. Coaching Practicum. 2-3 units.**

CR/NC

Prerequisite: Consent of instructor.

Practical experience through the actual coaching of a competitive sports team. 2-3 activities; minimum of 2 hours per week per unit. Total credit limited to 6 units. Credit/No Credit grading only. Learning outcomes must be developmental if more than one practicum is completed.

**KINE 290. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**KINE 297. Medical Terminology. 3 units.**

CR/NC

Prerequisite: Completion of GE Area B2.

Development of medical vocabulary used in health care occupations, through the study of root words, prefixes, suffixes, and case studies. Pronunciation, spelling, and use of medical terms and abbreviations related to diagnosis, clinical procedures, surgery, and anatomical and physiological systems. Course offered online only. Credit/No Credit grading only. 3 lectures.

**KINE 298. Chronic and Communicable Disease Prevention. 4 units.**

Prerequisite: KINE 250, KINE 255, or KINE 260, and BIO 111 or BIO 161.

Significant chronic and communicable diseases including disparities among population groups in the U.S. Social, ecological, behavioral and lifestyle factors. Primary, secondary and tertiary prevention strategies that promote health, prevent disease and improve quality of life. 4 lectures.

**KINE 300. Planning Techniques in Physical Education. 3 units.**

Prerequisite: KINE 180. Corequisite: KINE 306.

Practical skills and techniques of teaching physical education in schools. Unit and lesson planning, class management, implementation and evaluation of a lesson in a laboratory setting. 2 lectures, 1 laboratory.

**KINE 301. Functional Muscle Anatomy. 2 units.**

Corequisite: BIO 361 or ZOO 231 or ZOO 331.

Functional organization of the human muscular system. Review of all major muscle groups, with emphasis on segmental motion. 2 lectures.

**KINE 302. Biomechanics. 4 units.**

Prerequisite: PHYS 118 or PHYS 121; KINE 301.

Fundamental biomechanical concepts and their application to human movement activities, and analyses of exercise mechanics and skill performance. 3 lectures, 1 laboratory.

**KINE 303. Physiology of Exercise. 4 units.**

Prerequisite: ZOO 231 or ZOO 331 and ZOO 232 or ZOO 332 or BIO 361.

Application of human physiology to exercise situations. 3 lectures, 1 laboratory.

**KINE 304. Pathophysiology and Exercise. 3 units.**

Prerequisite: KINE 303.

Selected human diseases, their etiology, pathophysiology, symptoms, diagnosis, effects on health and physical performance, and as affected by preventive or therapeutic exercise. 3 lectures.

**KINE 305. Drug Education. 4 units.**

Prerequisite: KINE 250 or KINE 255 or KINE 260 or KINE 443.

Social, biological, and psychological factors of the major drugs associated with therapeutic and recreational use and abuse in society. Topics include drug use as a social problem, theories and treatment of addiction, how drugs work, and the detrimental health effects of drug use. Emphasis on illegal and legal drugs. 4 lectures.

**KINE 306. Assessment in K-12 Physical Education. 3 units.**

Prerequisite: KINE 180 and STAT 217 or STAT 218.

Measurement and evaluation techniques in physical education, including statistics, computer applications, and measurement theories. Assessment tools in psychomotor, cognitive, and affective domains. 2 lectures, 1 laboratory.

**KINE 308. Motor Development. 3 units.**

Prerequisite: GE D4.

Motor development of individuals from birth to maturity. Emphasis on interrelationship between motor and cognitive characteristics and affective needs and interests. Course may be offered in classroom-based or online format. 3 lectures.

**KINE 309. Creative and Nontraditional Games. 3 units.**

Prerequisite: KINE 300.

Introduction of preparatory teachers to non-traditional and multicultural games and activities which address the State Framework and the National Standards. Students present the activities in a manner which demonstrates effective models of instruction, including maximum participation. 1 lecture, 2 activities.

**KINE 310. Concepts and Applications in Elementary Physical Education. 3 units.**

Prerequisite: Junior standing.

Movement as it relates to physical motor skill development, fitness, wellness, social development, cross-cultural understanding, and self-image. 2 lectures, 1 activity.

**KINE 311. Strength Training Instruction. 1 unit.**

Prerequisite: KINE 231, KINE 301.

Proper use of weight room resistance modalities including free weights and machine based exercises. Emphasis on effective and safe methods for leading individuals through an exercise session. 1 activity.

**KINE 315. Field Sports. 3 units.**

Prerequisite: KINE 300.

Introduction and preparation for teaching field sports in accordance with state and national standards for K-12 physical education programs. Students learn to present activities in a manner that reflects effective models of instruction. 1 lecture, 2 activities.

**KINE 316. Net and Wall Games. 3 units.**

Prerequisite: KINE 300, KINE 306.

Introduction and preparation for teaching net and wall games in accordance with state and national standards for K-12 physical education programs. Students learn to present activities in a manner that reflects effective models of instruction. 1 lecture, 2 laboratories.

**KINE 319. Introduction to Research Methods in Kinesiology. 4 units.**

Prerequisite: STAT 217 or STAT 218.

Principles of measurement and evaluation including contemporary research perspectives in kinesiology, health and exercise science. 3 lectures, 1 laboratory.

**KINE 320. Media and Technology in Science and Human Performance. 4 units.**

Prerequisite: Completion of GE Area A.

Applications of computers, electronic media and information technology as related to understanding and solving problems in the field of kinesiology and human performance. Projects include white papers, digital video, ePortfolios, and blogs. 3 lectures, 1 laboratory.

**KINE 323. Sport and Gender. 4 units.**

GE Area D5; USCP

Prerequisite: Junior standing; completion of GE Areas A, D1 and either D3 or D4.

Intersections between sport and gender in American society. Identification and discussion of the historical, sociological and psychological issues that affect the sport experiences of males and females, especially as they relate to class, race/ethnicity, sexuality, and political movements. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE D5 except for Kinesiology majors. Fulfills USCP.

**KINE 324. Sports, Media and American Popular Culture. 4 units.**

GE Area D5; USCP

Prerequisite: Junior standing; completion of GE Areas A, D1 and D3.

Issues of class, race/ethnicity, gender, various forms of deviance, and other aspects of social life. Exploration of sociological manifestations and implications of how the aforementioned social issues are embedded in mediated forms of sports. Kinesiology majors will not receive GE Area D5 credit. 3 lectures, 1 activity. Fulfills GE D5 and USCP.

**KINE 384. Water Safety Instructor. 4 units.**

Prerequisite: Consent of instructor.

Analysis of swimming strokes and techniques with emphasis on teaching methods for beginners through advanced swimmers. Those students who complete the course requirements are eligible for American Red Cross Water Safety Instructor certification. 2 lectures, 2 activities.

**KINE 396. Outdoor Education. 3 units.**

Prerequisite: KINE 300, KINE 306, and KINE 384.

Introduction and preparation for teaching Outdoor Education activities in accordance with the Physical Education Content Standards for California. Students learn to present activities in a manner that reflects effective models of instruction. Includes a clinical teaching experience. 1 lecture, 2 activities.

**KINE 400. Special Problems for Advanced Undergraduates. 1-3 units.**

Prerequisite: Senior standing or consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 3 units per quarter.

**KINE 401. Managing Kinesiology Programs. 3 units.**

Prerequisite: KINE major and senior standing.

Planning, organizing and controlling programs in public, commercial, private and clinical physical activity settings. Emphasis on legal, ethical and budgetary considerations. 3 lectures.

**KINE 402. Motor Learning and Control. 4 units.**

Prerequisite: STAT 217 or STAT 218 or equivalent coursework.

Variables which control sensory-motor integration. Analysis of factors which affect the acquisition of motor skills as related to the learning process and the learning environment. 3 lectures, 1 activity.

**KINE 406. Neuroanatomy. 4 units.**

Prerequisite: ZOO 231 and ZOO 232, or ZOO 331 and ZOO 332, or BIO 361.

Structure and function of the human nervous system. Afferent and efferent pathways involved in perception and action. Behavioral aspects of motor control and related neurological dysfunction and pathologies. Designed for allied health professions students. 4 lectures.

**KINE 407. Adapted Physical Activity. 4 units.**

Prerequisite: Sophomore standing and completion of GE Areas B2 and B3.

Major categories of disabling conditions with implications for the development of physical activity programs for specific disabilities. 3 lectures, 1 laboratory.

**KINE 408. Exercise and Health Gerontology. 4 units.**

Prerequisite: KINE 228, KINE 231 or KINE 330; KINE 250; and KINE 255 or KINE 260.

Special fitness, exercise, and health needs of elder adults. Theories of aging and age-related changes. Health and physical activity programs for elder adults. 3 lectures, 1 activity.

**KINE 410. Psychology of Coaching. 3 units.**

Prerequisite: Junior standing. Recommended: PSY 201 or PSY 202.

Psychological considerations of the coach-athlete relationship and mental preparation of teams and individuals for competition and practice. Special emphasis on the male and female adolescent with regard to the psychological implications of sports participation. 3 lectures.

**KINE 419. Physical Education Program Content in the Elementary School. 3 units.**

Prerequisite: KINE 300 and two activity classes.

Cognitive and psychomotor competencies required to design a developmental physical education program for elementary aged school children. 2 lectures, 1 activity.

**KINE 421. Strategies for Teaching Physical Education. 3 units.**

Prerequisite: KINE 419.

Systematic analysis and refinement of teaching skills within the discipline of physical education. 2 lectures, 1 activity.

**KINE 422. Teaching Elementary School Physical Education. 4 units.**

Prerequisite: KINE 421.

Implementation of a developmental physical education program for elementary aged children. The program will complement that conducted in the local public schools. 1 lecture, 1 seminar, 2 laboratories.

**KINE 423. Teaching Middle School Physical Education. 4 units.**

Prerequisite: KINE 422.

Techniques for teaching physical education in middle school. Emphasis on class organization, lesson plan development and evaluation, class management and control, and understanding the middle school setting. For students teaching middle school physical education in the local public schools. 1 lecture, 1 seminar, 2 laboratories.

**KINE 424. Organization and Implementation of a K-12 Physical Education Program. 4 units.**

Prerequisite: KINE 425 or consent of instructor.

Methods of teaching K-12 physical education, with emphasis on alignment with the California Physical Education Challenge Standards, English language learners, special students, and educational technologies. 4 lectures.

**KINE 425. Teaching High School Physical Education. 4 units.**

Prerequisite: KINE 423, and one 300-level activity class.

Techniques for teaching physical education in high schools. Emphasis on teaching strategies, organization, lesson plan development, self-evaluation, class management, and behavior management. 1 seminar, 1 lecture, 2 laboratories.

**KINE 426. Senior Seminar. 2 units.**

Prerequisite: Senior standing.

Capstone course which engages students in activities that integrate the sub-disciplines of kinesiology, and facilitates the development of a personal portfolio. 2 seminars.

**KINE 434. Health Promotion Program Planning I. 4 units.**

Prerequisite: KINE 250 or KINE 255 or KINE 260, KINE 265, and junior standing.

Introduction to theory and methods to facilitate individual and group behavior change to promote health and prevent disease. Concepts from behavioral sciences and theories of health behavior change. Development of needs assessment and health promotion program design skills. 3 lectures, 1 laboratory.

**KINE 435. Health Promotion Program Planning II. 4 units.**

Prerequisite: KINE 265, KINE 298, KINE 319, and KINE 434.

Planning, implementation and evaluation of health promotion programs in school, community, medical, public health, worksite, and college/university settings. Planning, intervention design, implementation and design of evaluation protocols including process, impact and outcome assessments. 3 lectures, 1 laboratory.

**KINE 437. Directed Fieldwork. 1-3 units.**

CR/NC

Prerequisite: Senior standing or consent of instructor.

Practical work experience in related activities of kinesiology under qualified supervision. Total credit limited to 9 units. Credit/No Credit grading only. Minimum of 2 laboratory hours per week per unit.

**KINE 438. Adapted Physical Activity Fieldwork. 1-3 units.**

CR/NC

Prerequisite: KINE 407.

Practical experience in adapted physical activity programming. Students plan and conduct physical activity programs for people who are disabled. Total credit limited to 6 units. Credit/No Credit grading only.

**KINE 440. Physical Education Practicum. 1 unit.**

Prerequisite: Consent of instructor.

Supervised experience involving organizational and instructional responsibilities in activity, lecture and/or laboratory classes as determined by curricular concentration or certificate program. Total credit limited to 3 units.

**KINE 443. Health Education for Teachers. 4 units.**

Prerequisite: GE B2, D4 and junior standing.

The health status, special concerns and national health objectives for school aged children. Coordinated school health programs and California Health Framework. Health, nutrition, safety, alcohol, tobacco and other drugs, reproductive health, and chronic disease prevention. Satisfies CCTC requirement for credential. 4 lectures.

**KINE 445. Electrocardiography. 4 units.**

Prerequisite: KINE 303 or consent of instructor.

Basic principles of electrocardiography, including practical skills of the ECG technician. Recognition of normal ECG patterns and abnormal changes related to rhythm disturbances, conduction defects, myocardial ischemia/infarction, and exercise. 3 lectures, 1 laboratory.

**KINE 446. Echocardiography. 4 units.**

Prerequisite: KINE 445 or consent of instructor.

Basic principles of echocardiography, including practical skills of the echocardiographer. Recognition of normal echocardiographic patterns and abnormalities, including those caused by pathology and exercise conditioning. 2 lectures, 2 laboratories.

**KINE 449. Exercise Prescription and Leadership. 4 units.**

Prerequisite: KINE 230, KINE 231, KINE 304 and KINE 311.

Use of medical history, physical examination, laboratory and exercise testing data for establishment of appropriate exercise programs for healthy adults and those with chronic and acute disease. Exercise leadership for normal and clinical populations. 3 lectures, 1 laboratory.

**KINE 450. Worksite Health Promotion Programs. 3 units.**

Prerequisite: KINE 250 or KINE 255 or KINE 260, and senior standing.

Designed to acquaint students with those events, situations and relationships leading to healthy lifestyles in fitness and occupational settings. Design and implementation of workplace health promotion programs. 3 lectures.

**KINE 451. Nutrition for Fitness and Sport. 3 units.**

Prerequisite: KINE 250, KINE 255 or KINE 260; KINE 303.

Recommended: FSN 210.

Application of nutritional and metabolic facts to selected aspects of physical training, degenerative disease, obesity and weight control, diet manipulation and modification in sport, nutritional supplementation and special dietary considerations for the young and old, male and female athletes. 3 lectures.

**KINE 452. Exercise Testing and Prescription for Fitness Specialists. 4 units.**

Prerequisite: KINE 303.

Selected areas of health/fitness screening and evaluation. Application of components relevant to the development and administration of exercise programs for persons regardless of sex, age, functional capacity and presence or absence of CHD or CHD risk factors. 3 lectures, 1 laboratory.

**KINE 453. Lifestyle Prescriptions for Wellness. 3 units.**

Prerequisite: FSN 210 or FSN 250, and KINE 298, KINE 304.

Understanding weight, physical activity, and dietary recommendations for diverse patient populations. Effectively communicating with patients. Promoting health behaviors in multidisciplinary exercise science and health promotion settings. 3 lectures.

**KINE 454. Exercise Metabolism. 3 units.**

Prerequisite: KINE 303 and CHEM 312 and CHEM 313.

Recommended: KINE 304.

Advanced understanding of endocrine, metabolic, and physiological responses to physical activity, exercise and nutrition. How physical activity impacts human storage, delivery, and use of fuel required for energy conversion. 3 lectures.

**KINE 460. Experiential Senior Project. 1 unit.**

CR/NC

Prerequisite: KINE 319, completion of GE Area A, and senior standing.

A comprehensive applied capstone experience that integrates content from Kinesiology courses under faculty supervision. Projects must be approved by the supervising faculty member. Minimum 30 hours. Credit/No Credit grading only. 1 laboratory.



**KINE 461. Senior Project Report. 1 unit.**

Prerequisite: KINE 319 and completion of GE Area A.

A comprehensive synthesis of professional literature that integrates content from kinesiology courses resulting in a report. Topic must be approved by the instructor. Minimum 30 hours.

**KINE 462. Research Honors Senior Project. 1-2 units.**

Prerequisite: KINE 319, completion of GE Area A, and consent of instructor.

Completion of an advanced research, or creative project. Intended for students taking a significant or leadership role in a professional area. Results may be submitted for poster presentation or other public/professional forum. Total credit limited to 4 units. 1-2 laboratories (minimum 30 hours).

**KINE 463. Exercise Science and Health Promotion Fieldwork. 1-3 units.**

CR/NC

Prerequisite: Junior or senior standing and minimum GPA of 2.0.

Practical experience at an approved agency that provides exercise/fitness/health promotion programs. Students participate in program administration under the direct supervision of an approved on-site coordinator. Credit/No Credit grading only. Total credit limited to 3 units.

**KINE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**KINE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**KINE 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 12 units. Credit/No Credit grading only.

**KINE 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 24 units. Credit/No Credit grading only.

**KINE 500. Individual Study. 1-3 units.**

Prerequisite: KINE 517, graduate standing, and consent of instructor.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Only 6 units may be applied to degree requirements.

**KINE 501. Evaluation of Literature and Current Trends in Kinesiology. 3 units.**

Prerequisite: Graduate standing.

Analysis and evaluation of published studies and current trends in kinesiology. 3 seminars.

**KINE 503. Current Health Issues. 3 units.**

Prerequisite: KINE 250 or KINE 255 or KINE 260 and graduate standing.

Advanced seminar investigating current health issues. Factors that influence health status, current and historical trends in health and disease, and the healthcare system in the U.S. 3 seminars.

**KINE 504. Advanced Pathophysiology and Exercise. 3 units.**

Prerequisite: KINE 303 or equivalent, and graduate standing.

Selected human diseases, their etiology, pathophysiology, symptoms, diagnosis, effects on health and physical performance, and as affected by preventive or therapeutic exercise. Not open to students with credit for KINE 304. 3 lectures.

**KINE 505. Introduction to Issues, Ethics and Policies in Teaching. 1 unit.**

CR/NC

Prerequisite: Graduate standing.

Knowledge and skills of teaching at the college level. Preparation and support for teaching activity and laboratory classes in the department. Prepares students to be supervisors and teachers in their current or future employment. Credit/No Credit grading only. 1 seminar.

**KINE 510. Health Behavior Change. 3 units.**

Prerequisite: KINE 250 or KINE 255 or KINE 260 and KINE 503 or KINE 504 and graduate standing.

Examination of contemporary research, theory and practice related to facilitating healthy behavior change. Analysis of health problems from biological, ecological, and psycho-social perspectives with emphasis on understanding the acquisition and maintenance of healthy behavior. 3 seminars.

**KINE 511. Administration and Leadership in Kinesiology. 3 units.**

Prerequisite: Graduate standing.

Principles and techniques of administration in health, activity and academic settings including budget, personnel supervision, resource acquisition, leadership techniques, and facility management. 3 seminars.

**KINE 517. Research Methods in Kinesiology. 3 units.**

Prerequisite: KINE 501 or consent of instructor.

Experimental, descriptive, historical, philosophical, survey, and action research in kinesiology. Selection of adequate problems for investigation; various sampling techniques and analyses; use of library facilities; manuscript requirements for the thesis. 3 seminars.

**KINE 518. Research Prospectus and Proposal Writing. 2 units.**  
CR/NC

Prerequisite: KINE 517.

Strategies for identifying academically valid research topics. Planning considerations for qualitative and quantitative research including grant writing, human subjects review, personnel, equipment, and timelines. Design and composition of effective research proposals. Credit/No Credit grading only. 2 seminars.

**KINE 522. Advanced Biomechanics. 4 units.**

Prerequisite: KINE 302 or equivalent.

Advanced biomechanical concepts applied to human movement, examination of research, and biomechanical analyses of movement activities. Performance, occupational, and clinical settings. Laboratory techniques including motion analysis, force platform, and electromyography. 3 seminars, 1 laboratory.

**KINE 525. Advanced Motor Learning and Control. 3 units.**

Prerequisite: KINE 402 or equivalent.

Analysis of control theories, research principles and motor learning variables involved in the acquisition of skilled movement with an emphasis on the behavioral level of learning. 3 seminars.

**KINE 526. Sport and Exercise Psychology. 3 units.**

Prerequisite: Graduate standing.

Theoretical and professional issues in the psychological foundations of sport and exercise. 3 seminars.

**KINE 530. Advanced Physiology of Exercise. 4 units.**

Prerequisite: KINE 303 and graduate standing.

Physiological determinants of physical work capacity and sports performance. 3 seminars, 1 laboratory.

**KINE 534. Advanced Health Promotion Program Planning: Theory and Practice. 4 units.**

Prerequisite: KINE 503 or KINE 504 or KINE 510; graduate standing.

Theory and methods to facilitate individual and group behavior change to promote health and prevent disease. Concepts from behavioral sciences, health behavior theory, motivation, and decision making. Development of planning and evaluation skills. Not open to students with credit in KINE 434. 3 lectures, 1 laboratory.

**KINE 536. Advanced Electrocardiography. 4 units.**

Prerequisite: KINE 445.

Theory and application of electrocardiography and other techniques for cardiovascular assessment and treatment of cardiac disease and other abnormalities. 3 seminars, 1 laboratory.

**KINE 537. Internship. 3-12 units.**

CR/NC

Prerequisite: Graduate standing; consent of instructor.

Supervised work experience in an approved wellness/fitness clinical facility, school, or other faculty approved setting. Total credit limited to 12 units. Maximum of 6 units may be applied toward Master of Science in Kinesiology. Credit/No Credit grading only.

**KINE 539. Effective Practice in Teaching and Coaching. 3 units.**

Prerequisite: Graduate standing.

Observation and analysis of teaching physical education and coaching sports with special emphasis in pedagogical systems. 2 seminars, 1 laboratory.

**KINE 570. Selected Advanced Topics. 4 units.**

Prerequisite: Graduate standing.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 4 lectures.

**KINE 581. Graduate Seminar in Kinesiology. 1-3 units.**

Prerequisite: Graduate standing.

Directed group study of selected topics for advanced students. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1-3 seminars.

**KINE 585. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only.

**KINE 599. Thesis or Project. 1-6 units.**

Prerequisite: KINE 517, KINE 518 and consent of instructor.

Completion of a thesis or project pertinent to the field of kinesiology. Independent research under the guidance of the faculty.

## **Landscape Architecture (LA)**

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### **Landscape Architecture Courses**

**LA 101. Introduction to Landscape Architecture. 4 units.**

Introduction to the profession of landscape architecture and orientation to the department curriculum and learning processes. 4 lectures.

**LA 170. Principles of Design Communication. 4 units.**

Overview of design communications for landscape architects incorporating the principles, techniques, skills and tools used in design generation, exploration, review and implementation. 4 laboratories.

**LA 171. Principles of Digital Communication. 4 units.**

Introduction of digital media applications, software and techniques for landscape architects. Principles, techniques, skills and tools for using digital media in design projects. 4 lectures.

**LA 202. Design Fundamentals I. 4 units.**

Corequisite: LA 170.

Introduction to the principles, methods and elements of two- and three-dimensional design in order to communicate intended concepts and meanings. Exploration of the basic design elements including composition, design process and the creation of spatial settings. 4 laboratories.

**LA 203. Design Fundamentals II. 4 units.**

Prerequisite: LA 202, LA 243. Concurrent: LA 241.

Continuation of ideas introduced in LA 202 with the introduction of environmental and visual perception, including three-dimensional site design and landscape architectural design principles. Spatial design and sequencing of space with concern for human behavioral, environmental and natural site factors and generation of program, concept and design development. 4 laboratories.

**LA 204. Design Fundamentals III. 4 units.**

Prerequisite: LA 203, LA 241. Concurrent: LA 242.

Continuation of ideas introduced in LA 202 and LA 203 with the introduction of the principles of design theory, landscape ecology and technical applications. Problems of increasing complexity incorporate critical and creative problem solving, the relationship of aesthetics, response to human needs and design for sustainable environments. 4 laboratories.

**LA 211. History of Landscape Architecture: Ancient Civilizations through Colonial America. 4 units.**

GE Area C3

Exploration of the continuous alteration of the landscape through recorded time and examination of how humankind has influenced this change. The metaphor of 'garden' provides understanding for agrarian regions, urban spaces, and vernacular landscapes of the world. 4 lectures. Fulfills GE C3.

**LA 212. History of Modern and Contemporary Landscape Architecture. 4 units.**

GE Area C3

Philosophies and ethics of important personalities in twentieth and twenty-first century landscape architecture. Design theories supporting these individuals' projects and the nature of their practice, combined with the influential events in industry, the arts and sciences, politics, and society of these centuries. 4 lectures. Fulfills GE C3.

**LA 218. Applications in GIS. 3 units.**

ARC/INFO and ArcView Geographic Information System (GIS) computer software to explore environmental, natural resource, social and economic issues using spatial data. Develop and apply data base and software management competencies. 1 lecture, 2 laboratories. Crosslisted as LA/NR 218. Formerly LA/NR 318.

**LA 220. Landscape Ecology: Concepts, Issues and Interrelationships. 4 units.**

GE Area B5

Concepts, theories and techniques related to landscape analysis, ecology, planning and design with an emphasis on landscape assessment, sustainability, land health, environmental protection and restoration, and natural resource management. 4 lectures. Fulfills GE B5.

**LA 221. California Plants and Plant Communities. 4 units.**

Prerequisite: BIO 114 or BOT 121 or consent of instructor.

Introduction to the horticultural characteristics and landscape design potential of California native plants, California plant communities and associated vernacular plants. Includes experience in field identification, basic planting design, installation techniques and maintenance requirements. Required field trips. 2 lectures, 2 laboratories.

**LA 240. Additional Landscape Architecture Laboratory. 1-3 units.**

Total credit limited to 6 units, with a maximum of 3 units per quarter. 1-3 laboratories.

**LA 241. Site Engineering Techniques and Applications. 4 units.**

Prerequisite: LA 202, LA 243. Corequisite: MATH 118. Concurrent: LA 203.

Introduction and application of the techniques, methods, principles and criteria for site engineering and landform design. Includes an introduction to soil science, survey methods, and experiences in the principles, procedures and application of site grading and drainage for landscape architecture. 4 laboratories.

**LA 242. Implementation Strategies. 4 units.**

Prerequisite: LA 203, LA 241. Concurrent: LA 204.

Introduction and application of the methods, principles and criteria for landscape implementation. Encompasses fundamental design and technical decisions common to landscape architectural design and construction projects including the development of concept, design development and working drawings, and construction management process. 3 lectures, 1 activity.

**LA 243. Materials and Techniques of Landscape Construction. 4 units.**

Corequisite: LA 170. Concurrent: LA 202.

Introduction to the properties, uses and inherent qualities of the fundamental materials of landscape architectural concerns and associated construction techniques and processes. Materials and techniques explored as a source of design ideas, form and expression in landscape architecture. 3 lectures, 1 activity.

**LA 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**LA 317. The World of Spatial Data and Geographic Information Technology. 4 units.**

GE Area F

Prerequisite: Completion of GE Area B2.

Basic foundation for understanding the world through geographic information and tools available to utilize spatial data. Application of Geographic Information Systems (GIS) and related technologies, including their scientific basis of operation. Not open to students with credit in LA/NR 218. 3 lectures, 1 activity. Crosslisted as GEOG/LA/NR 317. Fulfills GE Area F.

**LA 320. Design Theory for Landscape Architects. 4 units.**

Prerequisite: LA 211, LA 212, or consent of instructor.

Complements the material and knowledge presented in the history of landscape architecture, architecture and art courses. Design theory and associated concepts as they are related to landscape architecture. Literature research and analysis of completed design projects. The artists/designers, materials and overall expressions of work are related to the social and economic issues of the time as well as their associations with the other arts and sciences. 4 lectures.

**LA 330. Cultural Landscapes: People, Places and Ethical Decisions. 4 units.**

Prerequisite: LA 211, LA 212.

Investigation of the complexities and interrelatedness of culture, environment and ethical decisions. Interpretation of personal and cultural values and ethics in terms of decisions made and behaviors and actions expressed in the built landscape. 4 lectures.

**LA 349. Advanced Planting Design. 4 units.**

Prerequisite: EHS 231, EHS 232 and EHS 381 or LA 221.

Advanced examination of the theories and applied principles of planting design. Emphasis on connections between art and science in the design of parks, gardens and other landscapes. Case studies and field trips. 2 lectures, 2 activities.

**LA 363. Recreation Plan and Design. 4 units.**

Prerequisite: Must have completed minimum of one 200-level course in planning, design or recreation and third-year standing or consent of instructor.

Planning and design methods for meeting leisure requirements. Issues of recreation and society. Relationship of recreation and open spaces, assessment of needs and supply of resources. 3 lectures, 1 activity.

**LA 370. Professional Practice. 4 units.**

Prerequisite: LA 204.

Issues related to the practice of landscape architecture incorporating processes, procedures and outcomes of professional practice. Topics include professional ethics, business and legal aspects of the profession, relationships to the client and society, personal goal setting, resume and portfolio preparation. 4 lectures.

**LA 371. Internship. 3 units.**

CR/NC

Prerequisite: Third year standing in Landscape Architecture.

Involvement in a work setting related to landscape architecture. Thirty hours work experience per unit of credit. Credit/No Credit grading only.

**LA 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**LA 401. Research Project. 2 units.**

Prerequisite: Completion of four design focus studios (16 units from LA 402 - LA 405).

Research methods in landscape architecture and proposal writing techniques. Students prepare proposal and strategy for fifth year study in area of concentration. 2 seminars.

**LA 402. Design Theory and Exploration Focus Studio. 4 units.**

Prerequisite: LA 204, LA 211, LA 212 or consent of instructor.

Concurrent: Integrated Learning Course (ILC) of student's option.

Exploration and application of design theory, exploratory design process and form exploration to design and planning projects. Emphasis on incorporation of inquiry techniques based on the synthesis of interdisciplinary frameworks of art and design theory with historical and cultural issues. Total credit limited to 12 units. 4 laboratories.

**LA 403. Natural Environments Design Focus Studio. 4 units.**

Prerequisite: LA 204, LA 211, LA 212 or consent of instructor.

Corequisite: LA 220. Concurrent: Integrated Learning Course (ILC) of student's option.

Assessment, exploration and integration of landscape ecology, sustainability and environmental planning to design and planning projects. Emphasis on interpretation and application of environmental and ecological issues at a range of design scales. Total credit limited to 12 units. 4 laboratories.

**LA 404. Cultural Environments Design Focus Studio. 4 units.**

Prerequisite: LA 204, LA 211, LA 212 or consent of instructor.

Concurrent: Integrated Learning Course (ILC) of student's option.

Assessment, exploration and interpretation of cultural values, issues and landscapes to design and planning projects. Emphasis on observation and inquiry of diverse cultural settings, differences in cultural values and personal ethics in the design process. Total credit limited to 12 units. 4 laboratories.

**LA 405. Project Design and Implementation Focus Studio. 4 units.**

Prerequisite: LA 204, LA 243, LA 242, LA 241 or consent of instructor.

Concurrent: Integrated Learning Course (ILC) of student's option.

Development, exploration and integration of project design and implementation strategies to design and planning projects. Emphasis on creative and exploratory problem solving, spatial design, project resolution, and graphic communication. Total credit limited to 12 units. 4 laboratories.

**LA 411. Regional Landscape History. 4 units.**

Prerequisite: Fourth year standing or consent of instructor.

Developmental history of the landscape in the western region with specific focus on the Basin and Range region and California. One or more field trips required. 4 lectures.

**LA 431. CAD and Digital Media Communications (ILC). 4 units.**

Prerequisite: LA 170, LA 204 or consent of instructor.

Integrated Learning Course (ILC) to assist integration and application of computer-aided drafting (CAD) skills in coursework, project planning and design studio courses. Focus on CAD skills and integration of digital media. Total credit limited to 12 units. 4 activities.

**LA 432. Landscape Ecology Applications (ILC). 4 units.**

Corequisite: LA 220. Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of landscape ecology principles in project planning and design studio courses. Focus on understanding and developing a framework for ecological planning and design to anticipate consequences of planning and design decisions. Total credit limited to 12 units. 4 activities.

**LA 433. Cultural Environments (ILC). 4 units.**

Prerequisite: LA 211 or consent of instructor. Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of culture, environment and personal ethics in coursework, project planning and design studio courses. Focus on skills, distinctions and integration of analyzing the cultural landscape, understanding diverse cultural values and assessing personal ethics. Total credit limited to 12 units. 4 activities.



**LA 434. Project Design and Implementation (ILC). 4 units.**

Prerequisite: LA 241, LA 242, LA 243 or consent of instructor.

Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of project design principles and implementation strategies in project planning and design studio courses. Focus on skills, techniques and decisions of the design, documentation and construction processes. Total credit limited to 12 units. 4 activities.

**LA 435. Professional Practice (ILC). 4 units.**

Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of professional practice principles and techniques in planning and design studio and internship courses. Focus on achieving a high level of professional quality, ethical concern, and legal responsibility in project work. Total credit limited to 12 units. 4 activities.

**LA 436. Traditional and Digital Media Communications (ILC). 4 units.**

Prerequisite: LA 170, LA 202, LA 203, LA 204 or consent of instructor.

Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of graphic communication and presentation skills in coursework, project planning and design studio courses. Focus on skills, distinctions and integration of traditional and digital media explorations. Total credit limited to 12 units. 4 activities.

**LA 437. 3D Digital Design Communications (ILC). 4 units.**

Prerequisite: LA 170, LA 204 or consent of instructor. Concurrent:

Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of 3D digital graphic communication and presentation skills in coursework, project planning and design studio courses. Focus on skills and integration of three-dimensional digital media explorations. Total credit limited to 12 units. 4 activities.

**LA 438. GIS Application to Design Projects (ILC). 4 units.**

Corequisite: LA 220. Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist integration and application of geographic information systems (GIS) and spatial information into focus design studio courses. Total credit limited to 12 units. 4 activities.

**LA 439. Planting Design (ILC). 4 units.**

Prerequisite: LA 221. Concurrent: Design Focus Studio of student's option.

Integrated Learning Course (ILC) to assist the integration and application of plant selection, use and appropriateness in planning and design studio courses. Focus is on the skills, theories and principles of planting design. Total credit limited to 12 units. 4 activities.

**LA 461. Senior Design Project Focus Studio. 4 units.**

Prerequisite: Completion of Design Focus Sequence (20 units from LA 402-LA 405).

Comprehensive landscape architectural design and research project showing professional level competency in the integration of design theory, landscape architectural principles and project resolution. Emphasis on creative resolutions, organization and communication skills and technical abilities in program generation, design process, design and research. Total credit limited to 8 units. 4 laboratories.

**LA 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**LA 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 laboratories.

**LA 481. Visual Resource Methods. 4 units.**

Prerequisite: Fourth-year standing or graduate standing, or consent of instructor.

Investigation and application of the major visual resource management methods relevant to landscape architecture. Theoretical basis for visual resource assessment, the different assessment techniques, and the process of translating assessment results into visual resource management techniques. 2 lectures, 2 activities.

**LA 482. Evaluating Social and Behavioral Factors for Open Space Design. 4 units.**

Prerequisite: Fourth-year or graduate standing or consent of instructor.

User oriented approach to open space design. Interview and survey techniques, behavioral trace mapping and systematic observation, post occupancy evaluation and similar methods are used to generate user input and feedback in the design process. Understanding the behavioral implications of designed environments. 2 lectures, 2 activities.

**LA 483. Special Studies in Landscape Architecture. 1-12 units.**

Prerequisite: Fourth- or fifth-year standing, or consent of instructor.

Special issues and problems through research, field trips, seminars and other forms of investigation and involvement. Course requirements are determined prior to each individual project through a contractual agreement between students and department. Departmental Off Campus Study Program guidelines apply. Total credit limited to 36 units. 1-12 activities.

**LA 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Junior standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 18 units. Credit/No Credit grading only.

**LA 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Junior standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 24 units. Credit/No Credit grading only.



**LA 551. Regional Landscape Assessment I. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Definition, research and filing of data covering the biological, cultural and physical resources of a specific region. Concepts of regionalism, land planning, reclamation and preservation are integral to the course. Utilization of mainframe and microcomputer facilities and software. 4 laboratories.

**LA 552. Regional Landscape Assessment II. 4 units.**

Prerequisite: LA 551 and graduate standing.

Application of data manipulation techniques in order to model both impacts on natural systems and land development potentials. Use of planning strategies to predict outcomes resulting from the land use decision process. Utilization of mainframe and microcomputer facilities and software. 4 laboratories.

**LA 585. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and part-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Total credit limited to 9 units. Credit/No Credit grading only.

**LA 595. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Graduate standing and consent of instructor.

Advanced study analysis and full-time work experience in student's career field; current innovations, practices, and problems in administration, supervision, and organization of business, industry, and government. Must have demonstrated ability to do independent work and research in career field. Credit/No Credit grading only.

## Liberal Arts and Engineering Studies (LAES)

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### Liberal Arts and Engineering Studies Courses

**LAES 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**LAES 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**LAES 301. Project-Based Learning in Liberal Arts and Engineering Studies. 4 units.**

Prerequisite: MATH 241; PHYS 132, PHYS 133; GE Area A.

Examination of how to define LAES as a new field of study; analysis of the creative process and team building in theory and in application. Researching, writing, revising and presenting a technical proposal suitable for submission to a national design competition seeking innovative solutions to complex technological/social problems. 2 seminars, 2 activities.

**LAES 302. Advanced Project-Based Learning in Liberal Arts and Engineering Studies. 4 units.**

Prerequisite: LAES 301.

Teamwork and leadership in project-based learning. Students lead, build, and maintain project teams; guide the creative process; and use and evaluate the principles of project management in theory and practice. Development of a technical proposal suitable for submission to a national design competition seeking innovative solutions to complex technological/social problems. 2 seminars, 2 activities.

**LAES 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**LAES 411. Global Synthesis in Liberal Arts and Engineering Studies. 4 units.**

Prerequisite: LAES 302; junior standing.

Onsite work with a global technical development and/or design team to develop a project to be completed/expanded upon in LAES 461. Through guided online discussion with the instructor and fellow LAES students, work through intercultural collaboration and design issues, and present works-in-progress. 4 lectures.

**LAES 430. Internship. 2-12 units.**

CR/NC

Prerequisite: Approval of area chair, junior standing, and a CPSLO cumulative GPA of at least 2.5 without being on academic probation.

Work experience in business, industry, government and other areas of student career interest. Periodic written progress reports, final report, and evaluation by work supervisor required. Credit/No Credit grading. Total credit limited to 12 units.

**LAES 461. Senior Project in Liberal Arts and Engineering Studies. 4 units.**

Prerequisite: LAES 302; senior standing; and permission of instructor.

Under faculty supervision, the selection and completion of a senior project, demonstrating an interdisciplinary focus in LAES. With one-on-one format with the instructor, individual or small group work through many iterations of the senior project, with occasional showing of works in small student groups.

**LAES 462. Capstone Senior Seminar in Liberal Arts and Engineering Studies. 4 units.**

Prerequisite: LAES 461.

The final refinement and completion of LAES senior projects and other projects. In a development workshop format, presentation of final versions of works-in-progress to combined faculty and professional review committees throughout the quarter.

**LAES 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**LAES 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**LAES 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 18 units. Credit/No Credit grading only.

**LAES 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. Major credit limited to 6 units; total credit limited to 24 units.

## Liberal Studies (LS)

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### Liberal Studies Courses

**LS 101. Introduction to Liberal Studies. 2 units.**

Introduction of the career pathway into elementary teaching profession and available options for concentrations and additional authorizations. Academic policies and procedures, study skills, goals, settings, career planning, wellness and other topics relevant to career and student success. To be taken during the first quarter in attendance at Cal Poly as a Liberal Studies major. 2 lectures.

**LS 211. Visual Arts in the Elementary Classroom. 4 units.**

Theory, aesthetics, appreciation and applications of visual arts, through multiple two dimensional art strategies, as related to educational processes for the elementary classroom. Focus on elements, principles of design while fostering artistic perception. One Saturday field trip required. 3 lectures, 1 laboratory. Formerly LS 311.

**LS 214. Constitutional Issues in the History of U.S. and California Education. 4 units.**

Examination of U.S. and California constitutions, significant legislation, and court cases affecting public education from the colonial period to the present. Overview of contributions by individuals of historical, national, and international educational significance. Examination of landmark decisions. 4 lectures.

**LS 230. Field Experience in the Elementary Classroom I. 2 units.**

Overview of current practices and issues in elementary education, including teacher compensation, cultural impact on schools, time and classroom management, English learners, and the affective aspect of teaching. 24 hours of fieldwork required. 1 lecture, 1 activity.

**LS 250. Field Experience in the Elementary Classroom II. 2 units.**

Overview of current practices and issues in elementary education, including components of effective teaching, motivating students, diagnostic/prescriptive teaching, curriculum, and accountability. In addition to class time, 24 hours of fieldwork required. 1 lecture, 1 activity.

**LS 260. Children's Literature. 4 units.**

Prerequisite: Completion of GE Area A.

Analysis and evaluation of traditional literature, fantasy, realistic fiction, historical fiction, informational books, picture books, and poetry for children in multiple subject classroom grades K-6. Emphasis on multicultural texts. 4 lectures. Crosslisted as ENGL/LS 260.

**LS 290. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**LS 310. Storytelling: Modern Applications of Traditional Narrative. 4 units.**

Prerequisite: COMS 101 or COMS 102.

Techniques for selection, preparation and presentation of traditional folktales and myths for an audience. Applications of storytelling in teaching and organizations; theory and history of folk literature and mythology. 4 lectures.

**LS 370. Integration of Visual and Performing Arts Standards in the Elementary Classroom. 4 units.**

Prerequisite: LS 211 (formerly LS 311) and GE C3. Recommended: LS 310.

Current theory and practice of standards based integrated arts with an emphasis on the use of music, theater, dance, and the visual arts as discrete disciplines with historical and cultural context. Outside performances required. 4 lectures. Formerly LS 270.

**LS 380. Subject Matter Apprenticeship. 2 units.**

CR/NC

Prerequisite: Junior standing and consent of instructor.

Structured application of a specific content area in schools and informal educational settings. Topics include: Arts, English, Science, Mathematics, Social Studies, and Physical Education and Health. The Schedule of Classes will list topic selected. Participation in public schools requires mandated fingerprint clearance. Credit/No Credit grading only. 1 lecture, 1 activity. Formerly LS 280.

**LS 382. Supervised Fieldwork. 1-2 units.**

CR/NC

Prerequisite: LS 380 and consent of instructor.

Fieldwork experience in the application of a specific content area or program in an educational setting. The Schedule of Classes will list topic selected. Total credit limited to 4 units with the same title with a maximum of 2 units per quarter. Repeatable to 4 units with the same title. Credit/No Credit grading only. 1-2 activities. Formerly LS 282.

**LS 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor, junior standing.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**LS 410. Subject Matter Seminar. 4 units.**

Prerequisite: LS Majors and Senior standing.

Analysis and practice of subject matter knowledge and skills to facilitate K-8 learning through identifying major themes and questions. The use of inquiry, assessment, curriculum integration, and technology to connect discipline specific content to contemporary social issues. Repeatable for up to 12 units. 3 seminars, 1 activity.

**LS 412. Advanced Visual Arts in the Elementary Classroom. 4 units.**

Prerequisite: LS 370.

Application of visual arts, through multiple strategies including direct curriculum inclusion for the elementary schools and art community settings. Two Saturday field trips required. 4 lectures. Formerly LS 312.

**LS 461. Senior Project Seminar. 4 units.**

Prerequisite: Senior standing, completion of GWR or consent of instructor.

Examination of issues in education of state, national and international concern. Students prepare presentations and conduct individual research and analysis of selected problems. Substantial research paper required. 4 seminars.

**LS 462. Senior Project Research. 4 units.**

Prerequisite: Senior standing, completion of GWR and emphasis in the targeted content area.

Application of content and theory to the educational experience of one specific subject matter area in the Liberal Studies program. The Schedule of Classes will list topic selected. 2 seminars, 2 units of independent study.

**LS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**LS 477. Myth and Folklore in Art for Elementary Classrooms. 4 units.**

Prerequisite: LS 370.

Symbols, metaphors, attributes of myths and folktales in artworks and literature. Both image and story used for teaching standards-based integrative lessons in art and other content areas in the elementary classroom. 4 lectures.

## Materials Engineering Courses

**MATE 110. Introduction to Materials Engineering Design I. 1 unit.**

Prerequisite: MATE majors only.

Laboratory work in teams to design, build and test a product. Material from math, science and engineering courses tied together. 1 laboratory.

**MATE 120. Introduction to Materials Engineering Design II. 1 unit.**

Prerequisite: MATE 110.

Second design laboratory, working in teams to design, build and test a complex system that benefits humanity. Focus on complete design process including project management, documentation in design, manufacturing techniques, and analysis of testing data. Issues of engineering ethics, technology and society, the environment and sustainability also studied. 1 laboratory.

**MATE 130. Introduction to Materials Engineering Design III. 1 unit.**

Prerequisite: MATE 120.

Third design laboratory in a sequence. Includes working in teams on project that benefits humanity. Issues of engineering ethnics, technology and society, the environment and sustainability. 1 laboratory.

**MATE 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**MATE 210. Materials Engineering. 3 units.**

Prerequisite: CHEM 111 or CHEM 124 or CHEM 127. Recommended: Concurrent enrollment in MATE 215.

Structure of matter. Physical and mechanical properties of materials including metals, polymers, ceramics, composites, and electronic materials. Equilibrium diagrams. Heat treatments, materials selection and corrosion phenomena. 3 lectures.

**MATE 215. Materials Laboratory I. 1 unit.**

Prerequisite or concurrent: MATE 210.

Focus on processing-structure-properties relationships of materials, including crystal structures, electronic properties of materials, materials selection, phase diagrams, corrosion, mechanical properties of polymers, cold work and annealing of alloys and heat treatments of steels. 1 laboratory.

**MATE 222. Materials Selection Life Cycle. 4 units.**

Prerequisite: MATE 210.

Materials selection for sustainable product design. Use of material selection software and techniques to solve design problems with multiple objectives and constraints. Focus on Triple Bottom Line design including functionality, economic viability, and sustainability. Principles and tools for weighted property optimization, production cost modeling, and life cycle analysis introduced through project-based learning mode. 4 lectures.

## Materials Engineering (MATE)

**MATE 225. Materials Laboratory II. 1 unit.**

Prerequisite: MATE 215. Concurrent: MATE 232.

Process-structure relationships of materials. Introduction to materials characterization techniques including differential scanning calorimetry, x-ray diffraction, and metallography. Emphasis on materials engineering professional practices and written communication. 1 laboratory.

**MATE 232. Materials, Ethics, and Society. 4 units.**

Prerequisite: MATE 210.

Materials Engineering principles through the context of historical and current events. Ethics and systems thinking are integrated in the study of the impacts of materials and technology on society during the Stone Age, Bronze Age, and Iron Ages, as well as today's world. Topics include crystallography, phase diagrams, microstructures, processing techniques, and nanotechnology. 4 lectures.

**MATE 235. Materials Laboratory III. 1 unit.**

Prerequisite: MATE 225. Concurrent: MATE 222.

Mechanical property testing by tensile tests and hardness tests. Emphasis of data interpretation and analysis with structure-property relationships of materials. Continued materials engineering professional practices. 1 laboratory.

**MATE 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**MATE 310. Noncrystalline Material Systems. 4 units.**

Prerequisite: MATE 210, MATE 340, STAT 312. Concurrent: MATE 350.

Design and synthesis of noncrystalline material systems. Synthesis, processing techniques, properties and fabrication methods of organic and inorganic polymeric materials. 3 lectures, 1 laboratory.

**MATE 322. Leadership and Project Management. 2 units.**

Prerequisite: Junior standing in an engineering program or consent of instructor.

Theory and practice in leadership and project management skills for engineering design teams. Basic issues related to, and tools used for, managing projects and concepts comprising project management. Emphasis on situations requiring resolutions and management decisions by groups representing various elements of an enterprise. 2 lectures. Crosslisted as HNRS/IME/MATE 322.

**MATE 330. Composite Materials Systems. 4 units.**

Prerequisite: MATE 350. Concurrent: MATE 370.

Properties, design and applications of composite material systems, concentrating on polymer-matrix, ceramic-fiber composites. Materials(matrices, fibers), mechanical behavior and properties, and manufacturing methods treated in detail. Laboratory practice concentrates on the mechanical testing of fiber-reinforced composite materials. 3 lectures, 1 laboratory.

**MATE 340. Electronic Materials Systems. 4 units.**

Prerequisite: MATE 210 and PHYS 133. Concurrent: MATE 360.

Design of electronic materials systems utilizing the basic concepts in electron theory of solids, electrical properties and conduction in materials, magnetic phenomena and optical properties in materials. 3 lectures, 1 laboratory.

**MATE 350. Structural Materials Systems. 4 units.**

Prerequisite: MATE 360, CE 204. Concurrent: MATE 310.

Design of structural materials systems. Topics include continuum mechanics - stress, strain, elasticity, anelasticity, plasticity. 3 lectures, 1 laboratory.

**MATE 359. Living in a Material World. 4 units.**

GE Area F

Prerequisite: Completion of one course from GE Area B.

Recommended: Junior standing.

Evolution of materials (ceramics, metals, polymers, composites, semiconductors) in the context of history. Traces the link between historical and technological developments enabled by materials from the Stone Age to the Electronic Age. 4 lectures. Crosslisted as HIST/MATE 359. Fulfills GE Area F.

**MATE 360. Metallurgical Materials Systems. 4 units.**

Prerequisite: MATE 232, MATE 225 and IME 144. Concurrent: MATE 340.

Physical metallurgy of engineering alloys including ferrous (steel) and nonferrous (aluminum, copper) systems. Connection to phase diagrams, microstructural development and phase transformations, physical and mechanical properties, precipitation hardening, cold work and annealing treated in detail. Laboratory focuses on microstructure development in steels and aluminum alloy casting. 3 lectures, 1 laboratory.

**MATE 370. Kinetics of Materials and Process Design. 4 units.**

Prerequisite: MATE 310 and MATE 380. Concurrent: MATE 330.

Design of processes for engineering materials. Topics include kinetics in materials: solid-state diffusion (steady-state and non-steady-state), nucleation and growth kinetics, solid state phase transformations. 3 lectures, 1 laboratory.

**MATE 380. Thermodynamics and Physical Chemistry. 4 units.**

Prerequisite: Junior standing; CHEM 125, PHYS 133, MATH 143, MATE 210 and MATE 215; Materials Engineering students only.

Thermodynamics concepts related to materials engineering systems and processes: process flowsheets, mass and energy balances, Ellingham diagrams. Physical chemistry concepts related to materials engineering: ideal gases, systems and surroundings, first through third laws of thermodynamics, phase equilibria, chemical reactions. 4 lectures.

**MATE 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**MATE 401. Materials Characterization Techniques. 4 units.**

Prerequisite: MATE 210 and MATE 215.

Hands-on experience with materials characterization instruments, such as scanning electron microscopy (SEM), light optical microscopy, x-ray diffraction (XRD), and atomic force microscopy (AFM). Open-ended projects to develop expertise with trouble-shooting ability, and the process of materials characterization and analysis 2 lectures, 2 laboratories.

**MATE 410. Nanoscale Engineering. 3 units.**

Prerequisite: CHEM 125, PHYS 133 and MATE 210.

Material properties (mechanics, electronics, heat transfer, photonics, fluid mechanics and biomechanics) at the nanometer scale. Evaluation of nano-scale systems designed from a bottoms-up approach with unique properties. Exploration of integration of biology, chemistry, physics and engineering. 3 lectures.

**MATE 425. Corrosion Engineering. 4 units.**

Prerequisite: CHEM 125 or CHEM 128, MATE 210, MATE 215.

Forms of corrosion. Influences of environmental variables on corrosion. Methods of corrosion control. 3 lectures, 1 laboratory.

**MATE 430. Microfabrication. 3 units.**

Prerequisite: MATE 210.

Silicon-based fabrication science and technology. Oxidation, diffusion, ion implantation, etching, chemical and physical vapor deposition, photolithography. 3 lectures. Crosslisted as BMED 434/MATE 430.

**MATE 435. Microfabrication Laboratory. 2 units.**

Corequisite: BMED 434/MATE 430.

Basic processes involved in microfabrication; cleanroom protocol, oxidation, diffusion, photolithographic and etching processes, sputtering and evaporation, process development through experimentation, device testing. Each student will be part of a 4-6 person team that will fabricate a micro electronic device or photovoltaic device. 2 laboratories. Crosslisted as BMED/MATE 435.

**MATE 440. Welding Metallurgy and Joining of Advanced Materials. 3 units.**

Prerequisite: MATE 210.

Principles, primary variables, and microstructural changes associated with the joining process. Physics of energy transfer. Heat and mass balances in joining, thermodynamic and kinetic justification of solidification and near interface microstructures. Heterogeneous interfaces, adhesion, wetting. Relation between process selection, interface design, microstructure, and properties, weldability. 3 lectures.

**MATE 445. Joining of Advanced Materials Laboratory. 2 units.**

Prerequisite: MATE 210.

Laboratory to accompany MATE 440. Illustration of principles, primary variables, and microstructural changes associated with the joining process. Physics of energy transfer. Heat and mass balances in joining, thermodynamic and kinetic justification of solidification and near interface micro-structures. Heterogeneous interfaces, adhesion, wetting. Relation between process selection, interface design, microstructure, and properties, weldability. 2 laboratories.

**MATE 446. Surface Chemistry of Materials. 3 units.**

Prerequisite: CHEM 351, MATE 380 or ME 302.

Surface energy. Capillarity, solid and liquid interface, adsorption. Surface areas of solids. Contact angles and wetting. Friction, lubrication and adhesion. Relationship of surface to bulk properties of materials. Applications. 3 lectures. Crosslisted as CHEM/MATE 446.

**MATE 450. Fracture and Failure Analysis. 4 units.**

Prerequisite: MATE 210, MATE 215, MATE 350; and Senior standing.

Fracture processes and fracture mechanics of structural materials concentrating on engineering alloys. Topics include fracture of alloys, fracture mechanics (Griffith analysis, Linear Elastic Fracture Mechanics), and fatigue. Laboratory focuses on fracture surface analysis, failure analysis, and mechanical testing. 3 lectures, 1 laboratory.

**MATE 458. Microelectronics and Electronics Packaging. 4 units.**

Prerequisite: EE 112 or EE 201. Recommended: MATE 210.

Materials, processes, and reliability of microelectronics and electronics packaging, surface mount assembly and printed circuit board fabrication. Organic substrates and ceramic substrates. Mechanical design, thermal, and electrical considerations in electronic packaging. Design for manufacturability. Overview of optoelectronics packaging and other emerging technologies in microelectronics and electronic packaging. Project on design and manufacture of an electronic device. 3 lectures, 1 laboratory. Crosslisted as CPE 488/IME 458/MATE 458.

**MATE 460. Materials Selection in Mechanical Design. 4 units.**

Prerequisite: MATE 350.

Materials-based approach to mechanical design. Using mechanical and physical properties of materials (performance indices) to select structural materials for applications (Materials Selection Charts). Detailed background of material properties - information from materials and mechanics. Numerous case studies highlight the concepts covered. 4 lectures.

**MATE 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**MATE 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**MATE 482. Senior Project I. 1 unit.**

Prerequisite: Senior standing; for MATE majors.

Foundations of senior project design. Completion of the preliminary stages of selecting a senior project, designing experiments, evaluating realistic constraints, conducting initial experiments, and managing a project timeline. 1 lecture.



**MATE 483. Senior Project II. 2 units.**

Prerequisite: MATE 482.

Continuation of senior project. Completion of a senior project experimental component under the guidance of a faculty supervisor. Research methodology, experimental design, experimental work and data analysis. 2 laboratories.

**MATE 484. Senior Project III. 2 units.**

Prerequisite: MATE 483.

Continuation of MATE 483. Completion of a senior project data analysis and communication under the guidance of a faculty supervisor. Mathematical modeling and technical communication. 2 laboratories.

**MATE 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**MATE 500. Individual Study. 1-4 units.**

Prerequisite: Consent of department head, graduate advisor, or supervising faculty member.

Advanced study planned and completed under the direction of a member of department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Total credit limited to 12 units.

**MATE 501. Advanced Engineering Materials. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

An advanced treatment of structure and behavior of matter. Designed for students intending to pursue an advanced degree in Materials Science and Engineering. Survey of materials specialization not presented in undergraduate curriculum. Use of scientific literature to explore fundamental principles of materials science. 4 lectures.

**MATE 504. Research Methods in Materials Engineering. 3 units.**

Prerequisite: MATE 210 and graduate standing.

Development of skills necessary for advanced research in Materials Science and Engineering, including conducting a literature review, designing an experiment, quantitative and qualitative analysis of data, and critical evaluation. Independent work in preparation of master's degree thesis. 2 lectures, 1 activity.

**MATE 510. Materials Analysis. 4 units.**

Prerequisite: MATE 210 and graduate standing.

Fundamentals of materials surface analysis methods and thin-film microanalytical techniques, including electron microscopy, SPM, AES, XPS, SIMS, Raman and FTIR. Selection of surface analysis techniques. 4 lectures.

**MATE 522. Advanced Ceramics. 4 units.**

Prerequisite: Graduate standing or permission of instructor.

Development, utilization, and control of properties in ceramic materials (inorganic-nonmetallic solids). Emphasis on application on processing to achieve structure and properties. Structure of crystalline ceramics and of glasses. Mechanical, thermal, optical, magnetic, and electrical properties. Application of ceramics in technology. Physical chemistry of ceramics. 4 lectures.

**MATE 530. Biomaterials. 4 units.**

Prerequisite: BIO 161, or BIO 213 and ENGR 213; MATE 210 and graduate standing or consent of instructor.

Structure-function relationships for materials in contact with biological systems. Interactions of materials implanted in the body. Histological and hematological considerations including foreign body responses, inflammation, carcinogenicity, thrombosis, hemolysis, immunogenic and toxic properties. Microbial interaction with material surfaces, degradation. 4 lectures. Crosslisted as BMED/MATE 530.

**MATE 550. Micro Systems. 4 units.**

Prerequisite: Graduate standing.

Fundamentals of intelligent systems employing sensors, actuators and intelligent controls. Impact on material properties as devices shrink in the micrometer realm. Applications toward exploring nanotechnology. 4 lectures. Crosslisted as BMED 531/MATE 550.

**MATE 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**MATE 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Senior or graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**MATE 590. Solidification and Densification. 4 units.**

Prerequisite: Graduate standing or permission of instructor.

Thermodynamics, kinetics and morphologies of solid-liquid interfaces. Heat flow in castings, crystal growth. Solidification mechanics, solute redistribution. Production, characterization and testing of metal powders. Compacting of powder. Sintering with/without liquid phase. Hot pressing, properties of sinterings as a function of processing conditions. Application of theory to the production of useful materials. 4 lectures.

**MATE 599. Design Project (Thesis). 2-5 units.**

Prerequisite: Graduate standing.

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis.

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## Mathematics (MATH)

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## Mathematics Courses

### **MATH 100. Beginning Algebra Review. 3 units.**

CR/NC

Review of basic algebra skills at the beginning algebra level intended primarily to prepare students for MATH 104. Course open only to students who have taken the ELM examination and are not qualified for MATH 104. Not for baccalaureate credit. Credit/No Credit grading only. 3 lectures.

### **MATH 104. Intermediate Algebra. 3 units.**

CR/NC

Prerequisite: Appropriate score on the ELM examination, or credit in MATH 100.

Review of basic algebra skills at the intermediate algebra level intended primarily to prepare students for MATH 116. Not for baccalaureate credit. Credit/No Credit grading only. 3 lectures.

### **MATH 110. Beginning Algebra Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 100.

Facilitated study and discussion of the theory, problems, and applications of beginning algebra. Not for baccalaureate credit. Credit/No Credit grading only. 1 laboratory.

### **MATH 112. Nature of Modern Math. 4 units.**

GE Area B1

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Topics from contemporary mathematics, their development, applications, and role in society. Some typical topics, to be chosen by the instructor: graph theory, critical path analysis, statistical inference, coding, game theory, and symmetry. 4 lectures. Fulfills GE B1.

### **MATH 114. Intermediate Algebra Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 104.

Facilitated study and discussion of the theory, problems, and applications of intermediate algebra. Not for baccalaureate credit. Credit/No Credit grading only. 1 laboratory.

### **MATH 116. Precalculus Algebra I. 3 units.**

GE Area B1

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Pre-calculus college algebra without trigonometry. Special products and factoring, exponents and radicals. Fractional and polynomial equations. Matrices, determinants, and systems of equations. Polynomial, rational, exponential, and logarithmic functions. Graphing, inequalities, absolute value, and complex numbers. MATH 116 and MATH 117 are equivalent to MATH 118, but are taught at a slower pace. Upon completion of MATH 116 and MATH 117, a student will receive 4 units of GE credit for Area B1. Not open to students with credit in MATH 118, MATH 141, MATH 161, or MATH 221. 3 lectures.

### **MATH 117. Precalculus Algebra II. 3 units.**

GE Area B1

Prerequisite: MATH 116 with a grade of C- or better or consent of instructor.

Pre-calculus college algebra without trigonometry. Special products and factoring, exponents and radicals. Fractional and polynomial equations. Matrices, determinants, and systems of equations. Polynomial, rational, exponential, and logarithmic functions. Graphing, inequalities, absolute value, and complex numbers. MATH 116 and MATH 117 are equivalent to MATH 118, but are taught at a slower pace. Upon completion of MATH 116 and MATH 117, a student will receive 4 units of GE credit for Area B1. Not open to students with credit in MATH 118. 3 lectures.

### **MATH 118. Precalculus Algebra. 4 units.**

GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination.

Pre-calculus algebra without trigonometry. Special products and factoring, exponents and radicals. Fractional and polynomial equations. Matrices, determinants, and systems of equations. Polynomial, rational, exponential, and logarithmic functions. Graphing, inequalities, absolute value, and complex numbers. MATH 118 is equivalent to MATH 116 and MATH 117. Not open to students with credit in MATH 117, MATH 141, MATH 161, or MATH 221. 4 lectures. Fulfills GE B1.

### **MATH 119. Precalculus Trigonometry. 4 units.**

GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination, or MATH 117, or MATH 118.

Rectangular and polar coordinates. Trigonometric functions, fundamental identities. Inverse trigonometric functions and relations. Vectors, complex numbers, conic sections, and analytic geometry. Not open to students with credit in MATH 141, MATH 161, or MATH 221. 4 lectures. Fulfills GE B1.

### **MATH 126. Pre-Calculus Algebra Workshop I. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 116.

Facilitated study and discussion of the theory, problems, and applications of precalculus algebra. Credit/No Credit grading only. 1 laboratory.

### **MATH 127. Pre-Calculus Algebra Workshop II. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 117.

Facilitated study and discussion of the theory, problems, and applications of pre-calculus algebra. Credit/No Credit grading only. 1 laboratory.

### **MATH 128. Pre-Calculus Algebra Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 118.

Facilitated study and discussion of the theory, problems, and applications of pre-calculus algebra. Credit/No Credit grading only. 1 laboratory.

**MATH 129. Precalculus Trigonometry Workshop. 1 unit.**

CR/NC

Corequisite: Concurrent enrollment in the associated section of MATH 119.

Facilitated study and discussion of the theory, problems, and applications of pre-calculus trigonometry. Credit/No Credit grading only. 1 laboratory.

**MATH 141. Calculus I. 4 units.**

GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination, or MATH 118 and high school trigonometry, or MATH 119.

Limits, continuity, differentiation. Introduction to integration. 4 lectures. Crosslisted as HNRS/MATH 141. Fulfills GE B1.

**MATH 142. Calculus II. 4 units.**

GE Area B1

Prerequisite: MATH 141 with a grade of C- or better or consent of instructor.

Techniques of integration, applications to physics, transcendental functions. 4 lectures. Crosslisted as HNRS/MATH 142. Fulfills GE B1.

**MATH 143. Calculus III. 4 units.**

GE Area B1

Prerequisite: MATH 142 with a grade of C- or better or consent of instructor.

Infinite sequences and series, vector algebra, curves. 4 lectures. Crosslisted as HNRS/MATH 143. Fulfills GE B1.

**MATH 151. Calculus Workshop I. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 141.

Facilitated study and discussion of the theory, problems, and applications of calculus. Credit/No Credit grading only. 1 laboratory.

**MATH 152. Calculus Workshop II. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 142.

Facilitated study and discussion of the theory, problems, and applications of calculus. Credit/No Credit grading only. 1 laboratory.

**MATH 153. Calculus Workshop III. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 143.

Facilitated study and discussion of the theory, problems, and applications of calculus. Credit/No Credit grading only. 1 laboratory.

**MATH 161. Calculus for the Life Sciences I. 4 units.**

GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination, or MATH 118.

Review of exponential, logarithmic, and trigonometric functions. Differential and integral calculus with applications to the biological sciences. Introduction to differential equations and mathematical modeling. Examples, exercises and applications to emphasize problems in life sciences. Not open to students with credit in MATH 141. 4 lectures. Fulfills GE B1.

**MATH 162. Calculus for the Life Sciences II. 4 units.**

GE Area B1

Prerequisite: MATH 161.

Review of exponential, logarithmic, and trigonometric functions. Differential and integral calculus with applications to the biological sciences. Introduction to differential equations and mathematical modeling. Examples, exercises and applications to emphasize problems in life sciences. Not open to students with credit in MATH 142. 4 lectures. Fulfills GE B1.

**MATH 171. Calculus for the Life Sciences Workshop I. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 161.

Facilitated study and discussion of the theory, problems, and applications of calculus for the life sciences. Credit/No Credit grading only. 1 laboratory.

**MATH 172. Calculus for the Life Sciences Workshop II. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 162.

Facilitated study and discussion of the theory, problems, and applications of calculus for the life sciences. Credit/No Credit grading only. 1 laboratory.

**MATH 182. Calculus for Architecture and Construction Management. 4 units.**

GE Area B1

Prerequisite: MATH 141.

Integral calculus with applications to architecture and construction management. The algebra of vectors. Polar, cylindrical, and spherical coordinate systems. Not open to students with credit in MATH 142. 4 lectures. Fulfills GE B1.

**MATH 192. Calculus for Architecture and Construction Management Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 182.

Facilitated study and discussion of the theory, problems, and applications of calculus to architecture and construction management. Credit/No Credit grading only. 1 laboratory.

**MATH 202. Orientation to Mathematics Major. 1 unit.**

CR/NC

Prerequisite: MATH 143.

Career opportunities in the field of mathematics, preparing a field of study, and a survey of departmental facilities and procedures related to research, study and graduation. Credit/No Credit grading only. 1 lecture.

**MATH 206. Linear Algebra I. 4 units.**

Prerequisite: MATH 143.

Matrices, inverses, linear systems, determinants, eigenvalues, eigenvectors, vector spaces, linear transformations, applications. 4 lectures.

**MATH 211. Computational Mathematics I. 4 units.**

Prerequisite: MATH 141.

Fundamentals of procedural programming in C/C++ and selected applications to problems in integral and differential calculus, matrix analysis, geometry, and physics. 4 lectures.

**MATH 212. Computational Mathematics II. 4 units.**

Prerequisite: MATH 211.

Fundamentals of procedural programming in C/C++ and selected applications to problems in integral and differential calculus, matrix analysis, geometry, and physics. 4 lectures.

**MATH 221. Calculus for Business and Economics. 4 units.**

GE Area B1

Prerequisite: Completion of ELM requirement and passing score on appropriate Mathematics Placement Examination, or MATH 118.

Polynomial calculus for optimization and marginal analysis, and elementary integration. Not open to students with credit in MATH 142. 4 lectures. Fulfills GE B1.

**MATH 227. Mathematics for Elementary Teaching I. 4 units.**

GE Area B1

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Introduction to problem solving, set theory, number systems, arithmetic operations, models, and number theory. This class is designed for Liberal Studies majors. Other students will be admitted only by consent of instructor. 4 lectures. Fulfills GE B1.

**MATH 231. Calculus for Business and Economics Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 221.

Facilitated study and discussion of the theory, problems, and applications of business calculus. Credit/No Credit grading only. 1 laboratory.

**MATH 241. Calculus IV. 4 units.**

Prerequisite: MATH 143.

Partial derivatives, multiple integrals, introduction to vector analysis. 4 lectures. Crosslisted as HNRS/MATH 241.

**MATH 242. Differential Equations I. 4 units.**

Prerequisite: MATH 206 and MATH 241.

Ordinary differential equations: first-order linear equations, separable equations, exact equations, second-order linear equations, nonhomogeneous equations, systems of first-order linear equations, systems of nonlinear equations, modeling and applications. Not open to students with credit in MATH 244. 4 lectures.

**MATH 244. Linear Analysis I. 4 units.**

Prerequisite: MATH 143.

Separable and linear ordinary differential equations with selected applications; numerical and analytical solutions. Linear algebra: vectors in  $n$ -space, matrices, linear transformations, eigenvalues, eigenvectors, diagonalization; applications to the study of systems of linear differential equations. 4 lectures. Crosslisted as HNRS/MATH 244.

**MATH 248. Methods of Proof in Mathematics. 4 units.**

Prerequisite: MATH 143.

Methods of proof (direct, contradiction, conditional, contraposition); valid and invalid arguments. Examples from set theory. Quantified statements and their negations. Functions, indexed sets, set functions. Proofs in number theory, algebra, geometry and analysis. Proof by induction. Equivalence and well-defined operations and functions. The axiomatic method. 4 lectures.

**MATH 258. Methods of Proof in Mathematics Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 248.

Facilitated study and discussion of the methods and techniques of proof in mathematics. Credit/No Credit grading only. 1 laboratory.

**MATH 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**MATH 300. Technology in Mathematics Education. 4 units.**

Prerequisite: MATH 248.

Examination of existing hardware and software designed for educational uses. Discussion of mathematical topics appropriate for computer enhancement. Special methods and techniques for educational uses of computers. Emphasis on activity learning and applications. Computer as a classroom management device. 4 lectures.

**MATH 304. Vector Analysis. 4 units.**

GE Area B6

Prerequisite: MATH 206 or MATH 244, and MATH 241.

Differential and integral calculus of vector-valued functions. Green's Theorem, Stokes' Theorem, and the Divergence Theorem. Applications and generalizations. 4 lectures. Fulfills GE B6.

**MATH 306. Linear Algebra II. 4 units.**

Prerequisite: MATH 241; and MATH 206 or MATH 244; and a C- or better in MATH 248, or consent of instructor.

Inner product spaces, orthogonality, Fourier series and orthogonal bases, linear transformations and similarity, eigenvalues and diagonalization. 4 lectures.

**MATH 316. Introduction to Linear Algebra Workshop II. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 306.

Facilitated study and discussion of the methods and techniques of proof in linear algebra. Credit/No Credit grading only. 1 laboratory.

**MATH 326. Mathematics and Visual Arts. 4 units.**

GE Area B5

Prerequisite: Completion of GE Area B1 and a college course in art or design.

Topics connecting mathematics and visual art including regular polygons, symmetry groups, repetition and pattern, perspective, straightedge and compass constructions, and origami. Examples of mathematical art including historic and contemporary art. 4 lectures. Fulfills GE B5.

**MATH 328. Mathematics for Elementary Teaching II. 4 units.**

Prerequisite: MATH 227 with a grade of C- or better or consent of instructor.

Introduction to rational and real numbers, probability and counting techniques, statistics, and geometry. Computer applications. 4 lectures.

**MATH 329. Mathematics for Elementary Teaching III. 4 units.**

Prerequisite: MATH 328.

Introduction to rational and real numbers, probability and counting techniques, statistics, and geometry. Computer applications. 4 lectures.

**MATH 330. Algebraic Thinking with Technology. 4 units.**

Prerequisite: MATH 329.

Algebraic concepts for elementary teachers. Mathematical patterns, equations and inequalities, linear and quadratic functions, exponential and logarithmic functions, systems of equations, roots of polynomials, factoring of polynomials, and right-triangle trigonometry. Computer applications. 4 lectures.

**MATH 335. Graph Theory. 4 units.**

Prerequisite: MATH 248 or junior standing.

Introduction to graph theory and its applications: isomorphism, paths and searching, connectedness, trees, tournaments, planarity, graph colorings, matching theory, network flow, adjacency and incidence matrices. Further topics to be selected from the theory of finite state machines, Ramsey theory, extremal theory, and graphical enumeration. 4 lectures.

**MATH 336. Combinatorial Math. 4 units.**

Prerequisite: MATH 248 or junior standing.

Methods of enumerative combinatorics: sum, product, and division rules, bijective and recursive techniques, inclusion and exclusion, generating functions, and the finite difference calculus. Advanced topics to be selected from the theory of partitions, Polya theory, designs, and codes. 4 lectures.

**MATH 341. Theory of Numbers. 4 units.**

Prerequisite: MATH 248 with a grade of C- or better or consent of instructor.

Properties of numbers. Euclid's Algorithm, greatest common divisors, diophantine equations, prime numbers, congruences, number theoretic functions, the quadratic reciprocity laws, primitive roots and indices. 4 lectures.

**MATH 344. Linear Analysis II. 4 units.**

GE Area B6

Prerequisite: MATH 206 and MATH 242, or MATH 241 and MATH 244.

Linear methods applied to the solution of differential equations. Laplace transforms. Series solutions to ordinary differential equations. Orthogonality in  $n$ -space, Gram-Schmidt orthogonalization and least squares methods. Orthogonal bases in function spaces, Sturm-Liouville theory. Fourier series and transforms. Special functions of applied mathematics. 4 lectures. Fulfills GE B6.

**MATH 350. Mathematical Software. 4 units.**

Prerequisite: MATH 206 or MATH 244, and MATH 241, and an introductory college-level programming course, or consent of instructor.

Problem-solving using mathematical software. 4 lectures.

**MATH 351. Typesetting with LaTeX. 1 unit.**

CR/NC

Prerequisite: Junior standing.

Preparing documents, especially mathematical ones, using LaTeX and AMS-LaTeX. Credit/No Credit grading only. 1 lecture.

**MATH 370. Putnam Exam Seminar. 2 units.**

Prerequisite: Consent of instructor.

Directed group study of mathematical problem solving techniques. Open to undergraduate students only. Class members are expected to participate in the annual William Lowell Putnam Mathematical Competition. Course may be repeated up to eight units. 2 seminars.

**MATH 371. Math Modeling Seminar. 2 units.**

Prerequisite: Consent of instructor.

Directed group study of mathematical modeling techniques. Open to undergraduate students only. Class members are expected to participate in the annual Mathematical Competition in Modeling. Total credit limited to 8 units. 2 seminars.

**MATH 372. Mathematical Community Service Projects. 2 units.**

CR/NC

Prerequisite: Consent of instructor and consent of department chair.

Directed group mathematical research in support of volunteer community service projects. Total credit limited to 8 units. 2 seminars.

**MATH 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Junior standing and consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units.

**MATH 404. Introduction to Differential Geometry. 4 units.**

Prerequisite: MATH 304.

Theory of curves and surfaces in space. Topics such as Frenet formulas, curvature, geodesics, Cartan structural equations, Gauss-Bonnet Theorem. 4 lectures.

**MATH 406. Linear Algebra III. 4 units.**

Prerequisite: MATH 306.

Complex vector spaces, unitary and self-adjoint matrices, Spectral Theorem, Jordan canonical form. Selected topics in linear programming, convexity, numerical methods, and functional analysis. 4 lectures.

**MATH 408. Complex Analysis I. 4 units.**

GE Area B6

Prerequisite: MATH 242, or MATH 241 and MATH 244.

Elementary analytic functions and mappings. Cauchy's Integral Theorem; Poisson's Integral Formula. Taylor and Laurent series, theory of residues, and the evaluation of integrals. Harmonic functions, conformal mappings. 4 lectures. Fulfills GE B6.

**MATH 409. Complex Analysis II. 4 units.**

Prerequisite: MATH 408.

Elementary analytic functions and mappings. Cauchy's Integral Theorem; Poisson's Integral Formula. Taylor and Laurent series, theory of residues, and the evaluation of integrals. Harmonic functions, conformal mappings. 4 lectures.

**MATH 412. Introduction to Analysis I. 4 units.**

Prerequisite: MATH 306.

Introduction to concepts and methods basic to real analysis. Topics such as the real number system, sequences, continuity, uniform continuity and differentiation. 4 lectures.

**MATH 413. Introduction to Analysis II. 4 units.**

Prerequisite: MATH 412.

A continuation of Introduction to Analysis I covering such topics as integration, infinite series, uniform convergence and functions of several variables. Highly recommended for students planning to enter graduate programs or secondary teaching and those interested in applied mathematics. 4 lectures.



**MATH 414. Introduction to Analysis III. 4 units.**

Prerequisite: MATH 413.

A continuation of Introduction to Analysis I covering such topics as integration, infinite series, uniform convergence and functions of several variables. Highly recommended for students planning to enter graduate programs or secondary teaching and those interested in applied mathematics. 4 lectures.

**MATH 416. Differential Equations II. 4 units.**

Prerequisite: MATH 206 and MATH 242, or MATH 241 and MATH 244.

Qualitative theory of ordinary differential equations: Existence and Uniqueness Theorem, phase portraits, limit sets, stability of fixed points and periodic orbits, energy functions, Poincare-Bendixson Theorem, Poincare maps, bifurcations, attractors, chaos. 4 lectures.

**MATH 418. Partial Differential Equations. 4 units.**

Prerequisite: MATH 344 or consent of instructor. Recommended: MATH 304.

Mathematical formulation of physical laws. Separation of variables. Orthogonal functions and generalized Fourier series. Bessel functions, Legendre polynomials. Sturm-Liouville problem. Boundary value problems; nonhomogeneous techniques. Applications to heat flow, potential theory, vibrating strings and membranes. 4 lectures.

**MATH 419. Introduction to the History of Mathematics. 4 units.**

Prerequisite: MATH 248 with a grade of C- or better and at least one upper division course in mathematics, or consent of instructor.

Evolution of mathematics from earliest to modern times. Major trends in mathematical thought, the interplay of mathematical and technological innovations, and the contributions of great mathematicians. Appropriate for prospective and in-service teachers. 4 lectures.

**MATH 422. Introduction to Analysis I Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 412.

Facilitated study and discussion of the methods and techniques of proof in introductory analysis. Credit/No Credit grading only. 1 laboratory.

**MATH 423. Advanced Mathematics for Teaching. 4 units.**

Prerequisite: MATH 442 and MATH 481.

Introduction to mathematics education research and advanced exploration of the mathematics taught in California's public high schools and middle schools through problem analysis, concept analysis, and problem connections. 4 lectures.

**MATH 424. Organizing and Teaching Mathematics. 4 units.**

CR/NC

Prerequisite: Acceptance into the Mathematics Single Subject Credential Program, or senior standing in the mathematics major, or consent of instructor.

Organization, selection, presentation, application and interpretation of subject matter in mathematics. Introduction to current issues in mathematics education. For students who will be teaching in secondary schools. Credit/No Credit grading only. 4 lectures.

**MATH 425. Mathematics Student Teaching Seminar. 1 unit.**

CR/NC

Prerequisite: Acceptance into Step II of the Single Subject Credential Program in Mathematics. Concurrent: EDUC 469 or EDUC 479.

Principles and practice in effective teaching of mathematics at the middle and high school level, learning theories, curriculum content and structure, classroom issues, and the teaching profession. Credit/No Credit grading only. Total credit limited to 2 units. 1 seminar.

**MATH 435. Discrete Mathematics with Applications I. 4 units.**

Prerequisite: MATH 248 with a grade of C- or better and MATH 336, or consent of instructor.

Methods of discrete mathematics with applications. Generating functions and Lagrange inversion, partition theory, permutation statistics and q-analogues, posets and Möbius inversion. Additional topics including lattice paths and basic hypergeometric series. 4 lectures. Not open to students with credit in MATH 530.

**MATH 436. Discrete Math with Applications II. 4 units.**

Prerequisite: MATH 435. Corequisite: MATH 482.

Methods of discrete mathematics with applications. Polya theory, codes, designs, matroids, the combinatorics of symmetric functions, and tableaux combinatorics. Additional topics including transversals and Latin squares, asymptotics, and discrete probability theory. 4 lectures. Not open to students with credit in MATH 531.

**MATH 437. Game Theory. 4 units.**

Prerequisite: MATH 206 or MATH 244, and MATH 248 with a grade of C- or better, or consent of instructor.

Development of the mathematical concepts, techniques, and models used to investigate optimal strategies in competitive situations; games in extensive, normal, and characteristic form, Nash equilibrium points and Nash Bargaining Model. 4 lectures.

**MATH 440. Topology I. 4 units.**

Prerequisite: MATH 412. Corequisite: MATH 481.

Introduction to general topological spaces with emphasis on surfaces and manifolds. Open and closed sets, continuity, compactness, connectedness. Quotient spaces. 4 lectures. Not open to students with credit in MATH 540.

**MATH 441. Topology II. 4 units.**

Prerequisite: MATH 440.

Introduction to general topological spaces with emphasis on surfaces and manifolds. Fundamental group. Triangulations of spaces, classification of surfaces. Other topics may include covering spaces, simplicial homology, homotopy theory and topics from differential topology. 4 lectures. Not open to students with credit in MATH 541.

**MATH 442. Euclidean Geometry. 4 units.**

Prerequisite: MATH 248 with a grade of C- or better or consent of instructor. Recommended: MATH 300 or familiarity with dynamic geometry software.

Foundations of Euclidean geometry, finite geometries, congruence, similarities, polygonal regions, circles and spheres. Constructions, mensuration, the parallel postulate. Appropriate for prospective and in-service mathematics teachers. 4 lectures.

**MATH 443. Modern Geometries. 4 units.**

Prerequisite: MATH 442.

Non-Euclidean and projective geometries. Properties of parallels, biangles, Saccheri and Lambert quadrilaterals, angle-sum and area. Limiting curves: hyperbolic trigonometry, duality, perspectivity, quadrangles, fundamental theorems of projective geometry, conics. 4 lectures.

**MATH 451. Numerical Analysis I. 4 units.**

Prerequisite: MATH 206 and MATH 242, or MATH 241 and MATH 244, and an introductory college-level programming course.

Topics in interpolation and approximation methods, initial value problems, and boundary value problems of ordinary differential equations. 4 lectures.

**MATH 452. Numerical Analysis II. 4 units.**

Prerequisite: MATH 451.

Numerical techniques for solving partial differential equations of the parabolic, hyperbolic and elliptic type. Further topics in approximation theory. 4 lectures.

**MATH 453. Numerical Optimization. 4 units.**

Prerequisite: MATH 306 and MATH 451.

Algorithms for solving optimization problems that cannot be solved analytically. Descent algorithms including exact and practical line-searches, steepest descent method, and Newton and quasi-Newton methods for unconstrained minimization. Optimality conditions for constrained optimization, linear programming. Projection and Lagrangian methods, and interior point methods for constrained minimization. 4 lectures.

**MATH 459. Senior Seminar. 4 units.**

Prerequisite: MATH 306, and completion of at least two additional upper-division courses in the math major.

Written and oral analyses and presentations by students on topics from advanced mathematics and mathematical modeling. 4 seminars.

**MATH 460. Applied Math Senior Seminar. 4 units.**

Prerequisite: MATH 306, MATH 344, and MATH 451.

Written and oral analyses and presentations by students on topics in applied mathematics, including applications to sustainability. Construction of mathematical models for physical and biological problems, with analysis and interpretation of the solutions of these models using both analytical and numerical techniques. 4 seminars.

**MATH 461. Senior Project I. 2 units.**

Prerequisite: MATH 459 or MATH 460.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 60 hours total time.

**MATH 462. Senior Project II. 2 units.**

Prerequisite: MATH 461.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 60 hours total time.

**MATH 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**MATH 474. Advanced Topics in Geometry and Topology. 1 unit.**

Prerequisite: MATH 248 and consent of instructor. Recommended: MATH 404 and MATH 440.

Exploration of advanced topics and problems in geometry and topology through reading, writing and oral presentations. The Schedule of Classes will list the specific topic as a subtitle. Total credit limited to 6 units. 1 seminar.

**MATH 481. Abstract Algebra I. 4 units.**

Prerequisite: MATH 306 or MATH 341.

Introduction to the study of algebraic structures, including groups, rings and fields. 4 lectures.

**MATH 482. Abstract Algebra II. 4 units.**

Prerequisite: MATH 481.

Introduction to the study of algebraic structures, including groups, rings and fields. 4 lectures.

**MATH 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 12 units. Credit/No Credit grading only.

**MATH 491. Abstract Algebra I Workshop. 1 unit.**

CR/NC

Concurrent: Enrollment in the associated section of MATH 481.

Facilitated study and discussion of the methods and techniques of proof in abstract algebra. Credit/No Credit grading only. 1 laboratory.

**MATH 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. No major credit allowed; total credit limited to 12 units. Credit/No Credit grading only.

**MATH 500. Individual Study. 1-4 units.**

Prerequisite: Graduate standing and consent of department chair.

Individual research or advanced study planned and completed under the direction of a departmental faculty member. Open only to graduate students demonstrating ability to do independent work. Total credit limited to 12 units.

**MATH 501. Analytic Methods in Applied Mathematics. 4 units.**

Prerequisite: MATH 344 or AERO 300, and graduate standing.

Introduction to advanced methods of mathematics useful in the analysis of engineering problems. Selected topics in perturbation theory, optimization and Fourier analysis. Not open to students in math major or master's degree program in mathematics. 4 lectures.

**MATH 502. Numerical Methods in Applied Mathematics. 4 units.**

Prerequisite: MATH 344 or AERO 300, an introductory college-level programming course, and graduate standing.

Introduction to advanced numerical analysis. Numerical techniques for solving ordinary and partial differential equations, error analysis, stability, methods for linear systems. Not open to students in math major or master's degree program in mathematics. 4 lectures.

**MATH 504. Mathematical Topics for Teachers. 1-4 units.**

CR/NC

Prerequisite: Multiple Subject or Single Subject teaching credential or consent of instructor.

Mathematical topics for practicing credentialed teachers. Professional growth through improvement of teachers' mathematical content knowledge and pedagogical approaches using technology, discussion, reflection, and hands-on activities. Content will vary according to teaching level. The Schedule of Classes will list topic selected. Total credit limited to 12 units. Not open to students in math major or master's degree program in mathematics. Credit/No Credit grading only. 1-4 activities.

**MATH 505. Graduate Teaching Seminar. 1 unit.**

CR/NC

Prerequisite: Graduate standing.

Principles and practice in effective teaching of college-level mathematics. Issues related to present and future teaching experiences, including time management, professionalism, student assessment, grading, classroom management, and qualities of good mathematics teachers. Reflection on individual teaching, and consideration of improvements in instruction. Credit/No Credit grading only. Total credit limited to 2 units. 1 seminar.

**MATH 520. Applied Analysis I. 4 units.**

Prerequisite: MATH 408, MATH 412 and graduate standing.

Recommended: MATH 418.

Advanced mathematical methods of analysis in science and engineering, integrated with modeling of physical phenomena. Topics include applications of complex analysis, Fourier analysis, ordinary and partial differential equations. Additional topics to be drawn from perturbation methods, asymptotic analysis, dynamical systems, numerical methods, optimization, and the calculus of variations. 4 lectures.

**MATH 521. Applied Analysis II. 4 units.**

Prerequisite: MATH 520.

Advanced mathematical methods of analysis in science and engineering, integrated with modeling of physical phenomena. Topics include applications of complex analysis, Fourier analysis, ordinary and partial differential equations. Additional topics to be drawn from perturbation methods, asymptotic analysis, dynamical systems, numerical methods, optimization, and the calculus of variations. 4 lectures.

**MATH 530. Discrete Mathematics with Applications I. 4 units.**

Prerequisite: MATH 248 with a grade of C- or better and MATH 336 and graduate standing, or consent of instructor.

Methods of discrete mathematics with applications. Generating functions and Lagrange inversion, partition theory, permutation statistics and q-analogues, posets and Möbius inversion. Additional topics including lattice paths and basic hypergeometric series. 4 lectures. Not open to students with credit in MATH 435.

**MATH 531. Discrete Mathematics with Applications II. 4 units.**

Prerequisite: MATH 530. Corequisite: MATH 482.

Methods of discrete mathematics with applications. Polya theory, codes, designs, matroids, the combinatorics of symmetric functions, and tableaux combinatorics. Additional topics including transversals and Latin squares, asymptotics, and discrete probability theory. 4 lectures. Not open to students with credit in MATH 436.

**MATH 540. Topology I. 4 units.**

Prerequisite: MATH 412 and graduate standing. Corequisite: MATH 481.

Introduction to general topological spaces with emphasis on surfaces and manifolds. Open and closed sets, continuity, compactness, connectedness. Quotient spaces. 4 lectures. Not open to students with credit in MATH 440.

**MATH 541. Topology II. 4 units.**

Prerequisite: MATH 540 and graduate standing.

Introduction to general topological spaces with emphasis on surfaces and manifolds. Fundamental group. Triangulations of spaces, classification of surfaces. Other topics may include covering spaces, simplicial homology, homotopy theory and topics from differential topology. 4 lectures. Not open to students with credit in MATH 441.

**MATH 550. Real Analysis. 4 units.**

Prerequisite: Satisfactory completion of the Graduate Written Examination in Analysis or consent of the Graduate Committee.

Introduction to Lebesgue measure and integration, convergence theorems,  $L^1$  spaces, Radon-Nikodym Theorem and Fubini's Theorem. 4 lectures.

**MATH 560. Field Theory. 4 units.**

Prerequisite: Satisfactory completion of the Graduate Written Examination in Algebra or consent of the Graduate Committee.

Polynomial rings, field extensions, normal and separable extensions, automorphisms of fields, fundamental theorem of Galois theory, solvable groups, solution by radicals, insolubility of the quintic. 4 lectures.

**MATH 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing and consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**MATH 580. Seminar. 1-4 units.**

Prerequisite: Graduate standing and consent of instructor.

Built around topics in advanced mathematics chosen according to the common interests and needs of the students enrolled. Each seminar will have a subtitle according to the nature of the content. Total credit limited to 12 units. 1-4 seminars.

**MATH 599. Thesis. 3 units.**

Prerequisite: Graduate standing and consent of instructor.

Serious research endeavor devoted to the development, pedagogy or learning of mathematics. Course to be taken twice for a total of 6 units.

## **Mechanical Engineering (ME)**

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### **Mechanical Engineering Courses**

**ME 128. Introduction to Mechanical Engineering I. 1 unit.**

Prerequisite: Mechanical Engineering student; first quarter of freshman year.

Introduction to mechanical engineering and its application in professional practice. Includes design, analysis, testing and dissection of mechanical engineering systems, from simple machines to more complicated systems. Introduction to engineering graphic communication. Introduction to HVAC, Manufacturing and Mechatronics concentrations. Includes first quarter cornerstone service learning project. 1 laboratory. Formerly ME 134.

**ME 129. Introduction to Mechanical Engineering II. 1 unit.**

Prerequisite: ME 128; Mechanical Engineering student; second quarter of freshman year. Concurrent: ME 163.

Communication of designs for manufacturing using basic definitions of points, lines and planes in space. Pictorials, orthographic projection, section views and auxiliary views. Techniques from geometry and spatial definitions integrated to provide information to both the design and manufacturing processes. Includes continuation of cornerstone service learning design project. 1 laboratory. Formerly ME 151.

**ME 130. Introduction to Mechanical Engineering III. 1 unit.**

Prerequisite: ME 129; Mechanical Engineering student; third quarter of freshman year.

Use of computer-aided design to communicate parts and assemblies. Dimensioned drawings for part fabrication. Introduction to fits and tolerances. Layout drawings and functional assemblies. Conclusion of cornerstone service learning project. 1 laboratory. Formerly ME 152.

**ME 163. Freshmen Orientation to Mechanical Engineering. 1 unit.**

Concurrent: ME 129.

Introduction to career opportunities in Mechanical Engineering, exploration of the ethical responsibilities of being a student and professional engineer, and familiarity with the ME curriculum including cooperative education and international exchange opportunities. 1 lecture.

**ME 211. Engineering Statics. 3 units.**

Prerequisite: MATH 241 (or concurrently), PHYS 131 or PHYS 141.

Analysis of forces on engineering structures in equilibrium. Properties of forces, moments, couples, and resultants. Equilibrium conditions, friction, centroids, area moments of inertia. Introduction to mathematical modeling and problem solving. Vector mathematics where appropriate. 3 lectures.

**ME 212. Engineering Dynamics. 3 units.**

Prerequisite: MATH 241; ME 211 or ARCE 211.

Analysis of motions of particles and rigid bodies encountered in engineering. Velocity, acceleration, relative motion, work, energy, impulse, and momentum. Further development of mathematical modeling and problem solving. Vector mathematics where appropriate. 3 lectures.

**ME 228. Engineering Design Communication. 2 units.**

Use of engineering communication principles to communicate details of project designs including: sketching, orthographic projection, section and auxiliary views, dimensioning, and tolerances. Hand and computer based methods explored. Introduction to design for manufacturability. 2 laboratories.

**ME 229. Introduction to Mechanical Engineering for Transfers. 2 units.**

Introduction to Mechanical Engineering and its application in professional practice. Includes design, analysis, testing and dissection of mechanical engineering systems. Investigation of personal and professional ethics. Familiarization with the ME curriculum including cooperative education and international exchange opportunities. 1 lecture, 1 laboratory.

**ME 234. Philosophy of Design. 3 units.**

Prerequisite: ME 130 or ME 228.

General approach to the meaning of engineering design. Conceptual blocks, creativity, design process, design considerations and elements. 3 lectures.

**ME 236. Measurements and Engineering Data Analysis. 3 units.**

Prerequisite: Engineering majors. Concurrent: ME 128.

Recommended: ENGL 134, CHEM 125, PHYS 131.

Introduction to principles and practice of measurement. Application of probability distributions, sampling, confidence intervals, uncertainty, and regression analysis to engineering experiments and design. Techniques for measuring common physical quantities such as temperature, pressure, and strain. Introduction to laboratory report writing and communication of technical data. 2 lectures, 1 laboratory.

**ME 251. Introduction to Detailed Design with Solid Modeling. 2 units.**

Prerequisite: ME 130 or ME 228; Sophomore standing.

Part and system or assembly design with solid modeling using current software and hardware. Techniques of advanced communication including weld symbols, threaded fasteners, dimensioning and tolerancing. Creation of design layouts and part models with varied configurations and dynamic assembly models. Introduction to section mass and inertia properties. Emphasis of group work and peer review in the production of parts for assemblies. 1 lecture, 1 laboratory.

**ME 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**ME 271. Selected Laboratory. 1-2 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 4 units. 1 to 2 laboratories.

**ME 302. Thermodynamics I. 3 units.**

Prerequisite: PHYS 132; ME 212 or CHEM 128.

Properties of working fluids and fundamental relations for processes involving the transfer of energy. First and second laws of thermodynamics, irreversibility and availability. 3 lectures.

**ME 303. Thermodynamics II. 3 units.**

Prerequisite: ME 302.

Vapor and gas power cycles, refrigeration cycles, thermodynamic relations, psychrometrics, and chemical reactions. 3 lectures.

**ME 305. Introduction to Mechatronics. 4 units.**

Prerequisite: EE 321 and EE 361, or consent of instructor.

Introduction to microcontrollers and assembly language programming. Emphasis on components and techniques for interfacing that are typical of embedded microcontroller applications (A/D conversion, D/A conversion, interrupts, timers, and pulse-width modulation). Laboratory exercises involve real-time interfacing of microcontrollers to external mechanical and/or electromechanical devices. 3 lectures, 1 laboratory.

**ME 318. Mechanical Vibrations. 4 units.**

Prerequisite: ME 326, MATH 344. Recommended: EE 201.

Free and forced vibration response of single and multiple degree of freedom systems. Experimental studies of the dynamic behavior of structures and machines. Instrumentation methods utilized in field and laboratory. 3 lectures, 1 laboratory.

**ME 320. Consumer Energy Guide. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary connection of everyday consumer decisions with energy costs, security, and global warming. Energy consumption by home appliances and automobiles. Methods to reduce the individual 'energy footprint' with renewable energy, purchasing carbon offsets, and behavioral modifications. 4 lectures. Fulfills GE Area F.

**ME 326. Intermediate Dynamics. 4 units.**

Prerequisite: MATH 244 (or concurrent), ME 212, CSC 231 or CSC 234.

Continuation of ME 212. Additional analysis of planar motion of rigid bodies with particular attention to the kinematics of mechanisms. Rotating reference frames. Introduction to three dimensional dynamics. Dynamic simulation of mechanisms. 3 lectures, 1 activity.

**ME 328. Introduction to Design. 4 units.**

Prerequisite: CE 207; ME 251; MATE 210; CSC 231 or CSC 234; ME 212; ME 234; and ENGL 149. Concurrent: IME 141 or IT 341.

Design of machine parts by stress and deflection. Effects of fluctuating stresses and stress concentration. Design of shafts and other machine parts. Modern industrial design practice using standard components and design layout drawings. 3 lectures, 1 laboratory.

**ME 329. Intermediate Design. 4 units.**

Prerequisite: ME 328.

Design of mechanical equipment and systems using various machine elements and components such as threaded fasteners, power screws, springs, gears, bearings, clutches, prime movers, etc. Decision modeling based on technical and economic feasibility. 3 lectures, 1 laboratory.

**ME 341. Fluid Mechanics I. 3 units.**

Prerequisite: ME 212 or ARCE 225.

Fluid properties and fluid statics. Euler and Bernoulli equations. Conservation equations; dimensional analysis. Viscous pipe flow. Course may be offered in classroom-based or online format. 3 lectures.

**ME 343. Heat Transfer. 4 units.**

Prerequisite: ME 341; and ME 302 or MATE 380; MATH 244; and CSC 231 or CSC 234.

Basic principles of heat transfer. Conduction, convection, radiation, and combined modes. Optional thermal engineering design project. 4 lectures.

**ME 346. Thermal Science Laboratory. 1 unit.**

Prerequisite: ME 303 and ME 343.

Heat transfer and thermodynamic experiments covering combined free convection and radiation, transient conduction, energy conversion, heat exchanger, polytropic blowdown, steam turbine, and refrigeration cycles. 1 laboratory.

**ME 347. Fluid Mechanics II. 4 units.**

Prerequisite: ME 236, ME 341, ME 302 or consent of instructor.

Conservation equations of fluid dynamics. Viscous flow, boundary layer concepts, lift and drag, compressible flow, turbomachinery. Laboratory measurement of turbomachine performance, velocity profiles, boundary layers on surfaces. 3 lectures, 1 laboratory.

**ME 359. Fundamentals of HVAC Systems. 4 units.**

Prerequisite: ME 302.

Fundamentals of heating, ventilating and air-conditioning (HVAC) systems, human comfort and indoor air quality, primary and secondary systems and components. 3 lectures, 1 laboratory.

**ME 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units.

**ME 401. Stress Analysis. 4 units.**

Prerequisite: CE 207, MATH 344, ME 328 or consent of instructor.

Advanced strength of materials: behavior of disks, plates, and shells. Theory of elasticity. Energy methods. 3 lectures, 1 laboratory.

**ME 402. Orthopedic Biomechanics. 4 units.**

Prerequisite: ME 328 or consent of instructor.

Biomechanical analysis of the musculoskeletal system. Emphasis on the use of statics, dynamics, strength of materials, viscoelasticity, and poroelasticity to analyze the mechanical loads acting on human joints, the mechanical properties of tissues, and the design of artificial joints. 3 lectures, 1 laboratory.



**ME 404. Applied Finite Element Analysis. 4 units.**

Prerequisite: ME 328 or CE 351 or BMED 410.

Finite element based solutions to engineering problems with an emphasis on elastostatic problems in structural mechanics. The power and pitfalls associated with the finite element method highlighted through practical modeling assignments. Introduces the use of commercial finite element codes. 3 lectures, 1 laboratory. Crosslisted as BMED/CE/ME 404.

**ME 405. Mechatronics. 4 units.**

Prerequisite: ME 305 and ME 329 (or concurrent), or CPE/EE 329 and CPE/CSC 369, or consent of instructor.

Microprocessor applications in machine control and product design. Applied electronics. Drive technology; transducers and electromechanical systems. Real-time programming. Mechatronic design methodology. 3 lectures, 1 laboratory.

**ME 410. Experimental Methods in Mechanical Design I. 4 units.**

Prerequisite: ME 328. Recommended: ME 318.

Bonded resistance strain gages for static and dynamic measurements; rosettes, bridge circuits, lead wire effects, special gages. Data acquisition systems, and measurement of displacement, velocity, and acceleration. Photoelastic methods including birefringent coatings. Applications in mechanical design and metrology. 3 lectures, 1 laboratory.

**ME 412. Composite Materials Analysis and Design. 4 units.**

Prerequisite: AERO 331 or ME 328.

Behavior of unidirectional fiber composites. Properties of short-fiber composites, and orthotropic lamina. Analysis of laminated composites. Strength and hygrothermal behavior of composite materials. Structural optimization. 3 lectures, 1 laboratory.

**ME 415. Energy Conversion. 4 units.**

Prerequisite: ME 302.

Engineering aspects of energy sources, conversion and storage. Topics selected from fossil fuel systems, nuclear power, thermoelectric systems, thermionic converters, fuel cells, magnetohydrodynamic generators, and geothermal, tidal, wind and ocean temperature energy conversion systems. 4 lectures.

**ME 416. Ground Vehicle Dynamics and Design. 4 units.**

Prerequisite: ME 318, ME 328.

Design of ground vehicles for directional stability and control. Tire mechanics and their effects on vehicle performance. Simulation of vehicle dynamics using digital computer. Synthesis of steering mechanism and suspension system. 3 lectures, 1 laboratory.

**ME 422. Mechanical Control Systems. 4 units.**

Prerequisite: ME 318.

Modeling and control of physical systems. Design of mechanical, hydraulic and electrical systems using time response, frequency response, state space, and computer simulation. 3 lectures, 1 laboratory.

**ME 423. Robotics: Fundamentals and Applications. 4 units.**

Prerequisite: ME 326, ME 422.

Introduction to robots and their types. Homogeneous transformations. Kinematic equations and their solutions. Motion trajectories, statics, dynamics, and control of robots. Robot programming. Actuators, sensors and vision systems. 3 lectures, 1 laboratory.

**ME 424. Design of Piping Systems. 4 units.**

Prerequisite: CE 207, ME 347, CSC 231, MATE 210.

Pipe specifications and pertinent codes. Valves, fittings, pumps and compressors. The transportation function of piping as related to power plants, refineries, slurry systems, pumping systems and drainage. Philosophy of system design. 3 lectures, 1 laboratory.

**ME 428. Senior Design Project I. 3 units.**

Prerequisite: ME 318, ME 329, and ME 343.

First of three courses taken sequentially in component and system design using real-world problems. Small teams study and apply techniques of the engineering design process including problem definition, concept generation, feasibility studies and decision making. Practice of professional skills including written and oral communication, teaming, project management, societal responsibility and ethics. 1 lecture, 2 laboratories.

**ME 429. Senior Design Project II. 2 units.**

Prerequisite: ME 428.

Continuation of a project begun in ME 428. Activities focused on detail design, analysis and material procurement. 2 laboratories.

**ME 430. Senior Design Project III. 1 unit.**

Prerequisite: ME 429.

Completion of a project begun in ME 428 and continued in ME 429. Design verified through prototyping and testing. 1 laboratory.

**ME 431. Mechanical Design Techniques. 4 units.**

Prerequisite: ME 329.

Comprehensive study of various design methods and techniques. Techniques used to explore various structural concepts such as prestressing, shaping, sizing, etc. Simulation of systems using digital computer. Design criteria identification of design parameters and constraints. 3 lectures, 1 laboratory.

**ME 432. Petroleum Reservoir Engineering. 4 units.**

Prerequisite: ME 341.

Types of reservoirs and reservoir rocks. Measurement and interpretation of physical properties of reservoir rocks and fluids: porosity, permeability, compressibility, electrical resistivity, fluid saturation, viscosity, solution gas and PVT properties of reservoir fluids. Introduction to flow in porous media, reserve calculations for different reservoirs and computer applications. 3 lectures, 1 laboratory.

**ME 434. Enhanced Oil Recovery. 4 units.**

Prerequisite: ME 302, ME 347, ME 343.

Primary, secondary, and tertiary (enhanced) oil recovery methods. Waterflooding, polymerflooding, gas injection, steam injection, in-situ combustion, chemical flooding, miscible flooding. Performance calculations and computer applications in EOR. 4 lectures.

**ME 435. Drilling Engineering. 4 units.**

Prerequisite: ME 329, ME 347.

Theory and practice of oilwell planning, drilling, well logging, and completion applied to the development of new oil and gas production, from onshore and offshore fields. 4 lectures.

**ME 436. Petroleum Production Engineering. 4 units.**

Prerequisite: ME 329, ME 347.

Design and operation of surface and subsurface equipment required in oil production. Processes and systems involved are rod pumping, gas lifting, acidizing, hydraulic fracturing, fluid gathering and storage, separation of oil, gas, water and sediment from produced fluid. Includes equipment used in enhanced oil recovery processes. 4 lectures.

**ME 440. Thermal System Design. 4 units.**

Prerequisite: ME 303, ME 347, ME 343.

Design and optimization of thermal systems. Engineering economics, thermal component sizing, steady-state simulation, and optimization techniques applied to the design and performance analysis of thermal systems. 3 lectures, 1 laboratory.

**ME 441. Single Track Vehicle Design. 4 units.**

Prerequisite: ME 318, ME 329, or consent of instructor.

Design of single track vehicles, including handling characteristics, ergonomics and human power, strength and stiffness considerations, braking and suspension. Laboratory focus on designing a single track vehicle, including fabrication of a handling prototype. 3 lectures, 1 laboratory.

**ME 443. Turbomachinery. 4 units.**

Prerequisite: ME 303, ME 347, ME 343, MATH 344.

Performance characteristics of various types for liquids and for gases. Criteria for proper selection of type and main dimensions. Cavitation criteria. Gas turbine cycles and performance. Two-dimensional cascades. Axial flow turbines and compressors. Centrifugal compressors and radial-inflow turbines. 4 lectures.

**ME 444. Combustion Engine Design. 4 units.**

Prerequisite: ME 303, ME 343, ME 347.

Application of design parameters to the various engine cycles. Aspects of the combustion processes. Emission regulation effects on engine design. Static and dynamic loading. 3 lectures, 1 laboratory.

**ME 446. Advanced and Hybrid Vehicle Design. 4 units.**

Prerequisite: ME 329 and ME 303.

Systematic methodology to design and optimize hybrid powertrains. Exploration of conventional and hybrid powertrain subsystem models and application in a vehicle simulation, including internal combustion engines, electric motors and generators, transmissions, batteries, fuel cells, hydraulic reservoirs, ultracapacitors, flywheels, etc. Analytical modeling and optimization. 3 lectures, 1 laboratory.

**ME 450. Solar Power Systems. 4 units.**

Prerequisite: ME 343. Recommended: ME 415.

High and intermediate temperature systems for conversion of solar energy to mechanical power and heat. Thermal energy storage and total thermal energy system design. 3 lectures, 1 laboratory.

**ME 456. HVAC Air and Water Distribution System Design. 4 units.**

Prerequisite: ME 302, ME 347.

Air and water distribution components and systems and the design of these systems with applications to the heating, ventilating and air-conditioning (HVAC) industry. 3 lectures, 1 laboratory.

**ME 457. Refrigeration Principles and Design. 4 units.**

Prerequisite: ME 341, ME 343.

Basic engineering principles of refrigeration processes including: vapor compression cycles, multipressure systems, absorption systems, steam jet cooling, air cycles, and low temperature refrigeration. 3 lectures, 1 laboratory.

**ME 458. Building Heating and Cooling Loads. 4 units.**

Prerequisite: ME 303, and ME 343.

Building heating and cooling load calculations, estimating energy consumption and operating costs for heating, ventilating and air-conditioning system design and selection. 3 lectures, 1 laboratory.

**ME 459. HVAC Senior Design Project I. 3 units.**

Prerequisite: ME 456, ME 458.

First quarter of a two quarter sequence. Team project work in designing heating, ventilating and air-conditioning (HVAC) systems. New developments, policies and practices in the HVAC industry. Professional ethics relevant for practicing engineers. 1 lecture, 2 laboratories.

**ME 460. HVAC Senior Design Project II. 2 units.**

Prerequisite: ME 459.

Continuation of work begun in ME 459. Team project designing heating, ventilating and air-conditioning (HVAC) systems. 2 laboratories.

**ME 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 lectures.

**ME 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

**ME 488. Wind Energy Engineering. 4 units.**

Prerequisite: ME 329, ME 347, ME 302.

Engineering aspects of windpower systems including mechanical design, support structure design, aerodynamic analysis, wind field analysis, system concepts and analysis, and economics. 4 lectures.

**ME 493. Cooperative Education Experience. 2 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 6 units.

**ME 494. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 18 units.

**ME 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. A more fully developed formal report and evaluation by work supervisor required. Credit/No Credit grading only. No major credit allowed; total credit limited to 24 units.

**ME 500. Individual Study. 1-3 units.**

Prerequisite: Consent of department head, graduate advisor and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition.

**ME 501. Continuum Mechanics and Elasticity. 4 units.**

Prerequisite: Graduate standing.

Introduction to continuum mechanics. Kinematics, stress, and balance laws. Constitutive theory for isotropic and anisotropic solids and viscous fluids. Applications including design of beams and pressure vessels, stress concentrations, fiber-reinforced composites, and non-homogeneous biological materials. 4 lectures. Crosslisted as CE 511/ME 501.

**ME 503. Inelastic Stress Analysis. 4 units.**

Prerequisite: ME 501 or CE 511.

Perfectly plastic and work hardening materials; von Mises and Tresca yield, isotropic and kinematic hardening flow rules, boundary-value problems. Finite elasticity: kinematics, Cauchy- and Green-elasticity, invariance, constraints, Neo-Hookean and Mooney-Rivlin materials, experimental approaches, non-uniqueness, anisotropy, residual stress, thermoelasticity, boundary-value problems. 4 lectures. Crosslisted as CE 513/ME 503.

**ME 504. Finite Element Analysis I. 4 units.**

Prerequisite: CE/ME 404 and CE 511 or ME 501 or consent of instructor.

Linear finite element theory and analysis. Strong, weak and variational formulations. Physical and isoparametric spaces. Error estimates and numerical integration. Development of finite element algorithms. Use of commercial finite element codes to illustrate course concepts including modeling issues and limitations. 3 lectures, 1 laboratory. Crosslisted as CE/ME 504.

**ME 505. Finite Element Analysis II. 4 units.**

Prerequisite: CE/ME 504.

Nonlinear and dynamic finite element theory and analysis. Variational formulations and their significance. Isoparametric formulation and numerical integration. Development of two and three-dimensional finite element algorithms. The limitations of FEA. 3 lectures, 1 laboratory. Crosslisted as CE/ME 505.

**ME 506. System Dynamics. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Unified approach for mathematical modeling and analysis of dynamic physical systems which may store energy in multiple energy domains. Emphasis on developing lumped-parameter linear system models from a set of primitive elements in a systematic manner. 4 lectures.

**ME 507. Mechanical Control System Design. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Application of principles of high-level design to mechanical control system implementation. Use of modified state transition logic in conjunction with object-oriented programming as design methodology. Real-time programming using above techniques for control of mechanical systems. 3 lectures, 1 laboratory.

**ME 517. Advanced Vibrations. 4 units.**

Prerequisite: ME 318, graduate standing or consent of instructor.

Vibration of complex engineering systems. Inertia and stiffness matrices. Natural frequencies and normal modes. Approximate solutions and computer techniques. Response to transient and periodic inputs. 3 lectures, 1 laboratory.

**ME 518. Machinery Vibration and Rotor Dynamics. 4 units.**

Prerequisite: ME 318, graduate standing or consent of instructor.

Vibrations relating to rotating machinery. Modeling of structural rotordynamic phenomena induced by shaft flexibility, bearings, and seals. Laboratory measurement of rotor system dynamic response and interpretation of machinery diagnostic information. Research project on a related topic. 3 lectures, 1 laboratory.

**ME 531. Acoustics and Noise Control. 4 units.**

Prerequisite: ME 318, MATH 344.

Description of sound using normal modes and waves. Interaction between vibrating solids and sound fields. Sound absorption in enclosed spaces. Sound transmission through barriers. Applications in acoustic enclosures, room enclosures, room acoustics. Design of quiet machinery and transducers. 3 lectures.

**ME 540. Viscous Flow. 4 units.**

Prerequisite: ME 347, MATH 344 and graduate standing or consent of instructor.

Introduction to tensor calculus and indicial notation. Development of Reynolds' Transport Theory. Special forms of the governing equations of fluid motion. Internal flows and other classical solutions to the Navier-Stokes equations. 4 lectures.

**ME 541. Advanced Thermodynamics. 4 units.**

Prerequisite: ME 303, ME 343, ME 347 and graduate standing or consent of instructor.

Selected modern applications of thermodynamics which may include topics from: 1) equilibrium and kinetics as applied to combustion and air pollution, analysis and evaluation of techniques used to predict properties of gases and liquids, and 2) improvement of modern thermodynamic cycles by second law analysis. 4 lectures.

**ME 542. Dynamics and Thermodynamics of Compressible Flow. 4 units.**

Prerequisite: ME 303, ME 343, ME 347, MATH 244, and graduate standing or consent of instructor.

Control volume analysis of fluid-thermo equations for one-dimensional, compressible flow involving area change, normal shocks, friction, and heat transfer. Two-dimensional supersonic flow including linearization, method of characteristics, and oblique shocks. One-dimensional constant area, unsteady flow, 4 lectures.

**ME 551. Mechanical Systems Analysis. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Various system modeling methods applied to mechanical systems. System stability studies and system optimization methods. 3 lectures, 1 laboratory.

**ME 552. Advanced Heat Transfer I. 4 units.**

Prerequisite: ME 343, ME 347, MATH 344, and graduate standing or consent of instructor.

Advanced principles of heat transfer. Classical solution techniques to problems in conduction and/or radiation. 4 lectures.

**ME 553. Advanced Heat Transfer II. 4 units.**

Prerequisite: ME 343, ME 347, MATH 344, and graduate standing or consent of instructor.

Advanced principles of heat transfer. Classical solution techniques to problems in convection. 4 lectures.

**ME 554. Computational Heat Transfer. 4 units.**

Prerequisite: ME 343, ME 347, MATH 418, graduate standing or consent of instructor.

Numerical solutions of classical, industrial, and experimental problems in conduction, convection, and radiation heat transfer. 3 lectures, 1 laboratory.

**ME 556. Advanced Heat Transfer III. 4 units.**

Prerequisite: ME 343, and ME 347 or FPE 502.

Advanced principles of heat transfer. Classical solution techniques to problems in radiation with applications related to the role of radiation heat transfer in the development of fire in buildings. 4 lectures. Crosslisted as FPE/ME 556.

**ME 563. Graduate Seminar. 1 unit.**

Prerequisite: Graduate standing in mechanical engineering program.

Current developments in mechanical engineering. Participation by graduate students, faculty and guests. 1 seminar.

**ME 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list topic selected. Total credit limited to 8 units; may be repeated in same term. 1-4 seminars.

**ME 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. The Schedule of Classes will list topic selected. Total credit limited to 8 units; may be repeated in same term. 1-4 laboratories.

**ME 579. Fluid Power Control. 4 units.**

Prerequisite: ME 422.

Design, analysis, and control of fluid power systems. Analysis of fluid power system components such as valves, actuators, pumps and motors. System response and stability. Dynamic modeling and computer simulation 3 lectures, 1 laboratory.

**ME 599. Design Project (Thesis). 1-9 units.**

Prerequisite: Graduate standing.

Each individual or group will be assigned a project for solution under faculty supervision as a requirement for the master's degree, culminating in a written report/thesis.

## Microbiology (MCRO)

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### Microbiology Courses

**MCRO 221. Microbiology. 4 units.**

GE Area B4; GE Area B2

Prerequisite: CHEM 110 or CHEM 111 or CHEM 124 or CHEM 127 or PSC 102.

Morphology, metabolism, classification, and identification; microbiology of air, soil, water, and foods with applications to industry, agriculture, medicine, and public health. Not open to students with credit in MCRO 224; not for credit for BIO or MCRO majors. 3 lectures, 1 laboratory. Fulfills GE B2 & B4.

**MCRO 224. General Microbiology I. 5 units.**

GE Area B4; GE Area B2

Prerequisite: BIO 161 and CHEM 111, CHEM 124 or CHEM 127.

Recommended: CHEM 128.

Microbial cellular structure and function, nutrition and growth dynamics, control of microbial growth, metabolism, genetics, and viruses. Both prokaryotic and eukaryotic microorganisms emphasized. 3 lectures, 2 laboratories. Fulfills GE B2 & B4.

**MCRO 225. General Microbiology II. 5 units.**

Prerequisite: MCRO 224.

Microbial diversity, systematics, ecology, and symbiotic relationships. Introduction to host-microorganism interactions including pathogenesis, epidemiology, and immunology. 3 lectures, 2 laboratories.

**MCRO 301. Wine Microbiology. 4 units.**

Prerequisite: MCRO majors must have MCRO 224; WVIT majors must have MCRO 221 and WVIT 202; open to MCRO or WVIT majors only.

Wine yeasts, bacteria, and molds: morphology and methods of identification; successful alcoholic and malolactic fermentations; management and prevention of unwanted microbial growth; microorganisms and flavor development. 3 lectures, 1 laboratory. Crosslisted as MCRO/WVIT 301.

**MCRO 320. Emerging Infectious Diseases. 3 units.**

Prerequisite: BIO 161; and MCRO 221 or MCRO 224.

Recent outbreaks of human diseases, interrelationships between infectious disease agents, human biology, and the environment. Infectious agents and disease processes, virulence mechanisms, and host immune response. Clinical approaches and surveillance methods to detect, investigate, and monitor emerging pathogens. Factors involved in the accelerating emergence of diseases and bioterrorist agents. 3 lectures.

**MCRO 342. Sanitary Microbiology. 4 units.**

Prerequisite: MCRO 221 or MCRO 224.

Principles of disease prevention and control. Water-, food-, and air-borne microbial contaminations and epidemiology of ensuing diseases. 3 lectures, 1 laboratory.

**MCRO 402. General Virology. 4 units.**

Prerequisite: BIO 351 or CHEM 373, or graduate standing in Biological Sciences. Recommended: BIO 452.

Infective macromolecules (prions, viroids, and viruses) associated with microbes, plants, and animals. Epidemiology, immune responses, pathogenicity, carcinogenesis, diagnoses, vaccination, and therapy. 3 lectures, 1 laboratory.

**MCRO 421. Food Microbiology. 4 units.**

Prerequisite: MCRO 221 or MCRO 224. Recommended: CHEM 212/312.

Physiological activities of microorganisms involved in the preparation, preservation, deterioration, and toxicity of foods and related products. Detection and prevention of spoilage microorganisms and foodborne pathogens. 3 lectures, 1 laboratory.

**MCRO 423. Medical Microbiology. 5 units.**

Prerequisite: Junior standing; MCRO 225; and CHEM 216, CHEM 312 or CHEM 316; and consent of instructor.

Microorganisms as agents of disease in humans. Epidemiology, host-parasite relationships, and chemotherapy. The compromised host and opportunistic disease. Laboratory safety. Procedures for laboratory diagnosis of human diseases. Rapid miniaturized methods of identification. 3 lectures, 2 laboratories.

**MCRO 424. Microbial Physiology. 5 units.**

Prerequisite: MCRO 225 and CHEM 313 or CHEM 371, or graduate standing in Biological Sciences.

Cellular structure and life processes of bacteria; chemical composition, growth, and metabolism. General biological and evolutionary considerations. 3 lectures, 2 laboratories.

**MCRO 433. Microbial Biotechnology. 3 units.**

Prerequisite: MCRO 221 or MCRO 224; and BIO 303 or BIO 351 or equivalent; and CHEM 216, CHEM 312 or CHEM 316 or equivalent, or graduate standing in Biological Sciences.

Principles and methods used for production of enzymes, pharmaceuticals, chemicals, and food additives using microorganisms. Topics include screening and strain improvement, regulation of metabolite production, genetic engineering, heterologous gene expression systems, large-scale production, and intellectual property. 3 lectures.

**MCRO 436. Environmental Microbiology. 4 units.**

Prerequisite: BIO 160 and BIO 161, or MCRO 221, or MCRO 224, or graduate standing in Biological Sciences.

Ecology and interactions of microorganisms in natural environments. Fundamentals of microbial ecology, microbes and ecosystem function, and practical aspects of microbes in the environment: nutrient cycling, extreme environments, symbioses, bioremediation, biocontrol, biofuels. 2 lectures, 2 activities.

## Military Science Leadership (MSL)

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### Military Science Leadership Courses

**MSL 101. Foundation of Officership I. 1 unit.**

Prerequisite: Freshman or sophomore standing.

Introduction to issues and competencies of the Army officer profession. Emphasis on stereotypes about the military, the role of the Army officer, customs and traditions within the military, and personal and physical development. 1 lecture.

**MSL 102. Foundation of Officership II. 1 unit.**

Prerequisite: Freshman or sophomore standing.

The role of leadership within a large organization. Emphasis on the definition of leadership, leadership framework, individual and organizational core values, and the moral responsibility of leadership. 1 lecture.

**MSL 103. Basic Leadership. 1 unit.**

Prerequisite: Freshman or sophomore standing.

The foundation of basic leadership fundamentals such as problem solving, communications, briefings and effective writing, techniques for improving listening and speaking skills, and an introduction to counseling. 1 lecture.

**MSL 110. Exercises in Military Leadership. 1 unit.**

CR/NC

Prerequisite: Enrollment in any MSL course or consent of department head.

Hands-on instruction on the proper execution of small-unit military operations. Incorporation of the military decision-making process in the planning, execution and conducting of a wide variety of squad, platoon and company sized missions. Credit/No Credit grading only. 1 activity.

**MSL 111. Orienteering. 2 units.**

Principles of orienteering, basic map reading and compass skills; course running techniques applied in field orienteering events. Open to all freshmen and sophomores. 1 lecture, 1 activity.

**MSL 112. The Army Physical Fitness Program. 1 unit.**

The Army Physical Fitness Program and its proper execution. Physical training to the Army standard with the goal of successfully passing the Army Physical Fitness Test. 1 laboratory.



**MSL 201. Foundations of Leadership I. 2 units.**

Prerequisite: Freshman or sophomore standing.

The development of individual leadership traits and capabilities using the Army officer as a model. The Army's problem solving methods, written and oral communications, tactics and group leadership. 2 lectures.

**MSL 202. Foundations of Leadership II. 2 units.**

Prerequisite: Freshman or sophomore standing.

The development of individual leadership traits and capabilities using the Army officer as a model. The Army's problem solving methods, tactics and group leadership. 2 lectures.

**MSL 203. Foundations of Leadership III. 2 units.**

Prerequisite: Freshman or sophomore standing.

The development of individual leadership traits and capabilities using the Army officer as a model. The Army's problem solving methods, land navigation techniques, tactics and group leadership. 2 lectures.

**MSL 212. Leader's Training Course. 1-7 units.**

One to seven units of credit may be granted depending upon successful completion of training. Five weeks of training, Fort Knox, Kentucky. Travel pay and salary provided through the Military Science Department. No obligation. LTC graduates eligible to enroll in ROTC Advanced Program.

**MSL 229. Ranger Challenge. 2 units.**

CR/NC

Selection and preparation of the Ranger Challenge Team which will represent Cal Poly in military tactical skills competition. Includes rope bridging, orienteering, weapons knowledge, hand grenade accuracy, 10K road march with equipment, first aid, marksmanship, physical fitness and tactics. Credit/No Credit grading only. 2 activities.

**MSL 240. American Military History and the Evolution of Western Warfare. 4 units.**

Comprehensive analysis of American military history from the early Anglo-French period to the end of the 20th Century. Examination of the strategies, operations and tactics of military warfare, and exploration of how social, economic, and technological factors produced the distinct patterns of war that characterize the struggles of the past two hundred plus years. Open to all students. 4 lectures.

**MSL 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**MSL 275. Challenge Course Facilitation. 2 units.**

Prerequisite: MSL 103 or RPTA 205 or RPTA 257.

Techniques and models used in challenge course leadership and facilitation. Emphasis on facilitation styles, challenge course terminology, facilitation models, safety guidelines, and industry best practices. 2 seminars. Crosslisted as MSL/RPTA 275.

**MSL 301. Tactical Leadership I. 3 units.**

Prerequisite: Completion of MSL 101, MSL 102, MSL 103, MSL 201, MSL 202, MSL 203, or completion of MSL 212, and consent of department head.

Introduction to the life of a professional Army officer. Instruction in the operational art of small-unit leadership, and the roles and responsibilities of an Army 2nd Lieutenant in preparation for attendance at the Leader Development and Assessment Course. 3 lectures.

**MSL 302. Tactical Leadership II. 3 units.**

Prerequisite: MSL 301, and consent of instructor.

Continuation of study of the life of a professional Army officer. Instruction in the operational art of small-unit leadership, and the roles and responsibilities of an Army 2nd Lieutenant in preparation for attendance at the Leader Development and Assessment Course. 3 lectures.

**MSL 303. Applied Leadership. 3 units.**

Prerequisite: MSL 301, MSL 302, and consent of instructor.

Demonstration of proficiency in leading small units. Emphasis on clear and concise oral communications, land navigation, weapons skills, and timely decision-making. Completion of training for the Leader Development and Assessment Course and preparation for attendance at the course. 3 lectures.

**MSL 310. Advanced Leadership of Military Exercises. 1 unit.**

Prerequisite: MSL 110 or consent of instructor. Recommended: MSL 203 or MSL 212.

The planning, resourcing and execution of selected Army tactical missions in a field environment, and leading all students enrolled in MSL 110. Total credit limited to 3 units. 1 activity.

**MSL 312. Leadership of the Army Physical Fitness Program. 1 unit.**

Prerequisite: MSL 112 or instructor consent. Recommended: MSL 203 or MSL 212.

The planning, resourcing and execution of the Army Physical Fitness Program, and leading all students enrolled in MSL 112. Total credit limited to 3 units. 1 laboratory.

**MSL 314. Leadership Development and Assessment Course. 6 units.**

CR/NC

Prerequisite: MSL 301, MSL 302, MSL 303, and consent of instructor.

Five week summer training program required to achieve an Army commission. Testing and training as functional Army officers and determination of potential for service. Travel pay, room and board, and salary provided by the U.S. Army. Held at Fort Lewis, Washington. Credit/No Credit grading only.

**MSL 400. Special Problems for Advanced Undergraduates. 2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**MSL 401. Developmental Leadership I. 3 units.**

Prerequisite: MSL 301, MSL 302, MSL 303 and consent of instructor.

In-depth study and analysis of the duties and responsibilities of an ethical Army officer. Emphasis on honing skills required at follow-on training. Administrative actions and self and subordinate developmental processes utilized by an Army 2nd Lieutenant. 3 lectures.

**MSL 402. Developmental Leadership II. 3 units.**

Prerequisite: MSL 401 and consent of instructor.

Continuation of MSL 401 with a focus on communications and personal development. Continuation of in-depth study and analysis of the duties and responsibilities of an ethical Army officer. Emphasis placed on honing skills required at follow-on training. Administrative actions and self and subordinate developmental processes utilized by an Army 2nd Lieutenant. 3 lectures.

**MSL 403. Adaptive Leadership. 3 units.**

Prerequisite: MSL 401 and MSL 402.

Beginning of transition from student to commissioned officer. Emphasis on expectations of an Army 2nd Lieutenant. Cultural awareness, effective command climates, terrorism and force protection in the current operational environment, and individual officer skills. 3 lectures.

**MSL 410. Administration and Evaluation of Exercises in Military Leadership. 1 unit.**

Prerequisite: MSL 303 or MSL 310. Recommended: MSL 314.

The supervision and evaluation of the organization, planning, resourcing, and execution of selected Army tactical missions, and mentoring assigned students enrolled in MSL 310. Total credit limited to 3 units. 1 activity.

**MSL 412. Administration and Evaluation of the Army Physical Fitness Program. 1 unit.**

Prerequisite: MSL 303 or MSL 312. Recommended: MSL 314.

The supervision and evaluation of the organization, planning, resourcing, and execution of the Army Physical Fitness Program, and mentoring assigned students enrolled in MSL 312. Total credit limited to 3 units. 1 laboratory.

**MSL 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

## Modern Languages and Literatures (MLL)

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### Modern Languages and Literatures Courses

**MLL 101. Elementary Modern Language I. 4 units.**

Organized group instruction arranged for students who wish to acquire basic skill in a language other than English indicated by subtitle. Language taught in its intercultural context. 3 lectures, 1 activity.

**MLL 102. Elementary Modern Language II. 4 units.**

Prerequisite: MLL 101 or consent of instructor.

Organized group instruction arranged for students who wish to acquire basic skill in a language other than English indicated by subtitle. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

**MLL 103. Elementary Modern Language III. 4 units.**

Prerequisite: MLL 102 or consent of instructor.

Organized group instruction arranged for students who wish to acquire basic skill in a language other than English indicated by subtitle. Language taught in its intercultural context. To be taken in numerical sequence. 3 lectures, 1 activity.

**MLL 200. Special Problems for Undergraduates. 1 unit.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems at the lower-division level. Total credit limited to 8 units.

**MLL 201. Intermediate Modern Language I. 4 units.**

Prerequisite: MLL 103 or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills within an intercultural context in a language other than English indicated by subtitle. To be taken in numerical sequence. 3 lectures, 1 activity. Formerly MLL 121.

**MLL 202. Intermediate Modern Language II. 4 units.**

Prerequisite: MLL 201 or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills within an intercultural context in a language other than English indicated by subtitle. To be taken in numerical sequence. 3 lectures, 1 activity. Formerly MLL 122.

**MLL 270. Language Study Abroad. 4 units.**

Prerequisite: Consent of department chair.

Acquisition of language and cultural competencies while studying abroad. Total credit limited to 12 units, with a maximum of 12 units per quarter. 3 lectures, 1 activity.

**MLL 290. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. Open to undergraduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**MLL 360. Research Methods in Modern Languages. 4 units.**

Prerequisite: Junior standing and MLL major. Recommended: SPAN 233 and SPAN 301.

Methods and techniques of doing research. Critical thinking and library research in languages other than English. Introduction to different senior project formats: scholarly essays, lesson planning, translations, creative works, community-based projects. 4 lectures.

**MLL 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units.

**MLL 460. Senior Project. 4 units.**

Prerequisite: MLL 360, advanced composition in primary and/or secondary language, senior standing and consent of instructor.

Selection and completion of a project under faculty mentorship. Projects represent individual, well-defined problems and potential solutions that reflect pertinent scholarly activity in the field of modern languages and literatures, with special emphasis in one of the languages/cultures taught in the department. Total credit limited to 4 units.

**MLL 470. Selected Advanced Topics. 4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected and language of instruction. Total credit limited to 8 units. 4 lectures.

## Music (MU)

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### Music Courses

**MU 101. Introduction to Music Theory. 4 units.**

GE Area C3

Introduction to the elements of music and their use by composers and performers. Notation of pitch and rhythm, scales, key signatures, intervals and chords. 3 lectures, 1 activity. Fulfills GE C3.

**MU 103. Music Theory I: Diatonic Materials. 4 units.**

Prerequisite: MU 101 or permission of instructor.

Introduction to species counterpoint, structure of tonality, four-part writing of root position and inverted triads, dominant seventh chord, phrase structure, harmonic progressions, harmonization of a melody and nonharmonic tones. Composition project. 4 lectures.

**MU 104. Musicianship I. 2 units.**

Prerequisite: MU 101; Music majors may be concurrently enrolled in MU 101 and MU 104.

Introductory sightsinging in the major mode; rhythmic performance and dictation in simple and compound meters; identification and performance of melodic and harmonic intervals and triads; dictation of major diatonic melodies and chord progressions using the primary triads. 2 activities.

**MU 105. Music Theory II: Chromatic Materials. 4 units.**

Prerequisite: MU 103.

Construction and resolution of diatonic seventh chords, secondary dominants, augmented sixth, and Neapolitan chords. Modal mixture and modulation to closely-related keys. Binary, ternary, and variation forms. Introduction to 18th-century counterpoint. Composition project. 4 lectures.

**MU 106. Musicianship II. 2 units.**

Prerequisite: MU 104. Corequisite: MU 103.

Sightsinging and dictation in minor mode; performance and dictation of one- and two-art rhythms in simple and compound meters syncopation; identification of compound intervals, triad inversions and cadence types; harmonic dictation using diatonic root position triads and the dominant seventh. 2 activities.

**MU 108. Musicianship III. 2 units.**

Prerequisite: MU 106.

One- and two-part sightsinging and melodic dictation; alto and tenor clefs; one- and two-part rhythmic performance and dictation including syncopation and triplets; harmonic dictation including diatonic triads in all inversions and dominant and supertonic seventh chords; identification of phrase structure. 2 activities.

**MU 114. Introduction to Composing. 4 units.**

Prerequisite: MU 101 or consent of instructor.

Fundamental concepts in music composition. Creative projects. Compositional techniques, development, and structure. Analysis of examples from the literature. 3 lectures, 1 activity.

**MU 120. Music Appreciation. 4 units.**

GE Area C3

Explores the world of music with emphasis on Western tradition. Language of music, the role of music in society. Historical context and major composers from the Middle Ages to the present. 3 lectures, 1 activity. Fulfills GE C3.

**MU 121. Introduction to Non-Western Musics. 4 units.**

Prerequisite: Music major, minor, or consent of instructor.

Survey of selected non-Western music cultures. Emphasis on listening and understanding the ensemble type, aesthetic principle, musical style, and performance practice of each. 3 lectures, 1 activity.

**MU 149. Applied Study/Technique. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance with emphasis on the technical skills needed for the performance of repertoire. Total credit limited to 3 units. The Schedule of Classes will list topic selected.

**MU 150. Applied Music. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance with emphasis on repertoire, technical skills, style, and interpretation. Total credit limited to 6 units. The Schedule of Classes will list topic selected.

**MU 151. Beginning Class Piano. 2 units.**

Beginning piano for student with no background in keyboard instruments. Includes fundamentals of notation, keyboard techniques, tone production, sightreading and facility. 1 lecture, 1 activity.

**MU 152. Elementary Class Piano. 1 unit.**

Prerequisite: MU 151 or consent of instructor; for non-music majors.

Continuation of MU 151. Piano for students with the ability to play a simple Bach or Mozart Minuet. Total credit limited to 3 units. 1 activity.

**MU 153. Intermediate Class Piano. 1 unit.**

Prerequisite: MU 152 or one year of piano instruction; for non-music majors.

Continuation of MU 152. Students are expected to play at the level of the easier Clementi Sonatinas. Total credit limited to 3 units. 1 activity.

**MU 154. Beginning Voice. 1 unit.**

Beginning study of vocal and performance technique for the untrained singer. Includes the beginning study of the vocal mechanism and the fundamentals of notation. 1 activity.

**MU 155. Beginning Guitar. 1 unit.**

Fundamentals of guitar technique and performance. Elements of classical, pop, and folk styles. Basics of staff and chord notations. No previous experience necessary. 1 activity.

**MU 161. Piano Skills I. 1 unit.**

Prerequisite: Music major and consent of instructor.

Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody, score-reading. 1 activity.

**MU 162. Piano Skills II. 1 unit.**

Prerequisite: MU 161 or consent of instructor.

Continuation of MU 161. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody, score-reading. 1 activity.

**MU 163. Piano Skills III. 1 unit.**

Prerequisite: MU 162 or consent of instructor.

Continuation of MU 162. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody, score-reading. 1 activity.

**MU 168. Piano Accompanying. 1 unit.**

Corequisite: MU 253 or piano topic in any of the following courses: MU 150, MU 250, MU 350 or MU 450; or consent of instructor.

Preparation and performance of vocal and instrumental music written with piano accompaniment. Choral rehearsal accompanist techniques. Open to students who are proficient on piano at a collegiate level. Total credit limited to 6 units. 1 activity.

**MU 170. University Jazz Band. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of music written for big band jazz. Limited to those who have had considerable experience playing musical instruments. The band performs concerts on campus and makes at least one tour annually. Total credit limited to 6 units. 1 laboratory.

**MU 171. Instrumental Ensembles. 1 unit.**

Prerequisite: Consent of instructor.

Open to qualified musicians. Rehearsal and public performances in large and small ensembles. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1 activity.

**MU 172. Wind Orchestra. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of music written for large wind band. Open to all qualified students who perform on woodwind, brass, and percussion instruments. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1 laboratory.

**MU 173. Wind Ensemble. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of music written for wind bands with limited doubling and flexible instrumentation. Open to all students who perform on woodwind, brass and percussion instruments on an advanced collegiate level. Total credit limited to 6 units. 1 laboratory.

**MU 174. Symphony Orchestra. 1 unit.**

Prerequisite: Consent of instructor, based on audition.

Preparation and performance of orchestral music including both the standard repertoire and rarely performed works. Open to all qualified students. Total credit limited to 6 units. 1 laboratory.

**MU 176. Mustang Band. 1 unit.**

Prerequisite: Consent of instructor.

Public performance of music and specially-designed shows written for marching band (woodwinds, brass, percussion, and flag team auxiliary). Limited to those students who have had marching experience with wind and percussion instruments, or flag, rifle or dance lines. Total credit limited to 6 units. 1 laboratory.

**MU 177. Chamber Winds. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of chamber music written for woodwinds, brass, or percussion. Open to all instrumentalists who have high school or college level performance experience. Total credit limited to 6 units. 1 activity.

**MU 178. Field Show Marching Skills. 1 unit.**

Study and application of advanced field show marching techniques used in performance by the Cal Poly Mustang Band and other university bands. Limited to those students who have experience performing on a wind/percussion instrument, or in a marching band flag/dance team auxiliary. Total credit limited to 6 units. 1 activity.

**MU 181. Polyphonics. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of music for mixed voices. Total credit limited to 6 units. 1 laboratory.

**MU 183. Vocal Ensemble. 1 unit.**

Prerequisite: Consent of instructor.

Open to qualified singers. Rehearsal and performance of specialized vocal music. Total credit limited to 6 units. 1 activity.

**MU 184. Music Production Workshop. 2 units.**

Prerequisite: By audition or consent of instructor.

Preparation of a musical theatre production for public presentation. Includes acting and stage management. Total credit limited to 6 units. 2 laboratories.

**MU 185. University Singers. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of music for large mixed chorus. Total credit limited to 6 units. 1 laboratory.

**MU 186. Early Music Ensemble. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of vocal and instrumental music from 1200 to 1750. Total credit limited to 6 units. 1 laboratory.

**MU 187. Vocal Jazz Ensemble. 1 unit.**

Prerequisite: Consent of instructor.

Study and performance of vocal jazz, including ensemble performance as well as solo performance and improvisation. Total credit limited to 6 units. 1 laboratory.

**MU 188. Arab Music Ensemble. 1 unit.**

Rehearsal and performance of instrumental and vocal repertoire drawn from art and popular music of wide-ranging Arabic-speaking societies and historically related cultures. Accompanying music theories, instrumental techniques, and performance practices, with presentation of seminal works in public concerts. Total credit limited to 6 units. 1 laboratory.

**MU 189. Vocal Practicum. 1 unit.**

Prerequisite: MU 150, MU 250, MU 350 or MU 450, or consent of instructor.

Study and implementation of performing techniques used by vocalists in a recital or concert setting. Total credit limited to 6 units. 1 activity.

**MU 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**MU 210. Musicianship IV. 1 unit.**

Prerequisite: MU 108. Corequisite: MU 105.

Continuation of MU 108. Sightsinging and melodic dictation using chromatic tones; rhythmic performance in changing meters; harmonic dictation including seventh chords, secondary dominants, and modulation to closely-related keys; seventh chord inversions; and aural identification of binary and ternary forms. 1 activity.

**MU 211. Musicianship V. 1 unit.**

Prerequisite: MU 210.

Continuation of MU 210. Sightsinging using chromatic tones; rhythmic performance and dictation in changing and asymmetric meters; harmonic dictation including Neapolitan triads, augmented sixth chords, modal mixture, and modulation to closely-related keys; aural identification of sonata, rondo, and variation forms. 1 activity.

**MU 212. Musicianship VI. 1 unit.**

Prerequisite: MU 211.

Continuation of MU 211. Emphasis on previously acquired skills, plus sightsinging, melodic dictation, and harmonic dictation using modulation to foreign keys; performance and dictation of cross-rhythms and complex beat divisions; tempo modulation; aural identification of contrapuntal genres; and modulatory melodic dictation in two parts. 1 activity.

**MU 221. Jazz Styles. 4 units.**

GE Area C3; USCP

Survey of Jazz as a significant American art form from 1900 to the present; its historical background and development in the United States; key elements, leading performers, and significant compositions in each style. Emphasis on listening skills. 3 lectures, 1 activity. Fulfills GE C3 and USCP.

**MU 227. Popular Music of the USA. 4 units.**

GE Area C3; USCP

Recommended: GE Area A1, GE Area A2, or GE Area A3.

Study of popular music of USA from the nineteenth century to contemporary times. Emphases include understanding of cultural identity, social diversity, musical aesthetics, and artistic significance. Investigations engage ethnic relations, gender issues, religious expression, performance practice, technological development, modernization, commodification, and political empowerment. 3 lectures, 1 activity. Fulfills GE C3 and USCP.

**MU 229. Music of the 60's: War and Peace. 4 units.**

GE Area C3; USCP

Explores wide spectrum of rock, folk and pop styles of the 60s. Relates music to social turmoil and historical trends, including Vietnam War, Civil Rights Movement, American Indian Movement, Chicano Movement, Free Speech Movement. 3 lectures, 1 activity. Fulfills GE C3 and USCP.

**MU 249. Applied Study/Technique. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance with emphasis on the technical skills needed for the performance of repertoire. Total credit limited to 3 units.

**MU 250. Applied Music. 1 unit.**

Prerequisite: 3 units of MU 150 and consent of instructor.

Individual instruction in performance with emphasis on repertoire, technical skills, style, and interpretation. Total credit limited to 6 units. Specific areas of study are listed in the Class Schedule.

**MU 251. Diction for Singers. 1 unit.**

Prerequisite: Consent of instructor.

The study of diction as it applies to singing in English, French, German, Italian, Spanish and the International Phonetic Alphabet. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1 activity.

**MU 252. Intermediate Voice. 1 unit.**

Prerequisite: MU 154 or consent of instructor.

Vocal and performance technique for experienced singers. Total credit limited to 3 units. 1 activity.

**MU 253. Advanced Class Piano. 1 unit.**

Prerequisite: MU 153 or consent of instructor; for non-music majors.

Advanced level piano techniques with emphasis on style, interpretation, sightreading, basic performance practices and the solution to general musical problems. Total credit limited to 3 units. 1 activity.

**MU 255. Intermediate Guitar. 1 unit.**

Prerequisite: MU 155 or consent of instructor.

Development of intermediate guitar techniques and performance. Elements of classical, pop, and folk styles. Intermediate skills, reading notes and chord charts. 1 activity.



**MU 259. Beginning Jazz Improvisation. 2 units.**

Prerequisite: Facility on a musical instrument or singing ability; MU 101 or consent of instructor.

Development of fundamentals of jazz improvisation including scales, arpeggios, patterns, swing feel, expressiveness, and motifs through in-class performance of written materials and improvisations with play-along recordings. Total credit limited to 6 units. 2 activities.

**MU 261. Piano Skills IV. 1 unit.**

Prerequisite: MU 163 or consent of instructor.

Continuation of MU 163. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, and improvisation of a melody, score-reading. 1 activity.

**MU 262. Piano Skills V. 1 unit.**

Prerequisite: MU 261 or consent of instructor.

Continuation of MU 261. Preparation for Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody, score-reading. 1 activity.

**MU 263. Piano Skills VI. 1 unit.**

Prerequisite: MU 262 or consent of instructor.

Continuation of MU 262. Completion of this course with a C- or better represents fulfillment of the Piano Proficiency Examination. Study of piano repertoire, sightreading, transposition, harmonization of a melody, accompanying, improvisation of a melody, score-reading. 1 activity.

**MU 265. Accelerated Piano Skills. 1 unit.**

Prerequisite: Music major and consent of instructor.

Preparation for Piano Proficiency Examination. For students with an extensive piano repertoire background but needing focused preparation in sightreading, transposition, harmonization of a melody, accompanying, and score reading. Total credit limited to 3 units. 1 activity.

**MU 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**MU 301. Counterpoint. 4 units.**

Prerequisite: MU 105.

Counterpoint as a compositional technique. Modal, tonal, and post-tonal practices. Composition project. 4 lectures.

**MU 303. Music Theory III: Advanced Chromaticism. 4 units.**

Prerequisite: MU 105.

Compositional procedures employed by composers of the Classical and Romantic periods. Chromatic third-related harmony, linear chromaticism, and extended tertian chords. Chromatic and enharmonic modulation to distantly-related keys. Sonata and rondo forms. Composition project. 4 lectures.

**MU 305. Music Theory IV: Contemporary Practices. 4 units.**

Prerequisite: MU 303 or permission of instructor.

Examination of 20th- and 21st-century compositional practices including impressionism, developments in rhythm, polytonality, non-serial atonality, serialism, timbre and form, neoclassicism, minimalism, and the new eclecticism. Analysis and creative projects. 4 lectures.

**MU 311. Sound Design: Technologies. 4 units.**

Prerequisite: MU 101, MU 120 or consent of instructor.

Fundamental tools of electroacoustic sound design. Concepts and application of music studio procedure, recording, synthesis, and MIDI. Studio projects. 3 lectures, 1 activity.

**MU 312. Sound Design: Recording. 4 units.**

Prerequisite: MU 311 or permission of instructor.

Exploring creative use of recording technology. Analog and digital equipment for recording music. Analysis and creative projects. 3 lectures, 1 activity.

**MU 320. Music Research and Writing. 4 units.**

Prerequisite: MU 105 and ENGL 134 or permission of instructor. Recommended: MU 120.

Methodology for researching, analyzing, and writing about music. Exploration of investigative tools including library resources, periodicals, bibliographic tools, computerized search methods. Performance practice. 4 lectures.

**MU 324. Music and Society. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and a foundation course in Area C. Recommended: Junior standing.

Exploration into the role of music historically and culturally. Emphasis on deeper understanding and appreciation of the context of music through topics of special interest. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 activity. Fulfills GE C4 except for Music majors.

**MU 325. America's Music. 4 units.**

USCP

Prerequisite: MU 105. Recommended: MU 120.

Explorations of the many styles of America's music through lectures, readings, sound recordings, musical scores, and performance. Includes 'Native American,' 'folk,' 'popular,' and 'fine art' traditions. How American music reflects the different cultural heritages, social contexts, and philosophies of its creators. 4 lectures. Fulfills USCP.

**MU 326. Cultural Concepts and Structures in Music. 4 units.**

Prerequisite: MU 121 or consent of instructor.

Exploring the definition, concepts, and structures of music in terms of theory, performance practice, and compositional procedures of selected non-Western cultures. 3 lectures, 1 activity.

**MU 328. Women in Music. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Area A and a foundation course in Area C. Recommended: Junior standing.

Survey of women's contributions as composers and performers of western art and popular music; historical overview of the experiences and perception of women as musicians. 3 lectures, 1 activity. Fulfills GE C4 except for Music majors.

**MU 331. Music of the Middle Ages and Renaissance. 4 units.**

Prerequisite: MU 320 or consent of instructor. Recommended: MU 120.

Musical literature, styles, composers, theory, genres and notation of the Middle Ages and Renaissance. Relationship to historical trends. 4 lectures.

**MU 332. Music of the Baroque and Early Classic Eras. 4 units.**

Prerequisite: MU 320 or consent of instructor. Recommended: MU 120.

Survey of the history of western art music from 1600 to 1780. 4 lectures.

**MU 336. Jazz History and Theory. 4 units.**

Prerequisite: MU 105.

Survey of Jazz theoretical techniques. Emphasis upon historical context and development of Jazz through study and analysis of scores and historical performances. 4 lectures.

**MU 340. Conducting: Fundamentals. 2 units.**

Prerequisite: MU 105 or consent of instructor.

Principles and techniques of conducting with experience in score reading. 2 activities.

**MU 341. Conducting: Choral. 2 units.**

Prerequisite: MU 340.

Continuation of MU 340. Emphasis on choral literature. Score reading, rehearsal techniques, and musical details associated with vocal music. 2 activities.

**MU 342. Conducting: Instrumental. 2 units.**

Prerequisite: MU 340 and MU 341.

Continuation of MU 340. Emphasis on band and orchestra literature. Score reading, rehearsal techniques, and musical details associated with instrumental music. 2 activities.

**MU 349. Applied Study/Technique. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance with emphasis on the technical skills needed for the performance of repertoire. Total credit limited to 3 units. The Schedule of Classes will list topic selected.

**MU 350. Applied Music. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance and composition. Total credit limited to 6 units. Specific areas of study are listed in the Class Schedule.

**MU 351. Jazz and Popular Music Arranging. 2 units.**

Prerequisite: MU 105.

Arranging for small and large jazz ensembles. Score and part preparation. 2 activities.

**MU 352. Orchestration. 4 units.**

Prerequisite: MU 105.

Ranges, transposition, technical capabilities, and scoring of vocal ensembles, band, and orchestra instruments. Creative project. 3 lectures, 1 activity.

**MU 360. Music for Classroom Teachers. 4 units.**

Prerequisite: MU 101.

Development of skills for fostering creative music experiences in the classroom. Exploration of various approaches to motivating children musically. Study of folk songs for singing, playing instruments, and learning about music as well as for their ethnic and cultural significance. 3 lectures, 1 activity.

**MU 361. Instruments. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Fundamentals of playing and teaching woodwind, brass, string, and percussion instruments. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1 activity.

**MU 366. Piano Pedagogy. 2 units.**

Prerequisite: MU 207 or consent of instructor.

Survey of elementary, intermediate and advanced teaching methods and literature; private and group instruction; studio policies. 2 activities.

**MU 368. Piano Accompanying. 1 unit.**

Prerequisite: Junior standing and MU 168 or consent of instructor.

Preparation and performance of vocal and instrumental music written with piano accompaniment. Choral rehearsal accompanist techniques. Open to students who are proficient on piano at a collegiate level. Total credit limited to 6 units. 1 activity.

**MU 370. University Jazz Band. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Study and public performance of music written for big band jazz. Limited to those who have had considerable experience playing musical instruments. The band performs concerts on campus and makes at least one tour annually. Total credit limited to 6 units. 1 laboratory.

**MU 371. Instrumental Ensemble. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Open to qualified musicians. Rehearsal and public performance in large and small ensembles. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1 activity.

**MU 372. Wind Orchestra. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Study and public performance of music written for large wind band. Open to all qualified students who perform on woodwind, brass and percussion instruments. The Schedule of Classes will list topic selected. Total credit limited to 6 units. 1 laboratory.

**MU 373. Wind Ensemble. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Study and public performance of music written for wind band with limited doubling and flexible instrumentation. Open to all students who perform on woodwind, brass and percussion instruments on an advanced collegiate level. Total credit limited to 6 units. 1 laboratory.

**MU 374. Symphony Orchestra. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Preparation and performance of orchestral music including both the standard repertoire and rarely performed works. Open to all students whose technique is adequate. Total credit limited to 6 units. 1 laboratory.

**MU 376. Mustang Band. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Public performance of music and specially-designed shows written for marching band (woodwinds, brass, percussion, and flag team auxiliary). Limited to those students who have had marching experience with wind and percussion instruments, or flag, rifle or dance lines. Total credit limited to 6 units. 1 laboratory.

**MU 377. Chamber Winds. 1 unit.**

Prerequisite: Consent of instructor.

Study and public performance of chamber music written for woodwinds, brass, or percussion. Open to all instrumentalists who have college level performance experience. Total credit limited to 6 units. 1 activity.

**MU 378. Field Show Marching Skills. 1 unit.**

Prerequisite: MU 178 or consent of instructor.

Study and application of advanced field show marching techniques used in performance by the Cal Poly Mustang Band and other university bands. Limited to those students who have experience performing on a wind/percussion instrument, or in a marching band flag/dance team auxiliary. Total credit limited to 6 units. 1 activity.

**MU 381. Polyphonics. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Study and public performance of music for mixed voices. Total credit limited to 6 units. 1 laboratory.

**MU 383. Vocal Ensemble. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Open to qualified singers. Rehearsal and performance of specialized vocal music. Total credit limited to 6 units. 1 activity.

**MU 384. Music Production Workshop. 2 units.**

Prerequisite: Junior standing and by audition, or consent of instructor.

Preparation of a musical theatre production for public presentation, including acting and stage management. Total credit limited to 6 units. 2 laboratories.

**MU 385. University Singers. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Study and public performance of music for large mixed chorus. Total credit limited to 6 units. 1 laboratory.

**MU 386. Early Music Ensemble. 1 unit.**

Prerequisite: Consent of instructor; junior standing.

Study and public performance of vocal and instrumental music from 1200 to 1750. Total credit limited to 6 units. 1 laboratory.

**MU 387. Vocal Jazz Ensemble. 1 unit.**

Prerequisite: Junior standing and consent of instructor.

Study and performance of vocal jazz, including ensemble performance as well as solo performance and improvisation. Total credit limited to 6 units. 1 laboratory.

**MU 388. Arab Music Ensemble. 1 unit.**

Prerequisite: MU 188 or consent of instructor.

Rehearsal and performance of instrumental and vocal repertoire drawn from art and popular music of wide-ranging Arabic-speaking societies and historically related cultures. Accompanying music theories, instrumental techniques, and performance practices, with presentation of seminal works in public concerts. Total credit limited to 6 units. 1 laboratory.

**MU 389. Vocal Practicum. 1 unit.**

Prerequisite: MU 150, MU 250, MU 350 or MU 450, or consent of instructor.

Study and implementation of performing techniques used by vocalists in a recital or concert setting. Total credit limited to 6 units. 1 activity.

**MU 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Junior standing and consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**MU 411. Sound Design: Synthesis. 4 units.**

Prerequisite: MU 312.

Compositional application of sound synthesis techniques. Realization of computer music. Creative projects. 3 lectures, 1 activity.

**MU 412. Sound Design: Composition and Production. 4 units.**

Prerequisite: MU 312.

Production of electroacoustic music in media. Program analysis, technical planning, composition, and product development. 3 lectures, 1 activity.

**MU 431. Music of the Classic and Romantic Eras. 4 units.**

Prerequisite: MU 303 and MU 320; Recommended: MU 120; or consent of instructor.

Survey of the history of western art music from 1780 to 1900. 4 lectures.

**MU 432. Music of the Modern Era. 4 units.**

Prerequisite: MU 303 and MU 320 or consent of instructor.  
Recommended: MU 305.

Composers, important works, and significant trends in the Western European and American classical tradition during the 20th and 21st Centuries. 4 lectures.

**MU 449. Applied Study/Technique. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance with emphasis on the technical skills needed for the performance of repertoire. Total credit limited to 3 units. The Schedule of Classes will list topic selected.

**MU 450. Applied Music. 1 unit.**

Prerequisite: Consent of instructor.

Individual instruction in performance and composition. Total credit limited to 6 units. Specific areas of study are listed in the Class Schedule.

**MU 461. Senior Project. 3 units.**

Prerequisite: Senior standing and consent of department head.

Selection and completion of a project under faculty supervision. Minimum of 90 hours total time. Results presented in a recital, creative work, formal report, or a combination of all three.

**MU 465. Choral Literature and Rehearsal Techniques. 4 units.**

Prerequisite: MU 341, or consent of instructor.

Survey of choral literature especially suited for secondary schools. Philosophy and strategy for developing a school program. Musical as well as non-musical techniques for effective rehearsal. 3 lectures, 1 activity.

**MU 466. Instrumental Literature and Rehearsal Techniques. 4 units.**

Prerequisite: MU 342.

Survey of literature written for solo instrument, chamber, and large ensembles. Philosophy and strategy for developing an instrumental music program. Musical as well as non-musical techniques for effective rehearsal. 3 seminars, 1 activity.

**MU 470. Music History: Selected Advanced Topics. 4 units.**

Prerequisite: MU 331, MU 332, MU 431, MU 432, or consent of instructor.

Intensive study of selected topics in music history through the use of readings, recordings, scores, and class presentations. The Schedule of Classes will list topics selected. Total credit limited to 8 units. 3 lectures, 1 activity.

## Natural Resources (NR)

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### Natural Resources Courses

**NR 140. Careers in Forestry and Environmental Management. 1 unit.**

CR/NC

Analysis and development of career goals in natural resources. Acquainting students with potential career options and preparation of academic plans at Cal Poly. Credit/No Credit grading. 1 activity.

**NR 141. Introduction to Forest Ecosystem Management. 3 units.**

Recommended: NR 140.

Fundamentals of forestry including basic silviculture, forest protection, measurement and policy. Integrated resource management of forest lands for water production, forage, recreation, wildlife, and timber. 3 lectures.

**NR 142. Environmental Management. 3 units.**

Recommended: NR 140.

Environmental management as a process within functioning societies seeking a harmonious balance between human activities and intrinsic behavior of the natural environment. Major components of the natural environment and the political and social activities that impact that environment. 3 lectures.

**NR 203. Resource Law Enforcement. 3 units.**

Law enforcement applied to natural resource conservation on public and private lands. Examination of state and federal laws related to fish and wildlife management. Problems associated with implementation of resource laws examined. 3 lectures. Crosslisted as NR/RPTA 203.

**NR 204. Wildland Fire Control. 3 units.**

Fire control techniques used on various wildland fuels. Elementary fire physics, fuels, weather, fire behavior, tactics and fire suppression techniques, line construction, 'mop-up', fire line safety, air operations and fire organization. Meets basic wildland fire fighter certification requirements for the USDA Forest Service. Partially meets California Department of Forestry Firefighter I requirements. 2 lectures, 1 laboratory.

**NR 208. Dendrology. 4 units.**

Recommended: BOT 121.

Identification, classification, silvical characteristics, distribution, environmental requirements and economic importance of woody plants in shrub, woodland, and forest ecosystems of the United States. Emphasis on species located in the Pacific Coastal, Sierran, and Cascade ecosystems. 2 lectures, 2 laboratories.

**NR 215. Land and Resource Measurements. 2 units.**

Introduction to land and resource measurement technology and methods - field instruments, property description, map and photograph reconciliation, data accuracy and precision. Trigonometric functions and fundamental identities especially as applied to natural resources applications. Course may be offered at Swanton Pacific Ranch during week prior to beginning of fall quarter, or weekend field trips. 1 lecture, 1 laboratory.

**NR 218. Applications in GIS. 3 units.**

ARC/INFO and ArcView Geographic Information System (GIS) computer software to explore environmental, natural resource, social and economic issues using spatial data. Develop and apply data base and software management competencies. 1 lecture, 2 laboratories. Crosslisted as LA/NR 218. Formerly LA/NR 318.

**NR 247. Forest Surveying. 2 units.**

Prerequisite: NR 215.

Use and care of tapes, staff compass, abney levels, total stations, and GPS receivers. Keeping field notes, measurements by tape. Closed and open traverse by compass and total stations. Turning angles and determining directions of lines. Map reading and public land description. GPS measurements. Weekend field trips required. 1 lecture, 1 laboratory. Crosslisted as BRAE/NR 247.

**NR 260. Forest Practices and Environmental Protection. 4 units.**

Recommended: NR 141, NR 247.

Relationships between forest ecosystem management, forest practices, harvesting methods, timber harvest planning, components of forest harvesting, harvesting effects; cost analysis of harvesting methods; safety management; value-added forest utilization; environmental protection; and road location. Overnight or weekend field trips required. 3 lectures, 1 laboratory.

**NR 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**NR 290. Intercollegiate Forestry Activities. 1 unit.**

CR/NC

Prerequisite: Enrollment limited to those qualified to compete in intercollegiate forestry activities and consent of instructor.

Beginning through advanced skills in the event areas of college forestry activities. Instruction in use of specialized equipment and safety. Minimum of 4 hours of laboratory per week. Total credit limited to 18 units. Credit/No Credit grading only.

**NR 306. Natural Resource Ecology and Habitat Management. 4 units.**

Prerequisite: Completion of GE Areas B2 and B4.

Resource ecology and management implications in the major ecosystems of North America. Importance of maintaining the natural dynamics of energy flow and nutrient cycles at the community and ecosystem level to sustain uses and values. Humanity's role as a principal factor of change of the resources in natural systems. 3 lectures, 1 laboratory.

**NR 307. Fire Ecology. 3 units.**

Prerequisite: Completion of GE Areas B2 and B4.

Effects of wildland fires on shrub, woodland, and forest environments to include fuels, plants, soil, water, wildlife, and air. Emphasis on western U.S. forest and shrub ecosystems. 2 lectures, 1 laboratory.

**NR 308. Fire and Society. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A3 and one lower division course in GE Area D.

Prehistorical and historical record of human use of and attitude toward fire. Mythology and religion of fire. Traditional, cultural and ethnic variations and their influence on modern U.S. institutions involved in managing fire. 3 lectures, 1 activity. Crosslisted as ES/NR 308. Fulfills GE D5 except for Comparative Ethnic Studies majors.

**NR 311. Environmental Measurements and Interpretation. 4 units.**

Prerequisite: NR 306 or BIO 325.

Measurement and interpretation of the biological, physical and social values of the natural elements of our environment; organization and presentation of interpretive materials by oral and written communication. 3 lectures, 1 laboratory.

**NR 312. Technology of Wildland Fire Management. 4 units.**

GE Area F

Prerequisite: Completion of GE Area B2 or B3.

Models and technology to solve complex land management problems. Historic, current and future perspectives of wildland fire in California. Sustainability and ecosystem health. Assumptions and limitations of fire behavior and suppression models. 3 lectures, 1 activity. Fulfills GE Area F.

**NR 315. Measurements and Sampling in Forested Environments. 4 units.**

Prerequisite: STAT 217/218, BRAE/NR 247. Recommended: MATH 161 or MATH 221 or equivalent.

Principles and methods of sampling and measurement for forest and natural resource quantities and qualities. Modeling and estimation for tree volumes, stand structure and composition, and related forest vegetation. Applications in sampling, statistical and inventory techniques. 2 lectures, 2 laboratories. Overnight, weekend field laboratories required.

**NR 317. The World of Spatial Data and Geographic Information Technology. 4 units.**

GE Area F

Prerequisite: Completion of GE Area B2.

Basic foundation for understanding the world through geographic information and tools available to utilize spatial data. Application of Geographic Information Systems (GIS) and related technologies, including their scientific basis of operation. Not open to students with credit in LA/NR 218. 3 lectures, 1 activity. Crosslisted as GEOG/LA/NR 317. Fulfills GE Area F.

**NR 319. Natural Resource Ecology, Theories and Applications. 4 units.**

GE Area B5

Prerequisite: Completion of GE Area B2.

Scope and nature of 'ecology' in modern society, including resource terminology and classifications systems; dynamics of natural systems (energy exchange and cycles); man's role as a principle agent of change; environmental impacts; historical perspective including people (ethnicity); and the future environment. 3 lectures, 1 laboratory. Crosslisted as HNRS/NR 319. Fulfills GE B5.

**NR 320. Watershed Management and Restoration. 4 units.**

Prerequisite: SS 121 and NR/LA 218. Recommended: NR 306.

Hydrologic cycle concepts and measurement. Analysis and measurement of watershed processes. Watershed management including restoration, erosion, and review of forest practice rules. Saturday and/or weekend field trip required. 3 lectures, 1 laboratory.

**NR 321. Water Systems Technology, Issues and Impacts. 4 units.**

GE Area F

Prerequisite: Completion of GE Area B2.

Sustainable strategies and technologies to enhance freshwater supplies and marine habitats. Systems treated include artificial wetlands, stormwater, drinking water, agricultural and industrial waste water. 3 lectures, 1 activity. Fulfills GE Area F.

**NR 323. Human Dimensions in Natural Resources Management. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A3 and D1.

Social, economic, political and ecological conditions and institutions that influence decisions affecting the environment; examination of human-caused environmental impacts and how they in turn influence social institutions. 4 lectures. Fulfills GE D5 except for Forestry and Natural Resources majors.



**NR 326. Natural Resources Economics and Valuation. 4 units.**

Prerequisite: MATH 161 or MATH 221 or equivalent. Recommended: GE Area D2 (ECON 201 recommended), AGB 212.

Theory of efficient use of renewable and nonrenewable natural resources, including methods for attaching value to marketable and non-market natural resources. Environmental economic theories and techniques to address allocation of water, timber, wildlife/fisheries, open space, and recreation. 3 lectures, 1 activity.

**NR 335. Conflict Management in Natural Resources. 4 units.**

Prerequisite: NR 141 or NR 142. Recommended: PSY 201 or PSY 202.

Application of behavioral science principles and techniques in the management of natural resource systems. Management of internal and external human resource issues and concerns in natural resources organizations is emphasized. 3 lectures, 1 laboratory.

**NR 339. Internship in Forest and Natural Resources. 1-12 units.**

CR/NC

Prerequisite: Consent of instructor.

Selected students will spend up to 12 weeks with an approved firm or agency engaged in forest or natural resources management. Applying and developing managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Credit/No Credit grading.

**NR 340. Wildland Fire Management. 3 units.**

Prerequisite: NR 204.

Wildland fuels, fire weather, and fire danger ratings in chaparral, grassland, and forested areas. Advanced modeling of surface and crown fire behavior. Fire management strategies and implications, policies and objectives of fire management organizations. Saturday field trips may be required. 3 lectures.

**NR 350. Urban Forestry. 3 units.**

Prerequisite: NR 208 or consent of instructor.

Establishment and management of municipal forests, wildland-urban interface, wildlife habitat, and pollution abatement. Management of forest areas requiring special attention because of heavy recreational use, fire hazard, watershed, and societal values. Full-day field trips may be required. 2 lectures, 1 laboratory.

**NR 351. Introduction to Emergency Management in California. 3 units.**

Prerequisite: Completion of GE Area B3 or D.

Emergency management emphasizing the Standardized Emergency Management System (SEMS) and Emergency Operations Center (EOC) operations. Earthquake hazard used as the case to explore potential wide geographic impacts, multiple secondary hazards, and multidisciplinary problem-solving methods in natural disasters faced by local governments and communities. 2 lectures, 1 activity. Crosslisted as CRP/DMHS/NR 351.

**NR 352. Terrorism: Understanding the Threat. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Theories, procedures, and practices to prepare field responders, first level governmental supervisors and managers in appropriate local emergency operations centers' response to a terrorist incident. 2 lectures, 1 activity. Crosslisted as DMHS/NR 352.

**NR 353. Introduction to Crisis Communications and the Media. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Theories, practices and procedures to educate public and private officials on methods and practices used to communicate with the media in time of local or national disasters or crises. 2 lectures, 1 activity. Crosslisted as DMHS/NR 353.

**NR 360. Ethnicity and the Land. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Area A and one lower division course in Area C. Recommended: One lower division Ethnic Studies course and an introductory natural resources course; junior standing.

Comparative study of how race and culture shape landscapes, and how social hierarchies allocate the use of natural resources and the burdens of environmental pollution. 4 lectures. Crosslisted as ES/NR 360. Fulfills GE C4 except for Comparative Ethnic Studies majors. Fulfills USCP.

**NR 365. Silviculture and Vegetation Management. 4 units.**

Prerequisite: NR 208 and NR 315.

Applied forest ecology and prescriptions for achieving forest ecosystem management; dynamic relations among trees, biological communities, environmental factors, and land use. Vegetation manipulation and reforestation methods. Overnight and/or weekend field trips required. 3 lectures, 1 laboratory.

**NR 400. Special Problems for Advanced Undergraduates. 2-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units.

**NR 401. Disaster Recovery. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Strategies and procedures for public sector management of recovery from disasters. Understanding the role of, and relationship between, federal, state and local agencies to provide assistance to individuals and communities in the post-disaster environment. Issues in the recovery process. 2 lectures, 1 activity. Crosslisted as CRP/DMHS/NR 401.

**NR 402. Forest Health. 4 units.**

Prerequisite: NR 208, and NR 306 or BIO 325, or consent of instructor.

Impact and losses to forested areas caused by physical and biotic agents (such as insects and diseases) other than fire; relation of direct and indirect control practices to forest management. Saturday field trips required. 3 lectures, 1 laboratory.

**NR 404. Environmental Law. 3 units.**

Prerequisite: Junior standing.

Detailed examination of the law governing use and protection of natural resources with focus on the legal institutions entrusted with the public duty of protecting the environment. 3 lectures. Crosslisted as CRP/NR 404.

**NR 405. Managing Sustained Operations. 3 units.**

Prerequisite: CRP/DMHS/NR 351.

Methods and techniques for managing Emergency Management Operations Centers in order to ensure support to local government efforts in rebuilding after a disaster. 2 lectures, 1 activity. Crosslisted as DMHS/NR 405.

**NR 406. Indigenous Peoples and International Law and Policy. 4 units.**

Prerequisite: ES 241; and NR 141 or NR 142; and junior standing required.

Interdisciplinary examination of the evolution of international law effecting indigenous peoples in the U.S. and in the Americas. Development of international legal and sociological norms and their impact on human rights of indigenous peoples with particular attention to environmental issues. 4 lectures. Crosslisted as ES/NR 406.

**NR 408. Water Resource Law and Policy. 3 units.**

Prerequisite: Junior standing.

Detailed examination of the various legal systems of water use, regulation and management in California and the United States. Discussion on the key concepts and principles of state, federal and interstate water quantity and quality control; focusing on issues and problems, why conflicts occur and how solutions evolve. 3 lectures. Crosslisted as CRP/NR 408.

**NR 412. Senior Assessment Project. 3 units.**

Prerequisite: NR 326 and completion of GE Area A3 or consent of instructor.

Principles and practices of integrated sampling and inventory of natural resource values in terrestrial ecosystems, culminating in a student project report. 2 lectures, 1 laboratory.

**NR 414. Sustainable Forest Management. 4 units.**

Prerequisite: NR 326, NR 365.

Biophysical, economic, social and political influences on optimal forest management for purposes of providing sustained yields of goods and services. Growth and yield modeling; forest investment analysis; sustainable forest production; harvest schedule modeling. Day field trip required. 3 lectures, 1 laboratory.

**NR 416. Environmental Impact Analysis and Management. 4 units.**

Prerequisite: NR 306 or BIO 325 or equivalent, and NR 335 or consent of instructor.

National Environmental Policy and California Environmental Quality Acts as applied to environmental and natural resource management problems and projects. Intent, purpose and history of the laws; differences between laws identified. Request for proposals and preparation of environmental assessment documents covered. 3 lectures, 1 laboratory.

**NR 418. Applied GIS. 3 units.**

Prerequisite: NR/LA 318.

Acquisition, organization and analysis of spatial data from diverse sources using Geographic Information System (GIS) software. GIS modeling applications and validation techniques used in development and preparation of client-driven projects. 1 lecture, 2 activities.

**NR 420. Advanced Watershed Hydrology. 4 units.**

Prerequisite: NR 320 or equivalent or graduate standing.

Sources of streamflow and processes by which watersheds undergo change from natural and anthropogenic processes. Fluvial processes, sediment transport and channel restoration techniques. Influences of forest and range management on water resources including water quality and analytical techniques. Weekend field trips required. 3 lectures, 1 laboratory.

**NR 421. Wetlands. 4 units.**

Prerequisite: BOT 121 or BIO 162, CHEM 111 or CHEM 127, and SS 121 or SS 131. Recommended: BOT 313, NR 306 or BIO 325.

The formation, characteristics, and functions of wetlands. Genesis of hydric soils. Plant adaptations to saturated soils. Wetlands as wildlife habitat. Policies and social issues associated with wetlands. The procedures of wetland delineations. 3 lectures, 1 laboratory. Crosslisted as BIO/NR/SS 421.

**NR 425. Applied Resource Analysis and Assessment. 4 units.**

Prerequisite: NR 416.

Environmental impacts in responses to resource management, projects, programs and activities. Preparation, implementation, and coordination of environmental plans. Criteria for measurements, interpretation, and evaluation. Resource inventories, analysis, evaluation, synthesis, environmental assessment writing and preparation. 3 lectures, 1 laboratory.

**NR 432. Disaster Operations Planning. 3 units.**

Prerequisite: NR/CRP/DMHS 351.

Developing emergency operations plans in support of the local, state and federal emergency management community needs. Major aspects and necessary elements of emergency planning required in a multi-hazard emergency operations plan. 3 lectures. Crosslisted as DMHS/NR 432.

**NR 434. Wood Properties, Products and Sustainable Uses. 4 units.**

Prerequisite: Completion of GE Area B.

Principles of wood properties, green building practices, sustainable and efficient use of renewable wood resources including methods for using wood as an energy source. Field trips required. 3 lectures, 1 laboratory.

**NR 435. Natural Resource Policy Analysis. 4 units.**

Prerequisite: NR 326. Recommended: NR 335.

Policy process approach to understanding the efforts to resolve natural resource problems in the public and private sector. Principles and techniques used to analyze the effects of environmental policies. Analysis of major federal and state environmental laws. 4 lectures.

**NR 450. Community Forestry. 3 units.**

Prerequisite: NR 208 or consent of instructor.

Development and management of the urban/wildland interface. Socio-economic problems related to forest tree establishment, care, and removal utilization. International implications also covered. Weekend or full-day field trips required. 2 seminars, 1 laboratory.

**NR 455. Wildland-Urban Fire Protection. 4 units.**

Prerequisite: NR 340.

Biophysical and socioeconomic issues affecting wildland fire management in urbanized landscapes. Fire risk assessment. Pre-fire prevention, mitigation, and preparedness, during-fire response, and post-fire recovery actions by public- and private-sector agencies and residents. 3 lectures, 1 laboratory.

**NR 461. Senior Project I. 3 units.**

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 180 hours total time.

**NR 462. Senior Project II. 3 units.**

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 90 hours total time.

**NR 465. Ecosystem Management. 4 units.**

Prerequisite: NR 326 and NR 416 or consent of instructor.

Capstone course that integrates biophysical, economic and socio-political sciences. Principles, concepts and techniques designed to utilize resources while sustaining ecosystem health within acceptable limits of change. Ecosystem assessment, planning, management and monitoring project. 3 lectures, 1 laboratory.

**NR 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**NR 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Junior standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**NR 472. Leadership Practice. 1 unit.**

Prerequisite: Junior standing or consent of instructor.

Leadership styles used in the natural resources management and recreation administration professions. Study and practice in setting goals and objectives; developing, evaluating and implementing an entrepreneurial project plan; decision making and problem-solving. Total credit limited to 4 units. 1 laboratory. Crosslisted as NR/RPTA 472.

**NR 475. Sustainable Forest and Environmental Practices. 12 units.**

Prerequisite: Completion of GE Area B and consent of instructor.

Recommended: Junior or senior standing.

Typical modules related to sustainable forest management, ecosystem sampling and inventory methods, photo interpretation, hydrologic resources, road condition, project impact analysis, best management practices. Topics covered vary from term to term depending on the priority for learning modules. Residency at Swanton Pacific and extended field trips required. 8 lectures, 4 activities. Crosslisted as HNRS/NR 475.

**NR 500. Individual Study. 1-3 units.**

Prerequisite: Consent of instructor.

Advanced independent study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Total credit limited to 4 units.

**NR 502. Resource Conservation. 3 units.**

Prerequisite: Consent of instructor.

Conservation, planning and administration for broad treatment of land, water, mineral, forest, range, and wildlife resources. 3 seminars.

**NR 503. Tropical Forest Ecosystem. 3 units.**

Prerequisite: Consent of instructor.

Tropical forest ecosystem classification, function and limitations. Applied tropical forest management systems; tropical problems, management, and political strategies; over-grazing and desertification; overcutting and fuelwood shortages. 3 seminars.

**NR 504. Agroforestry Systems. 2 units.**

Prerequisite: Consent of instructor.

Principles and practical applications of tree crop systems which are managed to provide fuel, fiber, fodder, and food. Tree crop identification and tree product uses. Plantation design, establishment, and cultural practices. Soil management. Integration of forest, and range management practices and values. Special applications to tropical forest ecosystems. 2 lectures.

**NR 521. Natural Resources Management for Educators. 3 units.**

Prerequisite: Consent of instructor.

Philosophy (theoretical and applied) of natural resource management strategies functioning in today's environment. Ecological principles applicable to specific resource components as they relate to the present perception of today's resource base, use demands and projected utilization. Environmental education programs such as Project Learning Tree. 3 seminars.

**NR 530. Social Systems in Natural Resources Management. 3 units.**

Prerequisite: Consent of instructor.

Theories and methods for incorporating community in the management of forest resources. Approaches to conflict resolution between resource owners and community stakeholders using tools such as GIS. 2 lectures, 1 laboratory.

**NR 532. Applications in Biometrics and Econometrics. 4 units.**

Prerequisite: One course in undergraduate statistics, graduate standing, or consent of instructor.

Parametric and semi-parametric statistical methods in modeling biological and economic phenomena. Biometric modeling of stand growth and inventory. Econometric modeling of market and environmental values. 3 lectures, 1 laboratory.

**NR 534. Forest Ecosystem Modeling. 3 units.**

Prerequisite: One course in undergraduate statistics, graduate standing, or consent of instructor.

Methods and modeling approaches used in quantifying ecological processes and conditions associated with forested ecosystems, such as fire behavior, hydrologic processes, terrestrial and aquatic habitat condition using GIS and other models. The Schedule of Classes will list topic selected; sections not repeatable. 2 lectures, 1 laboratory.

**NR 539. Graduate Internship in Forest Resources. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of forest resources or related businesses in the field. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**NR 570. Selected Topics in Forest Resources. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1-4 seminars.

**NR 571. Selected Topics Forest Resources Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1-4 laboratories.

**NR 575. Applications in Advanced Watershed Hydrology. 2 units.**

Prerequisite: Consent of instructor. Recommended: NR 420.

Techniques and applications in watershed hydrology to real-world projects. Projects could include water quality or quantity assessments, water quality or channel morphology monitoring, and structural and non-structural enhancements for channel and upland watersheds, culminating in a final report and presentation. 2 laboratories.

**NR 581. Graduate Seminar in Forestry and Environmental Sciences. 3 units.**

Prerequisite: Consent of instructor.

Student study and presentation of selected developments, trends and problems in the field of forest and natural resources. 3 seminars. Crosslisted as NR/SS 581.

**NR 599. Thesis. 1-9 units.**

Prerequisite: Consent of instructor.

Individual research in forest or natural resources management under the general supervision of faculty, leading to a graduate thesis. Degree credit limited to 9 units.

## Philosophy (PHIL)

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### Philosophy Courses

**PHIL 101. Introduction to Philosophy. 4 units.**

Foundational methods and central issues in contemporary philosophy including logic, epistemology, metaphysics and ethics. Required of all philosophy majors. Open to all majors and philosophy minors. 4 lectures. NOTE: This is not a GE course and will not count for GE credit.

**PHIL 126. Logic and Argumentative Writing. 4 units.**

GE Area A3

Prerequisite: Completion of GE Area A1 with a C- or better, or consent of instructor.

Principles of argument analysis, evaluation and construction. Deductive and inductive reasoning, including analogical arguments, universal and statistical generalizations, and causal inferences. Principles of organizing and writing argumentative essays. Moral dimensions of rational discourse. 4 lectures. Fulfills GE A3.

**PHIL 230. Philosophical Classics: Knowledge and Reality. 4 units.**

GE Area C2

Prerequisite: Completion of GE Area A.

Critical examination of primary philosophical texts, from the ancient and modern periods, with focus on the nature of reality and the sources and limits of human knowledge. 4 lectures. Crosslisted as HNRS/PHIL 230. Fulfills GE C2.

**PHIL 231. Philosophical Classics: Ethics and Political Philosophy. 4 units.**

GE Area C2

Prerequisite: Completion of GE Area A.

Readings from primary philosophical texts, from the ancient and modern periods, with focus on the identification, evaluation and contemporary relevance of the central ethical and political themes and arguments presented in them. 4 lectures. Crosslisted as HNRS/PHIL 231. Fulfills GE C2.

**PHIL 241. Symbolic Logic I. 4 units.**

Prerequisite: Completion of GE Area A3.

The nature of deductive logical systems. Methods of notation, translation and proof in sentential and predicate calculi including truth-trees and natural deduction systems. Introduction to meta-theory. 4 lectures.

**PHIL 242. Symbolic Logic II. 4 units.**

Prerequisite: PHIL 241 with a grade of C- or better or consent of instructor.

The nature of deductive logical systems. Methods of notation, translation and proof in sentential and predicate calculi including truth-trees and natural deduction systems. Introduction to meta-theory. 4 lectures.

**PHIL 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**PHIL 311. Greek Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Beginnings of Western philosophy and science. Topics include but are not limited to the Presocratics, Socrates, Plato, Aristotle, Epicureanism, Stoicism and Skepticism. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 312. Medieval Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Development of Western philosophy from Augustine to Ockham, including Anselm, Abelard, Roger Bacon, Bonaventure, Aquinas, and Duns Scotus. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 313. Early Modern Rationalism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Development of Western philosophy from the late Renaissance through Leibniz, with special emphasis upon the epistemology and metaphysics of the Continental Rationalists. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 314. Early Modern Empiricism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Development of Western philosophy from the Renaissance through Mill, with special emphasis on British Empiricism. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 315. Kant and 19th Century European Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Primary issues and concepts found in German philosophy from 1780 to 1900, with emphasis on Kant, Hegel, and Nietzsche. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 316. 20th Century European Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Recent movements within the Continental tradition, including French and German existentialism, phenomenology, and post-metaphysical philosophy. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 317. History of Analytic Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Major developments within 20th century British and American philosophy, with focus chiefly around Analytic philosophy. Other schools, such as Pragmatism, may be included, as may some philosophers outside of Britain and America whose work was influential in those countries. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 320. Asian Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Philosophies developed in India, South Asia, China and Japan, including the logical and epistemological presuppositions of the Six Schools of Hindu metaphysics, Buddhist philosophy, Confucian moral philosophy, Taoist metaphysics and social ecology. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 321. Philosophy of Science. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

The rational foundations of inquiry and explanation in the physical, biological and social sciences. Justification of scientific claims, the difference between science and pseudoscience, the relationship between science and other fields of investigation. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 322. Philosophy of Technology. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Analyses of the philosophical foundations and implications of technology. Technology and the human condition, technology and philosophical ethics, technology and political philosophy, technology and the metaphysics of human nature, and the relationship between science and technology. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 331. Ethics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Analyses of various traditional and contemporary positions on the difference between right and wrong, if there is one. Theories of metaethics and normative ethics including the divine command theory, relativism, intuitionism, noncognitivism, virtue ethics, egoism, utilitarianism and duty-based ethics. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 332. History of Ethics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

The history of moral thought from Homer and the Pre-Socratics to the 20th century, and focus on theories of moral goodness and rightness of action. Related issues and areas of thought, e.g. metaphysics, theology, science, politics, psychology freedom/determinism to be considered, where they shed light on moral thought. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 333. Political Philosophy. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Analyses of the philosophical foundations of political ideologies, including theories of political authority, legitimacy, obligation, and rights, and of the proper function of the state, and the relation of these theories to issues in meta-physics, theory of knowledge, and ethics. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 334. Philosophy of Law. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Normative and analytic questions about law. Nature of law and legal systems. Justification of law. Moral obligation to obey the law. Nature and justification of punishment. Guilt and legal responsibility. 4 lectures. Fulfills GE C4 except for Philosophy majors.



**PHIL 335. Social Ethics. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Examination of contemporary moral problems, solutions to these problems, and the arguments for these solutions, with emphasis on two or more of the following sample problem areas: abortion, suicide and euthanasia, capital punishment, family ethics, race relations, social justice, war, women's issues. 4 lectures. Fulfills GE C4 except for Philosophy majors. Fulfills USCP.

**PHIL 336. Feminist Ethics, Gender and Society. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Critical examination of the relations between gender, ethnicity, society and ethics from feminist perspectives, with special attention paid to problems in contemporary applied ethics. Joint focus on theory and application. 4 lectures. Fulfills GE C4 except for Philosophy majors. Fulfills USCP.

**PHIL 337. Business Ethics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Critical examination of ethical problems that arise in business. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 339. Biomedical Ethics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Critical examination of problems in biomedical ethics, proposed solutions to these problems, and the arguments for such solutions. Emphasis on two or more of the following sample problem areas: concepts of health and disease, human experimentation, informed consent, behavior control, genetic intervention, new birth technologies, euthanasia and physician-assisted dying. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 340. Environmental Ethics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Analyses of various positions on the moral status of nonhuman entities and problems such as the treatment of animals, wilderness preservation, population, pollution and global warming. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 341. Professional Ethics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Moral problems as they arise in professions such as law, medicine, engineering, research and education: deception, paternalism, confidentiality, discrimination and others. Consideration of various professional codes of ethics. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 342. Philosophy of Religion. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Inquiry into the rational and nonrational bases of religious claims. Arguments for and against the existence of God. Discussion of miracles, revelation, the definition of God, the problem of evil, the relation of faith and reason, the nature of religious experience, the verification of religious claims. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 350. Aesthetics. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Critical examination of philosophical views of art from both a historical and contemporary perspective. Treatment of theories from Plato and Aristotle through those of the twentieth century. Discussion of the problems raised by modern art. The relation between aesthetic values and metaphysics, epistemology, ethics and politics. 4 lectures. Fulfills GE C4 except for Philosophy majors.

**PHIL 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**PHIL 411. Metaphysics. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Traditional and current ideas and arguments about substance, the relation of universals to particulars, space and time, events, causation and necessity, the self and free will. 4 lectures.

**PHIL 412. Epistemology. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Analysis of the concept of knowledge. Development of competing theories of epistemic justification and truth. Inquiry into relationship between knowledge, belief, justification and truth. Examination of skepticism. 4 lectures.

**PHIL 420. Philosophy of Biology. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Philosophical implications and assumptions of evolutionary theory, the problem of reduction, feminist critiques, demarcation issues and the differences between biology and other sciences. Ethical and social issues, including Creationism and 'intelligent design' theories, eugenics, sociobiology, and ecology. 4 lectures.

**PHIL 421. Philosophy of Space, Time and Matter. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Investigation of the philosophical foundations and interpretation of relativity theory and elementary quantum mechanics. Emphasis on philosophical issues relevant to contemporary philosophy of science such as scientific realism. Some discussion of very recent theories of space, time, and matter. 4 lectures.

**PHIL 422. Philosophy of Mind. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Classic and current work in the problems and issues of the nature and unity of the self, consciousness, mental representations, and action, and of the relation of philosophy of mind to psychology, linguistics and computer science. 4 lectures.

**PHIL 423. Philosophy of Language. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Traditional and contemporary philosophical issues that arise from the structure of language. Relevant concepts include: syntax, semantics, pragmatics, meaning, reference, truth, identity, thought, reality. Important distinctions: use/ mention, relations/properties of relations, sentences/statements/-propositions. 4 lectures.

**PHIL 429. Special Topics in the History of Philosophy. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Advanced discussion of selected topics in the history of philosophy. Examination and analysis of important philosophical movements (e.g., positivism, postmodernism) or alternatively, of particular philosophers or philosophical works of exceptional importance (e.g., David Hume; Kant's Critique of Pure Reason). The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures.

**PHIL 439. Selected Problems in Ethics and Political Philosophy. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Advanced discussion of selected topics in ethics and political philosophy. Examination and analysis of significant ethical or political theories (e.g., utilitarianism, contractarianism) or alternatively, of particular philosophers or philosophical works of exceptional importance (e.g., John Stuart Mill; John Rawls' A Theory of Justice). The Schedule of Classes will list topic selected. 4 lectures.

**PHIL 449. Selected Topics in Recent Philosophy. 4 units.**

Prerequisite: Junior standing and completion of GE Area C2.

Advanced discussion of selected topics in recent philosophy. Examination and analysis of important recent movements in central philosophical areas (e.g., metaphysics, epistemology, philosophy of science, philosophy of language, philosophy of mind) or, alternatively, of particular philosophers or philosophical works of exceptional recent importance. The Schedule of Classes will list topic selected. Total credit limited to 12 units credit; may be repeated in same term. 4 lectures.

**PHIL 460. Senior Project I. 2 units.**

CR/NC

Prerequisite: PHIL 225 or PHIL 241, senior standing, and consent of instructor; Philosophy majors only.

Selection, development and completion of a project under faculty supervision. Results presented in a formal thesis. Minimum of 60 hours per quarter. PHIL 460 is graded on a CR/NC basis.

**PHIL 461. Senior Project II. 2 units.**

Prerequisite: PHIL 460; student must also receive a passing score on the senior examination in order to enroll in PHIL 461; Philosophy majors only.

Selection, development and completion of a project under faculty supervision. Results presented in a formal thesis. Minimum of 60 hours per quarter. Work in PHIL 461 is given a letter grade.

**PHIL 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Class Schedule will list topics selected. Total credit limited to 8 units. 1-4 lectures.

## Physical Education: Men (PEM)

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### Physical Education: Men Courses

**PEM 182. Baseball. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 183. Basketball. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 184. Cross Country. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 185. Football. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 189. Soccer. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 191. Swimming. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 192. Tennis. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 193. Track & Field. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 195. Golf. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEM 196. Wrestling. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

## Physical Education: Women (PEW)

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### Physical Education: Women Courses

**PEW 183. Basketball. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 184. Cross Country. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 189. Soccer. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 190. Softball. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 191. Swimming. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 192. Tennis. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 193. Track and Field. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 194. Volleyball. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

**PEW 195. Golf. 2 units.**

CR/NC

Enrollment limited to those academically qualified to compete in intercollegiate athletic programs. Consent of coach required. Total credit limited to 8 units. Courses are each 2 units and meet for a minimum of 10 hours per week. All competitive athletics courses are evaluated on a Credit/No Credit basis.

## Physical Science (PSC)

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## Physical Science Courses

### **PSC 101. Matter and Energy. 4 units.**

GE Area B4; GE Area B3

Introduction to the basic principles of physical science and application of these principles in modern society. Objects at rest and in motion, energy and power, fluids, heat, light, and sound. 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

### **PSC 102. Atoms and Molecules. 4 units.**

Prerequisite: PSC 101 or PHYS 121 or PHYS 131 or PHYS 141.

Introduction to the basic principles of the atomic, molecular, and sub-atomic behavior of matter, and applications of these principles in modern society. Electricity and magnetism, electrical nature of matter, organic and inorganic chemistry, modern physics, the nucleus. 3 lectures, 1 laboratory.

### **PSC 103. The Physical Environment: Earth. 4 units.**

Prerequisite: PSC 101 or PHYS 121 or PHYS 131 or PHYS 141.

Recommended: PSC 102.

Introduction to the basic principles of the earth sciences, and applications of these principles in modern society. Structure and formation of the Earth, earthquakes, weather, and oceanography. 3 lectures, 1 laboratory.

### **PSC 201. Physical Oceanography. 4 units.**

GE Area B5

Ocean origin, evolution, and sea floor features. Sediments; sea water; the ocean and our climate. Ocean surface and deep currents; waves and tides; coastal ocean. Marine life, food production, organisms, environments and lifestyles. Coastal development, pollution and food. Ocean resources and law. 4 lectures. Fulfills GE B5.

### **PSC 307. Nuclear Weapons in the Post-9/11 World. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Technology and basic science of fission/fusion weapons, uranium/plutonium, nuclear reactors, offensive/defensive missile systems, command/control, verification, weapon effects, nuclear testing. Historical context of Cold War and proliferation, recent events, global norms, arms control treaties. 3 lectures, 1 seminar. Fulfills GE Area F.

### **PSC 320. Energy, Society and the Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B.

Science and technology of current and future energy sources along with associated environmental problems and societal response. Energy production, consumption, efficient usage, fossil fuels, nuclear, solar, other renewables. Risks, benefits, planning, economics. 3 lectures, 1 activity. Fulfills GE Area F.

### **PSC 424. Organizing and Teaching Science. 4 units.**

Prerequisite: Admission to the Single Subject Credential Program or consent of instructor.

Techniques, aims and objectives in the teaching of physical and life sciences at the secondary level. Selection and organization of teaching material, including strategies for English language learners (ELL) and special needs students. Evaluation of results. 3 lectures, 1 activity. Crosslisted as BIO/PSC 424.

### **PSC 461. Senior Project. 2 units.**

Selection and completion of a project under faculty supervision. Project results are presented in a formal report. Minimum of 60 hours total time.

## Physics (PHYS)

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## Physics Courses

### **PHYS 104. Introductory Physics. 4 units.**

GE Area B3

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Elementary introduction to mechanics, gases, liquids and solids, heat, vibrations and waves, light, electricity and magnetism. Intended to provide non-science students with an understanding of basic physical concepts. Not open to students who have credit in a college physics course. 4 lectures. Fulfills GE B3.

### **PHYS 107. Introduction to Meteorology. 4 units.**

GE Area B3

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Physics of Earth's atmosphere. Topics include the physical basis for temperature, wind generation, atmospheric circulation, humidity, adiabatic processes, cloud formation, cyclone development, precipitation, and storm growth. Other topics include the variety of storms and their effects, satellite imaging, and air pollution and its possible effect on global temperature change. 4 lectures. Fulfills GE B3.

### **PHYS 111. Contemporary Physics for Nonscientists. 4 units.**

GE Area B3

Exploration of the key concepts of quantum mechanics and Einstein's special and general theories of relativity. Particle-wave duality, Heisenberg's uncertainty principle, Schrodinger's cat, warped spacetime, black holes. 4 lectures. Fulfills GE B3.

### **PHYS 115. Physics of Sound and Music. 4 units.**

GE Area B3

Prerequisite: Passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Fundamental physical principals of sound production in musical instruments; woodwind, brass, strings, piano and percussion. Generation and interference of mechanical and sound waves; overtone series, musical scales and Fourier spectra of complex waves. Electronic sound recording and production. Hearing and voice. Auditorium and room acoustics. 4 lectures. Fulfills GE B3.

### **PHYS 118. Introductory College Physics. 4 units.**

Prerequisite: MATH 118 and high school trigonometry, or MATH 119.

Introductory course in physics emphasizing motion, force, torque, momentum, and energy. Applications to human motion and metabolism. Primarily for students in kinesiology. Not open to students with credit in PHYS 121 or PHYS 131 or PHYS 141. 4 lectures.

**PHYS 121. College Physics I. 4 units.**

GE Area B3

Prerequisite: MATH 118 and high school trigonometry, or MATH 119.

Introductory course in mechanics emphasizing motion, force, and energy. Not open to students having a grade of C- or better in PHYS 131 or PHYS 141. 4 lectures. Fulfills GE B3.

**PHYS 122. College Physics II. 4 units.**

GE Area B3; GE Area B4

Prerequisite: PHYS 118, PHYS 121, PHYS 131, or PHYS 141.

Continuation of PHYS 121. Topics include properties of materials, fluids, waves and vibrations, sound, heat, light and optics. Not open for credit to students having a grade of C- or better in PHYS 132. 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

**PHYS 123. College Physics III. 4 units.**

Prerequisite: PHYS 118, PHYS 121, PHYS 131, or PHYS 141.

Recommended: PHYS 122.

Continuation of PHYS 121 and 122. Electrostatics, electric current, magnetic fields and induction. Elements of modern physics. Not open for credit to students having a grade of C- or better in PHYS 133. 3 lectures, 1 laboratory.

**PHYS 131. General Physics I. 4 units.**

GE Area B4; GE Area B3

Prerequisite: MATH 141 with grade C- or better and MATH 142 or MATH 182 (or concurrent enrollment); for ME and AERO students only. Recommended: High School Physics.

Fundamental principles of mechanics. Vectors, particle kinematics. Equilibrium of a rigid body. Work and energy, linear momentum, rotational kinematics and dynamics. Primarily for engineering students, and for students majoring in the physical sciences. Not open to students with credit in PHYS 141. 3 lectures, 1 laboratory. Crosslisted as HNRS/PHYS 131. Fulfills GE B3 & B4.

**PHYS 132. General Physics II. 4 units.**

GE Area B3; GE Area B4

Prerequisite: PHYS 131 or HNRS 131 or PHYS 141.

Oscillations, waves in elastic media, sound waves. Temperature, heat and the first law of thermodynamics. Kinetic theory of matter, second law of thermodynamics. Geometrical and physical optics. 3 lectures, 1 laboratory. Crosslisted as HNRS/PHYS 132. Fulfills GE B3 & B4.

**PHYS 133. General Physics III. 4 units.**

GE Area B4; GE Area B3

Prerequisite: PHYS 131 or HNRS 131 or PHYS 141, and MATH 142. Recommended: MATH 241.

Charge and matter, electric field, electric potential, dielectrics, capacitance, current and resistance, electromotive force and circuits, magnetic fields, magnetic field of a moving charge, induced emf. 3 lectures, 1 laboratory. Fulfills GE B3 & B4.

**PHYS 141. General Physics IA. 4 units.**

GE Area B3

Prerequisite: MATH 141 with grade C- or better and MATH 142 or MATH 182 (or concurrent enrollment). Recommended: High School Physics.

Fundamental principles of mechanics. Vectors, particle kinematics. Equilibrium of a rigid body. Work and energy, linear momentum, rotational kinematics and dynamics. Primarily for engineering and science students. Not open to students with credit in PHYS 131. 4 lectures. Crosslisted as HNRS 134/PHYS 141. Fulfills GE B3.

**PHYS 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**PHYS 201. Learning Center Tutor. 1 unit.**

CR/NC

Prerequisite: PHYS 133 and consent of instructor.

Act as a tutor in the Physics Learning Center. Help students with problem solving techniques and introductory physics course material. Total credit limited to 3 units, with a maximum of 1 unit per quarter. Credit/No Credit grading only.

**PHYS 202. Physics on the Computer. 4 units.**

Prerequisite: PHYS 133 and MATH 241.

Introduction to using computers for solving problems in physics: differential equations, matrix manipulations, simulations and numerical techniques, nonlinear dynamics. 4 lectures.

**PHYS 206. Experimental Physics. 3 units.**

Prerequisite: PHYS 133, MATH 143, and concurrent enrollment in PHYS 256.

L-R-C circuits and electronic circuit elements emphasizing the applications of analog and digital electronics to instrumentation in modern physics. 3 lectures.

**PHYS 211. Modern Physics I. 4 units.**

Prerequisite: PHYS 132 and PHYS 133 and MATH 241.

Special relativity, fundamental principles of quantum mechanics, emphasizing the modern description of atomic phenomena. Kinetic theory, wave particle duality, Bohr theory, Schroedinger equation, elementary atomic structure. 4 lectures.

**PHYS 212. Modern Physics II. 4 units.**

Prerequisite: PHYS 211.

Applications of quantum physics to atoms, nuclei, and elementary particles. Quantum statistics, principles of the laser. Topics in solid state physics such as the free electron theory of metals, bonding in solids and energy bands. Nuclear structure and nuclear energy. 4 lectures.

**PHYS 220. Introduction to Physics Research. 1 unit.**

CR/NC

Prerequisite: PHYS 132 or PHYS 133.

Introduction to the research programs of faculty in the department and opportunities for research. Survey of departmental facilities and procedures related to research. Overview of external research programs/internships. Credit/No Credit grading. 1 lecture.



**PHYS 256. Electrical Measurements Laboratory. 1 unit.**

Prerequisite: PHYS 133, MATH 143. Concurrent: PHYS 206.

Experimental studies of circuit analysis and electronics; introduction to digital techniques; instrumentation. 1 laboratory.

**PHYS 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**PHYS 301. Thermal Physics I. 4 units.**

Prerequisite: PHYS 211.

Thermodynamics and statistical mechanics. Entropy, temperature, ensembles, partition functions, chemical potential, free energy. Selected applications including paramagnetism, ideal gas, Fermi-Dirac and Bose-Einstein distributions. 4 lectures.

**PHYS 302. Classical Mechanics I. 4 units.**

Prerequisite: PHYS 131 or PHYS 141; and MATH 241; and MATH 242 or MATH 244.

Laws of motion, kinematics and dynamics of a particle. Use of numerical methods for solving problems. Work and energy. Linear and angular momentum. Lagrange's and Hamilton's equations and the calculus of variations. Newton's Law of gravity, Kepler's laws of orbital motion, and central force problems. 4 lectures.

**PHYS 303. Classical Mechanics II. 3 units.**

Prerequisite: PHYS 302.

Mechanics in non-inertial reference frames. Dynamics of a rigid bodies. Coupled oscillators and normal modes. Use of numerical methods for solving problems. 3 lectures.

**PHYS 310. Physics of Energy. 3 units.**

Prerequisite: PHYS 132.

Physics and mathematics applied to broad energy topics. Efficient usage, transportation, solar energy, nuclear fission and fusion. Plasma, hydrogen economy, fuel cells, wind wave, tidal, and geothermal energy. Transmission, storage, fossils. National planning, and energy economics. 3 lectures.

**PHYS 313. Introduction to Atmospheric Physics. 3 units.**

Prerequisite: PHYS 132 or PHYS 122, and MATH 241.

Recommended: MATH 304.

Properties of the atmosphere, atmospheric motions, solar and terrestrial radiation. Emphasis on conservation laws of momentum, energy and mass applied to understanding the Earth's atmospheric motions. 3 lectures.

**PHYS 315. Introduction to Lasers and Laser Applications. 3 units.**

Prerequisite: PHYS 211 and MATH 143.

Interaction of radiation with matter, theory of laser action, characteristics and modification of laser output, types of lasers. Holography and other applications. 3 lectures.

**PHYS 317. Special Theory Relativity. 3 units.**

Prerequisite: PHYS 211.

Fundamental experiments and basic postulates of special relativity. Simultaneity, length and time measurements. Lorentz transformations. Four-Vectors. Space-time diagrams. Relativistic mechanics and electromagnetism. 3 lectures.

**PHYS 322. Vibrations and Waves. 3 units.**

Prerequisite: PHYS 132; and MATH 242 or MATH 244.

Recommended: MATH 344.

Introduction to vibrations and waves and their applications. Harmonic oscillator, waves, complex notation, superposition, interference, coherence, Fourier analysis. Applications may include sound, optics, quantum mechanics, and electromagnetic radiation. 3 lectures.

**PHYS 323. Optics. 4 units.**

Prerequisite: MATH 241; and PHYS 133; and PHYS 322, EE 228, EE 201, or ME 318.

Geometrical optics, lens systems, aberrations, physical optics and polarization. 3 lectures, 1 laboratory.

**PHYS 330. Teaching Physics. 2 units.**

Prerequisite: PHYS 122, PHYS 123, PHYS 132, PHYS 133, PSC 102, or PSC 103.

Introduction to inquiry approaches to teaching physics incorporating insights from physics education research and the use of computer technology. Designed for undergraduates considering careers in science teaching. Emphasis is placed on introducing pedagogical approaches to help others develop basic models of physics through experimentation, development of skills in scientific discourse and presentation, and formative and summative assessment of learning of others. 2 activities.

**PHYS 340. Quantum Physics Laboratory I. 2 units.**

Prerequisite: PHYS 212 and PHYS 256.

Experimental studies of the quantum properties of atoms and nuclei. Measurements of fundamental constants. Statistics and data analysis. 1 lecture, 1 laboratory.

**PHYS 341. Quantum Physics Laboratory II. 2 units.**

Prerequisite: PHYS 340.

Experimental studies of quantum properties of atoms and nuclei. Interactions of radiation, particles and fields. 2 laboratories.

**PHYS 342. Quantum Physics Laboratory III. 1 unit.**

Prerequisite: PHYS 341.

Advanced experimental studies of quantum properties of atoms and nuclei. Interactions of radiation, particles and fields emphasizing spectroscopic techniques. 1 laboratory.

**PHYS 357. Advanced Instrumentation in Experimental Physics. 3 units.**

Prerequisite: PHYS 206 and PHYS 256.

Advanced analog and digital electronics, computer interfacing to experiments, robotics. 2 lectures, 1 laboratory.

**PHYS 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigations, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**PHYS 401. Thermal Physics II. 3 units.**

Prerequisite: PHYS 301.

Additional topics in thermodynamics and statistical physics, including chemical equilibrium, phase transitions, transport processes, and cryogenics. 3 lectures.

**PHYS 403. Nuclear and Particle Physics. 3 units.**

Prerequisite: PHYS 212 and PHYS 405.

Advanced nuclear physics topics. The two-nucleon problem at low energy. The deuteron. Subnuclear particles and their structure. Elementary particles. Symmetries and conservation laws. Parity, charge conjugation and time reversal invariance. Hadronic interactions. The weak interaction. 3 lectures.

**PHYS 405. Quantum Mechanics I. 4 units.**

Prerequisite: PHYS 212, PHYS 302, PHYS 322, MATH 241, MATH 242, or MATH 244. Recommended: MATH 344.

Wave nature of matter and the basic postulates of quantum mechanics. The wave function, operators, and their interpretation. Schrodinger's equation and its solutions in one and more dimensions. The hydrogen atom and the periodic table. 4 lectures.

**PHYS 406. Quantum Mechanics II. 3 units.**

Prerequisite: PHYS 405.

Angular momentum operators and problems in three dimensions including the hydrogen atom. The elements of matrix mechanics and spin wave functions. Perturbation theory. 3 lectures.

**PHYS 408. Electromagnetic Fields and Waves I. 4 units.**

Prerequisite: PHYS 133 and MATH 304.

Electric and magnetic field theory using vector analysis. Electric fields, dielectric materials, magnetic fields, induced emf, magnetic materials, Maxwell's equations, wave equation. 4 lectures.

**PHYS 409. Electromagnetic Fields and Waves II. 3 units.**

Prerequisite: PHYS 408. Recommended: PHYS 322.

Wave equation, plane electromagnetic waves, guided waves. Dipole radiation, radiation from an accelerated charge. Special relativity. 3 lectures.

**PHYS 410. Physics of Solid Earth. 3 units.**

Prerequisite: PHYS 133, MATH 241 and MATH 244.

Gravity and the figure of the Earth. Body wave seismology, structure and composition of the Earth, heat flow and heat sources, Earth tides, rotational dynamics, the geomagnetic field and its source, paleomagnetism. 3 lectures.

**PHYS 412. Solid State Physics. 3 units.**

GE Area B6

Prerequisite: PHYS 211 or MATE 340, MATH 244.

Properties of solids including the structural, mechanical, thermal, and electronic properties, energy band theory and the properties of metals and semiconductors. 3 lectures. Fulfills GE B6 with PHYS 452.

**PHYS 413. Advanced Topics in Solid State Physics. 3 units.**

Prerequisite: PHYS 412.

Semiconducting devices, including junction and field-effect transistors, LED's, and diode lasers. Magnetic properties of solids. Superconductivity, including discussion of high-temperature superconductors. Other topics of current interest in solid state physics. 3 lectures.

**PHYS 417. Nonlinear Dynamical Systems. 4 units.**

GE Area B6

Prerequisite: PHYS 132 or PHYS 122; and PHYS 133 or PHYS 123; and MATH 241; and MATH 242 or MATH 244. Recommended: Junior standing.

Analysis of linear and nonlinear dynamical systems with emphasis on geometrical methods and visualization techniques. Fixed points, phase plane analysis, bifurcations and limit cycles. Laboratory component includes data acquisition and analysis using computers, numerical simulations of dynamical systems, and analysis of discrete systems. 3 lectures, 1 laboratory. Fulfills GE B6.

**PHYS 422. Polymer Electronics Laboratory. 1 unit.**

Prerequisite: EE 347 or MATE 340 or CHEM 319 or PHYS 340.

Experimental procedures in polymer electronics. Investigation of the characteristics of a polymer electronic device. 1 laboratory. Crosslisted as EE/PHYS 422.

**PHYS 423. Advanced Optics. 4 units.**

Prerequisite: PHYS 323.

Advanced topics of modern optics. May include: fiber optics, Fourier optics, quantum optics, lasers, holography, non-linear optics. 3 lectures, 1 laboratory.

**PHYS 424. Theoretical Physics. 3 units.**

Prerequisite: PHYS 133, MATH 304, MATH 344.

Contour integration in the complex plane, properties of the delta function, properties of some common functions of theoretical physics, Green's function techniques for solving differential equations. 3 lectures.

**PHYS 452. Solid State Physics Laboratory. 1 unit.**

GE Area B6

Prerequisite or concurrent: PHYS 412.

Selected experiments on X-ray diffraction, Hall effect, optical absorption, thermo-electric effect, photovoltaic cells, diode characteristics, and superconductivity. 1 laboratory. Fulfills GE B6 with PHYS 412.

**PHYS 461. Senior Project I. 2 units.**

Prerequisite: Consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 60 hours total time.

**PHYS 462. Senior Project II. 2 units.**

Prerequisite: Consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 60 hours total time.

**PHYS 463. Senior Project - Laboratory Research I. 2 units.**

Prerequisite: Consent of instructor.

Selection and completion of a laboratory research project under faculty supervision. Projects typical of problems which graduates will encounter in industry or graduate school. Project results are presented in a formal report. Minimum 60 hours total time. 2 laboratories.

**PHYS 464. Senior Project - Laboratory Research II. 2 units.**

Prerequisite: Consent of instructor.

Selection and completion of a laboratory research project under faculty supervision. Projects typical of problems which graduates will encounter in industry or graduate school. Project results are presented in a formal report. Minimum 60 hours total time. 2 laboratories.

**PHYS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**PHYS 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 laboratories.

**PHYS 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 12 units; major credit limited to 2 units. Credit/No Credit grading only.

**PHYS 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Total credit limited to 12 units; major credit limited to 2 units. Credit/No Credit grading only.

## **Plant Protection Science (PPSC)**

### **Plant Protection Science Courses**

**PPSC 110. People, Pests and Plagues. 4 units.**

GE Area B4; GE Area B2

Introduction to the science of entomology, focusing on insect identification, biology, ecology, and interactions with humans. Insect pest and beneficial species, and their role in shaping how we live, work and eat. Not open for degree credit to students majoring in AEPS, CRSC, FRSC, EHS nor WVIT (viticulture concentration). 3 lectures, 1 activity. Fulfills GE B2 & B4.

**PPSC 311. Agricultural Entomology. 4 units.**

Prerequisite: CHEM 110 or CHEM 111; BOT 121 or HCS 120.

The science of entomology as it relates to insects of importance in agriculture. Focus on the biology, ecology and identification of insects and mites important to California horticulture, field crops and landscapes. 3 lectures, 1 laboratory.

**PPSC 321. Weed Biology and Management. 4 units.**

Prerequisite: BOT 121 or HCS 120.

Weed ecology, biology, and implications for management. Identification of weedy and invasive plant species in annual agricultural, perennial semi-managed, range, aquatic, and forest ecosystems, to elucidate weaknesses and strengths in order to facilitate vegetation management. Organic, cultural, biological, mechanical, and chemical methods and their integrated (IPM) uses. 3 lectures, 1 laboratory.

**PPSC 327. Vertebrate Pest Management. 4 units.**

Prerequisite: Junior standing.

Vertebrate pests injurious to crops, livestock, forest products, wildlife, stored products and humans. Life habits, identification, control methods, and materials. Related laws and regulations. 3 lectures, 1 laboratory.

**PPSC 405. Advanced Weed Management. 4 units.**

Prerequisite: PPSC 321.

Planning, design and implementation of long-term sustainable weed management programs. Analysis of traditional and new technologies for weed management based on their impact on agriculture, society and the environment. 3 lectures, 1 laboratory.

**PPSC 414. Grape Pest Management. 4 units.**

Prerequisite: PPSC 311; BOT 323; FRSC/WVIT 231 or FRSC/WVIT 311.

Comprehensive survey of major grape pests including diseases, insects, weeds, vertebrates, and nematodes. Identification and biology of grape pests and natural enemies, monitoring, and integrated pest management (IPM) strategies, including cultural, biological, and chemical controls. Guest lectures. Total credit limited to 8 units. 3 lectures, 1 activity. Crosslisted as PPSC/WVIT 414.

**PPSC 421. Plant-Pest Interactions. 4 units.**

Prerequisite: BOT 323 or BOT 324, and PPSC 311 or ZOO 335.

Plant biochemical and physical defenses to herbivorous insects, plant pathogens and weeds, and the evolutionary and genetic basis thereof. Effects of environmental manipulations, and other cultural controls on pest populations, and the use of induced resistance materials. Not open to students with credit in PPSC 521. 3 lectures, 1 laboratory.

**PPSC 427. Disease and Pest Control Systems for Ornamental Plants. 4 units.**

Prerequisite: BOT 323 or BOT 324, and HCS 120 and PPSC 311 and PPSC 321.

Recognition, prevention and control of diseases, insect/mite pests and weeds that impact commercial ornamental plantings. Integrated pest management strategies presented including biological, cultural, and safe and proper pesticidal controls. Laboratory emphasizes monitoring, problem solving and application of appropriate pest control measures. 3 lectures, 1 laboratory.

**PPSC 431. Insect Pest Management. 4 units.**

Prerequisite: PPSC 311.

Principles of insect and mite pest management, including integrated pest management (IPM), applications of ecological theory to pest management, cultural, biological and chemical controls, pesticide resistance management, insect and mite monitoring, biotechnology applications, pesticide laws and regulations, pest control advisor and qualified applicator licensing and certification. One field trip required. 3 lectures, 1 laboratory.

**PPSC 441. Biological Control for Pest Management. 4 units.**

Prerequisite: PPSC 311.

Control of arthropods, weeds and vertebrates to include history of biocontrol; biology of beneficial arthropods; methods of introduction, augmentation and conservation; and case studies. Identification of beneficial arthropods to appropriate taxonomic level. Technology, laws and regulations governing use of biocontrol agents. Field trips to insectaries, quarantine facilities and/or crop production areas. 3 lectures, 1 laboratory.

**PPSC 511. Ecological Biometrics. 4 units.**

Prerequisite: STAT 218 or STAT 512, or consent of instructor.

General survey of current analytical methodology available to ecological researchers to evaluate effects and assess the underlying mechanisms that drive natural and cultivated ecosystems. Methodology includes general linear models, ordination, survival analysis, multivariate analyses, and computer simulations. Student research used as a basis for instruction. Total credit limited to 8 units. 3 seminars, 1 activity. Crosslisted as HCS/PPSC 511.

**PPSC 521. Plant-Pest Interactions. 4 units.**

Prerequisite: BOT 323 or BOT 324, and PPSC 311 or ZOO 335, and graduate standing.

Plant biochemical and physical defenses to herbivorous insects, plant pathogens and weeds, and the evolutionary and genetic basis thereof, with particular focus on the master's thesis. Effects of environmental manipulations, and other cultural controls on pest populations, and the use of induced resistance materials. Not open to students with credit in PPSC 421. 3 lectures, 1 laboratory.

**PPSC 599. Thesis. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Systematic research of a topic in plant protection science, including weed science, entomology, plant pathology, nematology or vertebrate management. Thesis to describe the problem and its significance, methodology, results, data analysis, discussion and conclusion. Enrollment required every quarter in which facilities are used or advisement received. Degree credit limited to 6 units. Total credit limited to 9 units.

## Political Science (POLS)

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### Political Science Courses

**POLS 111. California Constitution and Government. 1 unit.**

Basic aspects of California state government. Satisfies GE D1 for students who have passed both AP US Government and US History exams, or transfer students who have received advice in writing from the Office of the Registrar to take POLS 111. 1 lecture.

**POLS 112. American and California Government. 4 units.**

GE Area D1

Study of governmental institutions, politics, issues and political behavior in the United States and California in constitutional, historical, social and cultural perspectives. Meets the U.S. government and California state/local government requirement. 4 lectures. Fulfills GE D1.

**POLS 180. Political Inquiry. 4 units.**

Introduction to the scope, language, concepts and approaches employed in political science and the social sciences. Includes emphasis on basic methodological and research strategies for assessing political issues, and an overview of the subfields of political science. 4 lectures.

**POLS 225. Introduction to International Relations. 4 units.**

Introduction to the basic concepts, issues, and theories surrounding the study of international politics. Changes in the nature of conflict, power, and national interests in the post-Cold War era. Role of states, non-governmental actors, and international organizations in the global arena. 4 lectures.

**POLS 229. Introduction to Comparative Politics. 4 units.**

Introduction to basic concepts, issues, methodology, and theories in comparative politics. Major issues/theories include electoral laws and party systems, parliamentary and presidential institutions, socialization, democratization, corporatism and pluralism, religious and cultural impacts on politics. Topics explored through politics of countries and regions throughout the world. 4 lectures.

**POLS 230. Basic Concepts of Political Thought. 4 units.**

Introduction to political theory. Focuses on concepts like: authority, liberty, equality, law, justice, community, rights, citizenship, property, class conflict, and constitutionalism. Readings from major thinkers, such as Plato, Aristotle, Augustine, Aquinas, Machiavelli, Locke, Hobbes, Rousseau, Marx, Nietzsche, Rawls, and others. 4 lectures.

**POLS 245. Judicial Process. 4 units.**

The nature of the legal system. Topics may include: private and public law, civil and criminal law, trial and appellate courts, criminal procedure, judges, attorneys, and juries. 4 lectures.

**POLS 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**POLS 285. Model United Nations. 4 units.**

Prerequisite: One course in POLS or consent of instructor.

Introduction to the United Nations and major issues that confront it. Preparation for participation in collegiate Model United Nations conferences. Rules of procedure and debate, preparation of country position papers, and resolution writing. 4 lectures.

**POLS 295. Foundations of Mock Trial. 4 units.**

Prerequisite: Completion of GE Area D1 and consent of instructor.

Introduction to evidence, trial procedure, objections, and witness examination. Preparation for intercollegiate mock trial competitions (held in winter and spring). Extensive hands-on experience in researching, preparing, and arguing a legal case. 4 lectures.



**POLS 308. Political Violence and Conflict Resolution. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

Causes, methods, and consequences of non-state groups that use violent means to pursue revolutionary, separatist, or ideological goals both domestically and internationally. Dynamics of ethnic conflict, terrorist movements, paramilitary groups, insurgencies, and narco-trafficking. Processes of conflict resolution in divided societies through military responses, negotiated settlements, democracy, and peacekeeping missions. 4 lectures.

**POLS 310. Politics of Ethnicity and Gender. 4 units.**

USCP

Prerequisite: Completion of Area D1. Recommended: POLS 112.

Analysis of factors that affect the changing role of women and major ethnic groups in American politics. Examination of the social construction of difference, exploring how gender, race, and class are shaped by social, cultural, and political contexts. 4 lectures. Fulfills USCP.

**POLS 315. The American Presidency. 4 units.**

Prerequisite: Completion of Area D1. Recommended: POLS 112.

Nature and problems of contemporary presidential leadership emphasizing the impact of Congress, bureaucracy, public opinion, the courts, non-governmental factors, and the party system upon presidential power. 4 lectures.

**POLS 316. Political Participation. 4 units.**

Prerequisite: Completion of Area D1. Recommended: POLS 112.

Role of political participation as manifested through social, psychological, and institutional constraints. Analysis of consensus and conflict in present day political participation as reflected in electoral, protest, and related behavior. 4 lectures.

**POLS 317. Campaigns and Elections. 4 units.**

Prerequisite: Completion of Area D1. Recommended: POLS 112.

Focus on contemporary political campaigns and elections in the U.S. Campaign management, message development and delivery. Impact of political ideology, mass media, technology, pressure groups on electoral outcomes. 4 lectures.

**POLS 319. United States Congress. 4 units.**

Prerequisite: Completion of Area D1. Recommended: POLS 112.

Congressional elections and their effects on congressional actions, including the organization, procedures and consequences of the legislative process in Congress. 4 lectures.

**POLS 320. Comparative Political Analysis. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

Survey of theories and methods in the field of comparative politics. Recognition of how history structures current politics. Application of abstract principles to contemporary or historical problems to illustrate the practical uses of comparative analysis. Evaluation of assorted issues to compare culturalist, institutionalist, and rationalist approaches. 4 lectures.

**POLS 321. Comparative Political Culture. 4 units.**

Prerequisite: POLS 229, or consent of instructor.

Survey of major concepts and theories of political culture and relationships among culture, politics, and society. Cultural influences of Christianity, Confucianism, Islam, and contemporary democratic, civic culture. The role of political culture in the industrialization process and post-colonial and post-communist transitions. 4 lectures.

**POLS 322. International Political Activism. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

Concepts, theories, and themes of collective activism in international politics from a comparative approach. Mobilization, organization, and implementation of domestic and transnational social movements in Europe, Latin America, Asia, and Africa, and their political and historical significance. 4 lectures.

**POLS 324. International Relations Theory. 4 units.**

Prerequisite: POLS 225 or POLS 229.

Survey of theoretical approaches to the study of international political processes and issues, including foreign policies, global political issues, cooperation and conflict. Analyses of selected problems to elucidate differences between realist, liberal, socialist, constructivist, and other theories. 4 lectures.

**POLS 325. Global Political Issues. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, one course from D1 (POLS 112 recommended) and one course from either D2 or D3. Recommended: Junior standing.

Concepts and theories in international relations and contemporary global issues. Application of principles of international relations to political issues and subjects which affect our lives. 4 lectures. Fulfills GE D5 except for Political Science majors.

**POLS 328. Politics of Developing Areas. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

A detailed survey of the domestic politics of developing countries from a comparative perspective. Assessment of theories of development with appropriate examples taken from particular areas and countries. Repeatable to 8 units with different subtitles (e.g., 'Latin America,' 'East Asia,' 'Africa'). The Schedule of Classes will list topic selected. 4 lectures.

**POLS 329. Ancient and Medieval Political Thought. 4 units.**

Prerequisite: POLS 230 or consent of instructor.

Political theory from ancient Greece, ancient Rome, and the Medieval period. Readings from major authors, such as Plato, Aristotle, Augustine, Aquinas, and others. 4 lectures.

**POLS 330. Modern Political Thought. 4 units.**

Prerequisite: POLS 230, or consent of instructor.

Theories of political participation and the relationship between the individual and the state as developed in the works of influential thinkers such as Locke, Rousseau, Mill and Marx. 4 lectures.

**POLS 331. Contemporary Political Thought. 4 units.**

Prerequisite: POLS 230 or consent of instructor.

Ideas of major contemporary political thinkers, such as Wolff, Singer, Rawls, Strauss, MacKinnon, Beauvoir, Dewey, Walzer and others in historical context, compared and contrasted. 4 lectures.



**POLS 333. World Food Systems. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B, or consent of instructor.

Integrated, interdisciplinary study of the technologies of global food production, environmental and social issues related to the application of those technologies, and moral and ethical issues associated with global food production and distribution. Emphasis on the politics of change. 4 lectures. Crosslisted as POLS/UNIV 333. Fulfills GE Area F.

**POLS 334. Jurisprudence. 4 units.**

Prerequisite: POLS 112 and POLS 230, or consent of instructor.

Normative and analytical problems concerning law. Nature of law and legal systems including liberty and justice. Topics may include the connection between law and morality, feminist and critical race perspectives, crime and punishment, and economic analysis of the law. 4 lectures.

**POLS 338. Critical Issues in American Politics. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, one course from D1 (POLS 112 recommended) and one course from either D2 or D3. Recommended: Junior standing.

Examination of significant social, legal, economic and political issues that face the country and how the basic institutions of government-national, state, local-are responding to them; assessment of policies to correct these problems. 4 lectures. Fulfills GE D5 except for Political Science majors.

**POLS 339. Authoritarian and Democratic Rule. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Area A and one course from two of the three subfields of Area D1, D2, and/or D3, or consent of instructor.

A comparative examination of governing institutions used throughout the world. Emphasis on the diversity of governmental designs found within both authoritarian and democratic regimes. 4 lectures. Fulfills GE D5 except for Political Science majors.

**POLS 340. American Judicial Politics. 4 units.**

Prerequisite: POLS 112 or consent of instructor; for Law and Society minors and POLS majors with pre-law concentration.

Empirical aspects of the decision making of federal and state courts, with an emphasis on understanding how interactions between the courts and other political factors shape judicial behavior. 4 lectures.

**POLS 341. American Constitutional Law. 4 units.**

Prerequisite: POLS 112, or consent of instructor.

United States Supreme Court decisions in the areas of separation of powers, judicial review, commerce clause, federalism, due process. 4 lectures.

**POLS 343. Civil Rights in America. 4 units.**

USCP

Prerequisite: POLS 112, or consent of instructor.

Case-based examination of discrimination based on race, ethnic, gender, and sexual orientation in the United States. Emphasis on the Supreme Court's interpretation of the Equal Protection Clause. 4 lectures. Fulfills USCP.

**POLS 344. Civil Liberties. 4 units.**

Prerequisite: POLS 112, or consent of instructor.

Role of Supreme Court as interpreter of civil liberties. Topics may include freedom of expression and religion, search and seizure, due process of law. 4 lectures.

**POLS 346. Politics in Literature. 4 units.**

Prerequisite: POLS 112 or consent of instructor.

Political concepts and values examined, based on literary sources such as plays and novels. Topics may include: power, justice, violence and social responsibility. 4 lectures.

**POLS 347. Politics and Popular Culture. 4 units.**

Prerequisite: POLS 112 or consent of instructor.

Intersection of politics and mass media. How political actors use popular culture to establish issue agendas, convey political concepts, symbolism, rhetoric and values. 4 lectures.

**POLS 348. Early American Political Thought. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, one course from D1 (POLS 112 recommended) and one course from either D2 or D3. Recommended: Junior standing.

The central political ideas of America's leading thinkers from the arrival of the Mayflower to the Civil War. Selections may include readings of American political ideas from Winthrop, Paine, Publius, Hamilton, de Tocqueville, Douglass, Calhoun, Thoreau, and Lincoln, among others. 4 lectures. Fulfills GE D5 except for Political Science majors.

**POLS 349. Contemporary American Political Thought. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, one course from D1 (POLS 112 recommended) and one course from either D2 or D3. Recommended: Junior standing.

The central political ideas of America's leading thinkers from the Civil War to the present. 4 lectures. Fulfills GE D5 except for Political Science majors.

**POLS 351. Public Administration. 4 units.**

Prerequisite: Completion of GE D1. Recommended: POLS 112.

Development of the management functions in government. Survey of administrative concepts and cases. Attention given to national, state and local administrative systems. Case studies and simulations. 4 lectures.

**POLS 359. Research Design. 4 units.**

Prerequisite: STAT 217.

Methodology and research design used in qualitative and quantitative analysis. Examination of multiple methods used to analyze political phenomena in the political science discipline. 4 lectures.

**POLS 361. Quantitative Methodology. 4 units.**

Prerequisite: POLS 359, or consent of instructor.

Survey of quantitative methodology in political science, up to and including multiple regression. Laboratory computer instruction to facilitate understanding of quantitative approaches to political research. 3 seminars, 1 activity.

**POLS 375. California Politics. 4 units.**

Prerequisite: Completion of GE D1. Recommended: POLS 112.

Political culture, processes, behavior, institutions, public policy and distribution of power in California state and substate governments. 4 lectures.

**POLS 380. Religion and Politics in the Israeli-Palestinian Conflict. 4 units.**

Prerequisite: Completion of GE Area A. Recommended: Completion of one class in POLS or RELS.

The root causes of the Israeli-Palestinian conflict and its current manifestation. Possibilities for solutions from the perspectives of religious studies and political science. 4 lectures. Crosslisted as POLS/RELS 380.

**POLS 381. Peace and War. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

Dynamics of interstate peace and war. Topics include: military strategy, the military-industrial complex, arms races and disarmament, diplomacy, deterrence and pre-emption, collective security and alliance behavior, civil-military relations, post-conflict reconstruction, and the role of international law and organizations. 4 lectures.

**POLS 382. Comparative Foreign Policy. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

Systematic analysis of the international and domestic pressures leading different states to take particular foreign policy stances, with appropriate examples taken from different regions of the world. Discussion of contemporary foreign policy issues and responses. 4 lectures.

**POLS 383. Politics of the European Union. 4 units.**

Prerequisite: POLS 225 or POLS 229, or consent of instructor.

History and development of the European Union in the context of theories of regional integration. Overview of institutional and policymaking machinery of the EU. Current issues facing member states. Impact of EU on US interests and world politics more generally. 4 lectures.

**POLS 385. Advanced Model United Nations. 2 units.**

CR/NC

Prerequisite: POLS 285 or consent of instructor.

Preparation for participation in collegiate Model United Nations conferences. Rules of procedure and debate, preparation of country position papers, and resolution writing. Discussion of current issues of concern to the United Nations. Credit/No Credit grading only. Total credit limited to 6 units. 2 lectures.

**POLS 386. Government Internship. 2-12 units.**

CR/NC

Prerequisite: Consent of instructor. Recommended: Junior standing with a minimum 2.5 GPA.

Supervised work experience in a government or related public agency. Intern will function as an employee subject to all the duties and responsibilities of employees engaged in comparable work. 30 hours of work experience per unit of credit. Total credit limited to 12 units. Credit/No Credit grading.

**POLS 395. Advanced Mock Trial. 2 units.**

CR/NC

Prerequisite: Consent of instructor.

Advanced preparation for participation in intercollegiate mock trial competitions. Emphasis on advanced topics and techniques related to evidence, trial procedure, objections, and witness examination. Extensive hands-on practice in arguing a legal case. Credit/No Credit grading only. Total credit limited to 4 units. 2 lectures.

**POLS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, study, or survey of selected problems. Total credit limited to 4 units.

**POLS 419. Social Movements and Political Protest. 4 units.**

Prerequisite: Completion of GE D1. Recommended: POLS 112.

Selected U.S. social movements, including abolitionism, feminism, civil rights, gay rights, the Christian right, and environmentalism. Political opportunities and constraints that impact collective political action, and effects of grassroots struggles for justice in U.S. politics and society. 4 lectures.

**POLS 420. Contemporary U.S. Foreign Policy. 4 units.**

Prerequisite: POLS 225 or POLS 229.

Historical influences and theoretical assumptions behind U.S. foreign policy. Examination of American power and influence, examining key concepts from public opinion, business interests, executive privilege, diplomacy, propaganda, trade, and military strategies. 4 lectures.

**POLS 426. International Organizations and Law. 4 units.**

Prerequisite: POLS 225 or POLS 229.

Analysis of contemporary international legal issues, such as arms control and nonproliferation, intellectual property rights and the World Trade Organization, and human rights and the United Nations. Case studies drawn from advancements in the biological sciences, such as those affecting public health. 4 lectures.

**POLS 427. Politics of the Global Economy. 4 units.**

Prerequisite: POLS 225, completion of GE D2, or consent of instructor.

Political conflicts surrounding the trading, financial, and security structures of the international economy. Motivations, resources, and responses of states, international organizations, multinational corporations and other nonstate actors as they address economic, political, environmental, and security issues within these structures. Desirability and inevitability of globalization. 3 lectures and a research paper.

**POLS 428. Issues and Topics in Comparative Politics. 4 units.**

Prerequisite: POLS 229 or consent of instructor.

Selected topics and issues in the field of comparative politics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**POLS 429. Issues and Topics in International Relations. 4 units.**

Prerequisite: POLS 225 or consent of instructor.

Selected topics and issues in the field of international relations. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**POLS 430. Advanced Topics in Political Theory. 4 units.**

Prerequisite: POLS 230 or consent of instructor.

In-depth examination of a theme or thinker in political theory. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**POLS 431. Issues and Topics in American Politics. 4 units.**

Prerequisite: POLS 112 and junior standing, or consent of instructor.

Selected topics and issues in the field of American politics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**POLS 451. Technology and Public Policy. 4 units.**

Prerequisite: Completion of GE D1. Recommended: POLS 112.

Exploration of the historical and contemporary political influences shaping modern science and technology policy. Addresses sources of technological innovation, such as public-private partnerships, military R & D, democratic governance, and competitiveness among nations. Case studies may include cybersecurity, geoengineering, nanotechnology, and neurosciences. 3 lectures and a research paper.

**POLS 456. Politics and Economic Policy. 4 units.**

Prerequisite: Completion of GE D1. Recommended: POLS 112.

Goals of economic policy, based on efficiency, equity, and other values. Theories of market failure and government regulation. Influence of electoral calculations, bureaucracy, and interest group pressures on government approaches to address market failures. Government intervention in the marketplace, and intervention by economic interests into politics, and how this challenges democracy 3 lectures and a research paper.

**POLS 459. The Politics of Poverty. 4 units.**

Prerequisite: Completion of GE D1. Recommended: POLS 112.

Analysis of the politics and policies associated with the American welfare state, focusing on welfare and homelessness policies. Exploration of the causes of poverty and how social policy responds to poverty. 4 lectures.

**POLS 461. Senior Project I. 2 units.**

Prerequisite: POLS 359, POLS 361, and senior standing.

Selection and completion of a project under faculty supervision. Project results presented in a formal paper.

**POLS 462. Senior Project II. 2 units.**

Prerequisite: POLS 359, POLS 361, and senior standing.

Selection and completion of a project under faculty supervision. Project results presented in a formal paper.

**POLS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: POLS 112 and junior standing, or consent of instructor.

Directed courses on timely issues and topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1-4 lectures.

**POLS 471. Urban Politics. 4 units.**

Prerequisite: POLS 112, or consent of instructor.

Theoretical approaches, concepts, and politics associated with urban governments. Urban power structures, the relationship between urban society and politics, and inter-governmental relations. 3 lectures and a research paper.

**POLS 500. Independent Study. 1-4 units.**

Prerequisite: Graduate standing with minimum of 12 units.

Individual research, studies, or surveys under the supervision of the faculty. Total credit limited to 4 units.

**POLS 510. Research Design. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Approaches to policy research, question development, hypothesis framing, literature reviews, sampling, measurement, and approaches to analysis. 4 lectures.

**POLS 515. Public Policy. 4 units.**

Prerequisite: Graduate standing, or consent of instructor.

Theoretical and practical approaches to public policy making and contemporary policy issues such as markets; regulation; criminal justice; housing; environment; poverty; health care and education. 4 lectures.

**POLS 516. Public Finance. 4 units.**

Prerequisite: POLS 515, or consent of instructor.

Economic and political factors affecting federal, state and local governments. Intergovernmental relations and policy considerations in finance, debt management and tax administration. 4 lectures.

**POLS 517. Organizational Theory. 4 units.**

Prerequisite: POLS 515, or consent of instructor.

Major theoretical approaches, concepts, case studies, and debates related to organizational theory. Emphasis on applications of concepts to public and non-profit organizations. 4 lectures.

**POLS 518. Public Policy Analysis. 5 units.**

Prerequisite: POLS 560.

Contextual, problem oriented analysis of the societal problems and possible solutions to them. Development and use of concepts and tools related to policy evaluation with particular emphasis on qualitative methods. 4 lectures, 1 activity.

**POLS 540. Leadership and Management in Public Policy. 4 units.**

Prerequisite: POLS 515 and graduate standing or consent of instructor.

An exploration of the changing notion of leadership in public policy. Focus on understanding and developing leadership capacity within the complex inter-organizational structure in which the student works. 4 seminars.

**POLS 550. Regulatory and Economic Policy. 4 units.**

Prerequisite: POLS 515.

Theories of regulatory and economic policy, including markets and market failures, politics of economic policy, and applications of government regulatory and economic policy, and skills and experience necessary to social and economic questions. 4 seminars.

**POLS 560. Quantitative Methods. 5 units.**

Prerequisite: Graduate standing or consent of instructor.

Social science methodology focusing on research design and quantitative methods used in policy and political research, such as multi-regression, non-linear techniques, diagnostics and time series. Advanced computer packages used to analyze challenging data sets. 4 lectures, 1 activity.

**POLS 568. Topics and Issues in Public Policy. 4 units.**

Prerequisite: POLS 515 or consent of instructor.

Selected advanced topics applicable to public policy problems. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 3 seminars and a research project.

**POLS 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**POLS 586. Policy Internship. 4-8 units.**

CR/NC

Prerequisite: Completion of 12 units in the Master of Public Policy Program, and consent of instructor.

Supervised work experience in a government or related public agency. Intern will function as an employee engaged in comparable work. Credit/No Credit grading only. Total credit limited to 8 units.

**POLS 590. Graduate Seminar. 4 units.**

Prerequisite: POLS 560 or consent of instructor.

Seminar designed as a culminating component to the Master of Public Policy Program. Individual research under the supervision of the faculty within a small discussion environment, leading to a graduate project or paper that demonstrates practical mastery of the MPP curriculum. Total credit limited to 8 units. 4 seminars.

**POLS 595. Directed Readings for MPP Comprehensive Exams. 2 units.**

CR/NC

Prerequisite: POLS 590.

Directed readings and preparation for Master of Public Policy (MPP) comprehensive exams. Regular consultation between advisor and student. Credit/No Credit grading only. 2 seminars.

## Psychology (PSY)

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### Psychology Courses

**PSY 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: PSY 201 or PSY 202 and consent of department head.

Individual investigation, research, study or survey of selected problems in consultation and with prior approval of instructor. Written report required. Total credit limited to 4 units.

**PSY 201. General Psychology. 4 units.**

GE Area D4

Introduction to the psychological study of human beings. Applications and research in area such as psychobiology, perception, learning, motivation, consciousness, memory and cognition, personality, emotion, development, psychological assessment, social behavior, psychopathology and psychotherapy. A student may enroll for credit in either PSY 201 or PSY 202, but not both. 4 lectures. Fulfills GE D4.

**PSY 202. General Psychology. 4 units.**

GE Area D4

Introduction to the psychological study of human beings. Applications and research in area such as psychobiology, perception, learning, motivation, consciousness, memory and cognition, personality, emotion, development, psychological assessment, social behavior, psychopathology and psychotherapy. A student may enroll for credit in either PSY 201 or PSY 202, but not both. 3 lectures, 1 discussion. Fulfills GE D4.

**PSY 212. Interpersonal Communication. 4 units.**

Introduction to the interaction process in two-person (dyadic) communication settings. Emphasis on the functions of varying messages in the initiation, development, maintenance and termination of personal and professional relationships. 4 lectures. Crosslisted as COMS/PSY 212.

**PSY 251. Laboratory in Group Activities. 1-3 units.**

CR/NC

Skills and techniques of solving problems in large and small groups. Conducting and reporting meetings. Analyses of leadership dynamics in campus organizations. Credit/No Credit grading only. Total credit limited to 6 units. 1-3 activities.

**PSY 252. Social Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

How attitudes, beliefs, and behavior are affected by the social situation. Gender roles, prejudice, aggression, altruism, attitudes and persuasion, liking and loving, and group behavior. Use of social psychology to understand diversity issues, reduce racism and sexism and international conflict, improve relationships, and communicate persuasively. 4 lectures.

**PSY 254. Family Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Introduction to research and theory on family relationships and behavior across the lifespan. Contextual influences, diversity of family forms, and topics such as love, mate selection, marital quality, parenting, gender, household work, divorce, and remarriage. 4 lectures. Crosslisted as CD/PSY 254.

**PSY 256. Developmental Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Introduction to the scientific study of development with emphasis on the lifespan, from infancy to old age. Basic research and concepts in understanding social, emotional, cognitive, contextual, and diversity influences on development. 4 lectures.

**PSY 260. African American Psychology. 4 units.**

USCP

Recommended: PSY 201 or PSY 202.

A historical overview of African American psychology, and a critical examination of the psychocultural forces (e.g., history of slavery, racism, oppression, education, familial factors) that have helped to shape the beliefs, attitudes, identities, behavior, and well-being of African Americans.

**PSY 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**PSY 301. Psychology of Personal Development. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Application of developmental psychology to self awareness. Includes communication skills, self modification skills and examination of life goals and values. 4 lectures.

**PSY 302. Behavior in Organizations. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Characteristics of functioning organizations and their effects on individuals. Psychological issues relevant to the maintenance of the organization. Motivation, leadership, group phenomena, communication, decision-making, attitudes, personnel selection and organizational change. 4 lectures.

**PSY 303. Intergroup Dialogues. 4 units.**

CR/NC

Prerequisite: Completion of GE Area D1, D3 or D4 or any USCP course.

Weekly semi-structured meetings of students from two distinct identity groups, with trained peer facilitators, in which readings, experiential activities, informed dialogue, and reflective writing are integrated as a means of encouraging self and group awareness and exploring ways to promote just community across difference. Credit/No Credit grading only. 2 lectures, 2 discussions.

**PSY 305. Personality. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Personality theories and research. Assessment, dynamics, and development of personality. Trait, behavioral, social learning, cognitive, humanistic, psychoanalytic and biological approaches. 4 lectures.

**PSY 306. Adolescence. 4 units.**

Prerequisite: PSY 256 or CD/EDUC 207.

Psychological analysis of the years from prepubescence to young adulthood. Current research on behavior and development during adolescence with emphasis on physical, affective, cognitive, sociocultural, historical, family, peer and school aspects of life during the post-child, pre-adult years. 4 lectures. Crosslisted as CD/PSY 306.

**PSY 309. Psychology of Consciousness. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Characteristics and functions of selected, qualitatively unique patterns of consciousness such as hypnosis, meditation, dreaming, drug experiences and parapsychological phenomena, with particular emphasis on adaptive and maladaptive expressions of these states of consciousness. 4 lectures.

**PSY 310. Psychology of Death. 4 units.**

Prerequisite: PSY 201 or PSY 202, or consent of instructor.

Psychological aspects of death, loss and grief, including scientific findings, person-culture transactions and expressions in the arts and humanities. Personal exploration and interdisciplinary application of psychology to issues such as death anxiety, dying processes, funerals, immortality beliefs, suicide, and grieving. 4 lectures.

**PSY 311. Environmental Psychology. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D4 (PSY 201 or PSY 202 recommended). Recommended: Junior standing.

Interrelationship between behavior and the built and natural environments. Evaluating and understanding environments, environmental stress, and the human aspects of environmental problems. 4 lectures. Fulfills GE D5 except for Psychology and Child Development majors.

**PSY 317. Psychology of Stress. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Examines the relationship between stress and psychological and physical well-being. Research on the psychological factors influencing stress as well as a description and critical evaluation of methods of stress reduction. 4 lectures.

**PSY 318. Psychology of Aging. 4 units.**

GE Area D5

Prerequisite: Completion of Area A; any two lower-division GE Area D courses (PSY 201 or PSY 202 recommended). Recommended: Junior standing.

Psychological and physiological aging in the context of the culture. Theories and research relating to the issues of stability and both positive and negative changes in perception, learning, memory, intelligence, personality, identity, motivation, sexuality, family relationships, career. Disorders, institutionalization, death and bereavement. 4 lectures. Fulfills GE D5 except for Psychology and Child Development majors.

**PSY 319. Motivation and Emotion. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Examination of the mechanistic and cognitive-based theories of motivation and emotion. Practical applications of each theory covered in an attempt to understand certain personal and societal behaviors. Research evaluating each theory and diversity consideration. 4 lectures.

**PSY 320. Health Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Scientific study of how mental, behavioral, and social processes affect physical health. Topics include health-risk behaviors and promotion of personal control over health improvement, social status and health disparities, stress and coping, and the patient-provider relationship. 4 lectures.

**PSY 323. The Helping Relationship. 4 units.**

Prerequisite: Junior standing, completion of one USCP course, Psychology and Child Development majors only, or consent of instructor.

Basic skills and approaches common to helping relationships with children, adults, and families. Examines theoretical, empirical, and practical applications of helping. Differentiation between professional, paraprofessional, and nonprofessional helping relationships. 2 lectures, 2 activities.



**PSY 324. Psychology of Gender. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Investigation of psychological gender beyond ideas associated with biological sex. Exploration of sex differences from a social psychological (e.g., socialization) perspective. Implications of both the male and female gender roles for relationships and health. 4 lectures. Crosslisted as PSY/WGS 324.

**PSY 325. Introduction to Positive Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Scientific study of the enhancement of strengths and optimal functioning in humans. Basic research, assessment and helping concepts in understanding optimal functioning within diverse populations. 4 lectures.

**PSY 329. Research Methods in Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202, STAT 217 or STAT 211, or consent of instructor.

Introduction to research methods used in psychology and other behavioral sciences. Topics include the logic and ethics of research; experimental, correlational, and survey methodology; library search strategies; basic statistical procedures; and the format of the research report. 3 lectures, 1 activity.

**PSY 330. Behavioral Effects of Psychoactive Drugs. 4 units.**

Prerequisite: Completion of GE D4.

Pharmacokinetic, pharmacodynamic and behavioral effects of psychoactive drugs. Social and psychological issues related to drug use and misuse. 4 lectures.

**PSY 333. Quantitative Research Methods for the Behavioral Sciences. 3 units.**

Prerequisite: PSY 329 or SOC 333, and STAT 217, or consent of instructor.

Thorough introduction to the quantitative aspects of empirical research. Using SPSS statistical software, students will learn how to choose, conduct, and interpret analyses of research data from different behavioral science disciplines. 2 lectures, 1 activity.

**PSY 339. Psychology of Religion. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Major psychological perspectives on religion, faith, and religious experience. Objective and subjective approaches to the study of religion as related to prayer, meditation, social attitudes, behavior, mental health, mysticism, religious orientation, and personal development. 4 lectures.

**PSY 340. Biopsychology. 4 units.**

GE Area B5

Prerequisite: PSY 201 or PSY 202.

Relationship between physiological and behavioral processes such as learning and memory, language, sleep, and abnormal behavior. Information processing, biochemistry, and structural organization at the cellular and nervous system levels. 4 lectures. Fulfills GE B5.

**PSY 350. Teamwork. 4 units.**

Prerequisite: Completion of GE D4.

Group dynamics applied to teams. Topics include team development, basic team processes, conflict management, decision making, leadership, problem solving, and the impacts of diversity and culture on teams. Focus on effective use of teams in the workplace. Not open to students with credit for PSY 351. 4 lectures.

**PSY 351. Group Dynamics. 4 units.**

Prerequisite: PSY 252 or PSY 323.

Dynamics of small groups. Topics include functions of groups, group structure, power, leadership, intragroup conflict, personal space and territoriality, groups as agents of societal and personal change. Demonstrations emphasizing experiential learning in groups. Not open to students with credit for PSY 350. 2 lectures, 2 activities.

**PSY 352. Conflict Resolution: Violent and Nonviolent. 4 units.**

GE Area D5

Prerequisite: Junior standing; and completion of GE Area A, PSY 201 or PSY 202, and one course from D3.

Psychological, situational, political, and cultural determinants of violence and nonviolence in interpersonal, intergroup, and international conflict. Self-assessment of conflict resolution attitudes, competencies, and behaviors. Negotiation, mediation, and other approaches to conflict management. Educational and structural approaches to violence prevention. 4 lectures. Fulfills GE D5 except for Psychology and Child Development majors.

**PSY 360. Applied Social Psychology. 4 units.**

Prerequisite: PSY 252.

Applications of social psychology to education, business and industry, environmental problems, interpersonal and intergroup relations, health and welfare, mass communication, judicial systems, and politics. Analysis of social and organizational problems, methods of intervention, and program evaluation. 4 seminars.

**PSY 370. Introduction to Clinical and Counseling Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202 and at least one other PSY course.

Introduction to the fields of clinical and counseling psychology. History, education and training, theories, assessment, diagnosis, and treatment. Introduction to diverse settings, ethical principles, legal guidelines, credentialing and employment opportunities. 4 lectures.

**PSY 372. Multicultural Psychology. 4 units.**

USCP

Prerequisite: PSY 201 or PSY 202; and sophomore standing.

The impact of culture, ethnicity, and race on human behavior within the framework of psychological theory and research. Emphasis on ethnic minority groups within the U.S. including: African Americans, Native Americans, Asian Americans/Pacific Islanders, and Latino/a Americans. Not open to students in MS Psychology program. 4 seminars. Formerly PSY 472.

**PSY 375. Forensic Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Application and practice of psychology in both the civil and criminal justice systems. Examination of police and investigative psychology, correctional psychology, expert witness testimony, psychological evaluations for the courts, understanding aggression. 4 lectures.

**PSY 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: PSY 201 or PSY 202.

Individual investigation, research, study or survey of selected problems in consultation and with prior approval of instructor. Written report required. Total credit limited to 4 units.

**PSY 401. Special Problems: Experiential Learning. 2-4 units.**  
CR/NC

Prerequisite: Psychology major or gerontology minor, junior standing, and consent of instructor.

Supervised experience in various community, governmental, educational, or research settings. Especially designed for individuals in applied settings requiring additional hours or a pre-fieldwork training experience. Applied psychological, developmental, or educational experiences determined by participating institution, supervising faculty member, and student. Cannot be substituted for PSY 448, PSY 449, PSY 453, or PSY 454. Credit/No Credit grading only. Total credit limited to 4 units.

**PSY 405. Abnormal Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Normal and abnormal behavior in everyday life. Anxiety, somatoform, dissociative, mood, childhood, personality, psychotic, cognitive, eating, and substance use disorders and their treatment. 4 lectures.

**PSY 410. History and Systems of Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202, PSY 305, PSY 458 or consent of instructor.

Survey of the philosophical and scientific roots of modern psychology, pioneer laboratories, systems, and schools of psychology, the refining of experimental methods, and applications of psychology in testing and psychological services. Examination of contributions by women and minorities in psychology. 4 seminars.

**PSY 413. Parent-Child Relationships. 4 units.**

Prerequisite: PSY 256, junior standing.

Application of major theories to understanding of parent-child relations. Examination of primary prevention strategies and programs. Review of current research and evaluation of literature on parent-child interactions. 4 lectures.

**PSY 419. Self and Identity. 4 units.**

Prerequisite: PSY 256 or PSY 305 and senior standing.

Concepts, theories, and research related to the development of the self across the lifespan. Examination of the influence of temperament, culture, individuation, self-esteem, self-awareness, roles and identity on maturity. 4 seminars.

**PSY 420. Social and Emotional Development. 4 units.**

Prerequisite: PSY 256 or consent of instructor.

Analysis of the development of social interaction and emotional processes across the lifespan. Research and theories on such behaviors as attachment and love, empathy and altruism, competition and aggression, peer relations and cooperation. 4 seminars.

**PSY 421. Language and Cognitive Development. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Examination of significant processes in the development of cognition across the lifespan. Theory and research regarding Piagetian theory, information processing, problem solving, creativity, and language development. Educational and counseling applications. 4 seminars.

**PSY 422. Lifespan Sexuality. 4 units.**

Prerequisite: PSY 201 or PSY 202, or PSY 205, and junior standing.

Sexual interest, activity, and functioning from birth through the late adult years. Influence of sexual roles, attitudes, and adaptation during the life span. Sexual practices in our society. Therapies for enhancing a comfortable sexuality. 4 lectures.

**PSY 430. Sensation and Perception. 4 units.**

Prerequisite: PSY 340.

Principles of sensory systems, psychophysics, attention and the perception of color, shape, movement, space, and time. Survey of the development of perception through the lifespan. 4 lectures.

**PSY 431. Assessing Children's Development and Environments. 4 units.**

Prerequisite: CD 304 and CD 305 or two of the following: PSY 419, PSY 420, PSY 421; and CD 329 or PSY 329.

Current developmental and environmental assessments used in childcare and educational settings and in research. Practice using, creating, and evaluating child assessments. 3 lectures, 1 activity. Crosslisted as CD/PSY 431.

**PSY 432. Psychological Testing. 4 units.**

Prerequisite: PSY 333.

Theory and practice of psychological measurement and testing. Principles of test construction, administration, and interpretation. Survey of common testing domains such as intelligence, scholastic aptitude and achievement, and personality. 4 lectures.

**PSY 448. Research Internship I. 5 units.**

CR/NC

Prerequisite: PSY 329, PSY 333, Psychology and Child Development majors only, junior standing, and consent of instructor. Recommended: PSY 366.

Faculty-supervised research experience on various topics in psychology. Student apprenticeship with a department faculty member to conduct research. Responsibilities include some or all of the following: collecting data, entering and/or analyzing data, electronic literature search, report writing. Credit/No Credit grading only.

**PSY 449. Research Internship II. 5 units.**

CR/NC

Prerequisite: PSY 329, PSY 333, Psychology and Child Development majors only, junior standing, and consent of instructor. Recommended: PSY 366.

Faculty-supervised research experience on various topics in psychology. Student apprenticeship with a department faculty member to conduct research. Responsibilities include some or all of the following: collecting data, entering and/or analyzing data, electronic literature search, report writing. Credit/No Credit grading only.

**PSY 450. Family Intervention. 4 units.**

Prerequisite: PSY 254, or graduate standing.

Basic elements of marriage and family therapy and crisis intervention. Emphasis on concepts, goals, and techniques of various family therapy approaches and family crisis intervention. 4 lectures.

**PSY 453. Supervised Fieldwork I. 5 units.**

CR/NC

Prerequisite: PSY 323, Psychology and Child Development majors only, junior standing, and consent of instructor.

Supervised fieldwork experience in various community, governmental, and educational settings. Applied psychological, developmental, or educational experiences determined by participating institution, supervising faculty member, and student. Credit/No Credit grading only.

**PSY 454. Supervised Field Work II. 5 units.**

CR/NC

Prerequisite: PSY 323, Psychology and Child Development majors only, junior standing, and consent of instructor.

Supervised fieldwork experience in various community, governmental, and educational settings. Applied psychological, developmental, or educational experiences determined by participating institution, supervising faculty member, and student. Credit/No Credit grading only.

**PSY 456. Behavioral Disorders in Childhood. 4 units.**

Prerequisite: PSY 201 or PSY 202, junior standing.

Applications of psychological principles to childhood behavioral disorders. Aggression, delinquency, stress reactions, motivational, perceptual-attentional deficiencies, psychoses, anxiety disorders, biological dysfunctions, and retarded social and cognitive development. 4 seminars.

**PSY 457. Memory and Cognition. 4 units.**

Prerequisite: PSY 333.

Principles and theories of memory and cognition including processes; models of perception, attention and memory; concept formation; language; intelligence; problem-solving and decision making; creativity; applications to areas such as law, artificial intelligence, and education. 4 lectures.

**PSY 458. Learning. 4 units.**

Prerequisite: PSY 333.

Theoretical and philosophical foundations of the experimental analysis of behavior. Principles of classical and operant conditioning including aversive control of behavior through punishment and avoidance learning and the theoretical basis for behavior therapy techniques and applications of learning principles in education and health settings. 4 lectures.

**PSY 459. Lifespan Theories. 4 units.**

Prerequisite: PSY 201 or PSY 202, junior standing.

Comparative study of theories that have been offered as explanations for lifespan development. Controversial issues, evaluations and applications of theories. Emphasis on biological, psychological, and social aspects of lifespan development. 4 seminars.

**PSY 460. Child Abuse and Neglect. 4 units.**

Prerequisite: PSY 201 or PSY 202 and junior standing.

Issues in child maltreatment, including definitions and forms, causes, consequences, assessment, reporting, treatment, and prevention. Possible links among research, intervention, and public policy will be emphasized. 4 seminars.

**PSY 461. Senior Project Seminar. 1 unit.**

CR/NC

Prerequisite: Senior standing; PSY 329; Psychology and Child Development majors only.

Discussion of occupational and graduate school opportunities and of current issues in psychology for the purpose of defining professional objectives and individual projects for PSY 462. Senior project progress reports with class critique. Credit/No Credit grading only. 1 seminar.

**PSY 462. Senior Project. 3 units.**

Prerequisite: PSY 461; Psychology and Child Development majors only.

Design and completion of a faculty-supervised project in psychology. The project must be presented in a formal, written report. Minimum of 90 hours total time.

**PSY 465. Cross-Cultural Issues in Psychology. 4 units.**

Prerequisite: PSY 201 or PSY 202 and junior standing.

Psychological, cultural, ecological and behavioral influences on human development in different cultural settings. Focuses on from one to three different cultures outside the U.S. in any given quarter. 4 seminars.

**PSY 470. Selected Advanced Topics. 4 units.**

Prerequisite: Junior standing and consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 seminars.

**PSY 475. The Social Psychology of Prejudice. 4 units.**

USCP

Prerequisite: PSY 252 or PSY 254 or PSY 256.

Examination of social psychological frameworks for understanding the origins and consequences of prejudice and ways to improve relationships between people who come from different social groups (e.g., race, ethnicity, class, age, sexual orientation, gender). 4 lectures. Fulfills USCP.

**PSY 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 12 units. Credit/No Credit grading only.

**PSY 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 12 units. Credit/No Credit grading only.

**PSY 500. Individual Study. 1-6 units.**

Prerequisite: Consent of department head, graduate major advisor and supervising faculty member.

Advanced study planned and completed under the direction of a member of the department faculty. Open only to graduate students who have demonstrated ability to do independent work. Enrollment by petition. Only 6 units may be applied to degree requirements.

**PSY 504. Psychopharmacology. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Advanced course in brain-behavior relationships. Neuropathology of brain disorders including the neurochemical etiology and treatment of mental illness and chemical dependency. 4 seminars.

**PSY 555. Counseling & Communication. 4 units.**

Prerequisite: PSY 560 and admission to MS Psychology program.

Overview of the counseling profession, history, philosophy, theory, and ethics. Emphasis on developing interviewing, assessment and communication skills. Required practicum. 3 seminars, 1 activity.

**PSY 556. Multicultural Counseling and Psychology. 4 units.**

Prerequisite: PSY 555, PSY 560 and admission to MS Psychology program.

Psychological, cultural, and ecological analysis of the experiences and histories of various cultural groups within the United States. Development of personal self-awareness of multicultural issues and culturally relevant counseling skills. 4 seminars.

**PSY 560. Individual Therapy: Theory and Application. 4 units.**

Prerequisite: Admission to MS Psychology program.

Counseling theories and concepts applied to individuals. Develop skills in interviewing, assessment, intervention selection, termination and crisis intervention. Ethics and law included. 4 seminars.

**PSY 564. Ethics and the Law: MF Therapy. 4 units.**

Prerequisite: PSY 450, PSY 560 and admission to MS Psychology program.

Ethical, legal and case management issues related to individual, child, family and group therapy. Client rights and professional orientation to ethical standards and state regulation of clinical practice. 4 seminars.

**PSY 565. Diagnosis and Treatment: Psychopathology. 4 units.**

Prerequisite: PSY 560 and admission to MS Psychology program.

Assessment of mental status. Diagnostic and statistical Manual of Mental Disorders, treatment planning, treatment case documentation and research applied to client psychopathology. 4 seminars.

**PSY 566. Group Therapy: Theory and Application. 4 units.**

Prerequisite: PSY 560 and admission to MS Psychology program.

Group therapy theory, leadership and research applied to client assessment, screening, treatment selection, evaluation and termination. Ethics, law included. 4 seminars.

**PSY 568. Advanced Psychotherapies. 4 units.**

Prerequisite: PSY 555, PSY 560, PSY 565 and admission to MS Psychology program, or consent of instructor.

Theory and application of advanced approaches in psychotherapy, including, but not limited to: cognitive-behavioral therapies, psychodynamic therapies and humanistic/existential therapies. The Schedule of Classes will list therapy selected. Total credit limited to 12 units. 4 seminars.

**PSY 569. Counseling Clinic Practicum. 3 units.**

CR/NC

Prerequisite: PSY 450, PSY 555, PSY 560, PSY 565 and admission to MS Psychology program.

Applied experience and instruction in assessment, diagnosis, treatment planning and treatment of individuals, couples, families and children under direct supervision of faculty in program clinic. Weekly meetings. Total credit limited to 12 units. Credit/No Credit grading only.

**PSY 570. Selected Advanced Topics. 4 units.**

Prerequisite: Admission to MS Psychology program or consent of instructor.

Directed group study of selected topics for advanced students. Open to graduate students and selected seniors. Class Schedule will list topic selected. Total credit limited to 8 units. 4 seminars.

**PSY 571. Advanced Family Therapy: Theory and Application. 4 units.**

Prerequisite: PSY 450, PSY 555 and admission to MS Psychology program.

Theory and application of process, structural and systems approaches to family and couple therapy. Assessment, diagnosis, treatment and follow-up of family and couple therapy. Ethics and law related to family therapy. 4 seminars.

**PSY 572. Child and Adolescent Therapy: Theory and Application. 4 units.**

Prerequisite: PSY 456, PSY 555, PSY 560 and admission to MS Psychology program.

Assessment, diagnosis, treatment planning and therapeutic modalities appropriate for children and adolescents. Both theoretically based and empirically based treatment approaches presented. Instruction in the assessment and treatment of abuse and neglect of children with relevant ethics and law. 4 seminars.

**PSY 574. Psychological Assessment. 4 units.**

Prerequisite: Admission to MS Psychology program.

Administration, scoring and interpretation of psychological tests. Reliability and validity of psychological measures. Ethical and cultural issues in testing. 4 seminars.

**PSY 575. Gender, Couple and Sexual Dysfunction Therapy. 4 units.**

Prerequisite: PSY 450, PSY 560 and admission to MS Psychology program.

Antecedents to sex-role identity, gender aware therapy, couple therapy, treatment of spousal abuse, assessment, diagnosis, treatment of sexual dysfunction. 4 seminars.

**PSY 576. Traineeship: Marital and Family Therapy. 4 units.**  
CR/NC

Prerequisite: PSY 569, PSY 564 and consent of MS program committee.

Supervised experience in applied psychotherapeutic techniques, assessment, diagnosis and treatment of individual, marital, family and child relationship problems. Total credit limited to 16 units. Credit/No Credit grading only. Weekly seminar with on-site and university supervisors.

**PSY 577. Community Mental Health: Issues and Practices. 4 units.**

Prerequisite: Admission to the MS Program in Psychology; PSY 456, PSY 555, PSY 556, and PSY 560.

An overview of community mental health as envisioned via California's Mental Health Services Act. Examination of the opportunities and challenges in delivering effective mental health services in publicly-funded setting. Exploration of concepts and practices in contemporary public mental healthy, including innovative approaches. 4 seminars.

**PSY 585. Research Methods for Counseling Psychology. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Research methods relevant to practitioners in counseling psychology and human services. Basic understanding of descriptive and inferential statistics as well as applications related to these topics. 4 seminars.

**PSY 588. Substance Abuse: Assessment and Treatment. 4 units.**

Prerequisite: Graduate standing and PSY 560, PSY 565, PSY 574, or consent of instructor.

Etiological, assessment, diagnostic, and treatment models of chemical depend-ency. Comparison of disease/medical, psychodynamic, cognitive/ behavioral, humanistic, existential, and sociocultural approaches. Differential diagnosis, co-morbidity with other conditions, and associated factors. 4 seminars.

**PSY 599. Thesis. 2-4 units.**

Prerequisite: PSY 585 and advancement to candidacy.

Completion of a thesis pertinent to the fields of psychology and human services. Total credit limited to 8 units.

## Recreation, Parks and Tourism Administration (RPTA)

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### Recreation, Parks and Tourism Administration Courses

**RPTA 101. Introduction to Recreation, Parks and Tourism. 4 units.**

Prerequisite: RPTA or FNR majors only.

History, philosophy, theory, and organization of recreation and leisure services. Exploration of the recreation, parks, and tourism profession; emphasis upon functions, areas, facilities, clientele, and career opportunities. 4 lectures.

**RPTA 110. Career Planning in Recreation, Parks and Tourism. 1 unit.**

CR/NC

Prerequisite: Recreation, parks and tourism administration majors only.

Development and application of philosophy, learning strategies, and problem solving for career planning in recreation, parks, and tourism. Credit/No Credit grading only. 1 activity.

**RPTA 112. Parks and Outdoor Recreation. 4 units.**

Introduction to park and outdoor recreation systems. History, philosophy, policy and principles of outdoor recreation, wilderness, park management, environmental education, outdoor education, and natural resources recreation at the local, regional, national, and international levels. Field visits. 3 lectures, 1 activity.

**RPTA 127. Leisure Behavior. 4 units.**

Prerequisite: RPTA majors only.

Sociological, psychological, and cultural aspects of leisure behavior. Needs, motivations, constraints, values and benefits explored. 4 lectures.

**RPTA 160. Introduction to Sport Management. 4 units.**

Prerequisite: Sophomore standing.

Introduction to the philosophy, organization, issues and career paths of sport management. Emphasis on ethical decision-making and career opportunities in youth, interscholastic, intercollegiate, professional, and international sport. 4 lectures.

**RPTA 203. Resource Law Enforcement. 3 units.**

Law enforcement applied to natural resource conservation on public and private lands. Examination of state and federal laws related to fish and wildlife management. Problems associated with implementation of resource laws examined. 3 lectures. Crosslisted as NR/RPTA 203.

**RPTA 205. Leadership and Facilitation. 4 units.**

Prerequisite: RPTA or FNR majors only, sophomore standing or consent of instructor.

Recreation, parks, and tourism leadership with small and large groups. Skills, knowledge, and abilities required of effective leaders in leisure organizations and settings. 3 lectures, 1 activity.

**RPTA 210. Introduction to Program Design. 4 units.**

Prerequisite: RPTA or FNR majors only, sophomore standing or consent of instructor.

Methods of program planning, organization, implementation and evaluation in public and private settings. Interrelationship of needs and interests of people, physical settings, and activity content. Emphasis on program construction and scheduling in recreation, parks, and tourism services. 3 lectures, 1 activity. Not open to students with credit in RPTA 260.

**RPTA 214. Introduction to Hospitality and Travel. 4 units.**

Corequisite: RPTA 210 or RPTA 260.

History and development of hospitality and tourism. Examination of different sectors of the hospitality and tourism industry. Supply and demand for tourism products and services. Effects of tourism on individual cultures and the natural environment. Travel motivations. Career opportunities in the hospitality and travel industries. Field visits required. 4 lectures.



**RPTA 221. Professionalism and Customer Service. 4 units.**

Prerequisite: RPTA major; sophomore standing.

Emphasis on professional service qualities and behaviors in a variety of recreation, parks, and tourism environments. Focus on development and delivery of customer service strategies to create a service-focused organization. Development of competencies to enhance participant experience. 4 lectures.

**RPTA 252. Therapeutic Recreation and Special Populations. 4 units.**

Prerequisite: Recreation, Parks, and Tourism Administration majors only, sophomore standing or consent of instructor.

Introduction to special populations and therapeutic recreation. Specialized leadership and communication techniques. Modification requirements for programs, areas, facilities, equipment, and supplies. Exploration of disability rights issues, including legislation which impacts the delivery of recreation and leisure services. 3 lectures, 1 activity.

**RPTA 257. Leadership and Diverse Groups. 4 units.**

Prerequisite: RPTA major; sophomore standing.

Development and application of leadership skills in recreation activity settings. Emphasis on applicable leadership techniques for working with groups consisting of representatives from diverse populations such as those with disabilities or special needs, cultural and social differences, and diversity of ages. 3 lectures, 1 activity.

**RPTA 260. Recreational Sport Programming. 4 units.**

Prerequisite: RPTA majors only, sophomore standing.

Philosophy, foundations, policy and techniques underlying recreational sport programs in public, private and commercial settings. Methods of program planning, organization, implementation and evaluation with emphasis on program construction and scheduling. Not open to students with credit in RPTA 210. 3 lectures, 1 activity.

**RPTA 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**RPTA 275. Challenge Course Facilitation. 2 units.**

Prerequisite: MSL 103 or RPTA 205 or RPTA 257.

Techniques and models used in challenge course leadership and facilitation. Emphasis on facilitation styles, challenge course terminology, facilitation models, safety guidelines, and industry best practices. 2 seminars. Crosslisted as MSL/RPTA 275.

**RPTA 302. Environmental and Wilderness Education. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better, junior standing or consent of instructor.

Education and teaching techniques that apply to learning experiences in an outdoor environment. Impact of natural resource usage that affects sociological, biological and physical resources. Educational strategies for presenting environmental learning to grades K-12 in selected environments. 3 lectures, 1 activity.

**RPTA 313. Sustainability in Recreation, Parks, and Tourism. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better, junior standing or consent of instructor.

Investigation of the recreation, parks, tourism, and leisure services-related industry from a sustainability perspective. Emphasis on facility design, industry practices, and services provisions in the RPTA field that sustain social, cultural, heritage, and natural environments while generating economic development. 3 lectures, 1 laboratory.

**RPTA 314. Sustainable Travel and Tourism Planning. 4 units.**

Prerequisite: RPTA 210 or RPTA 260, RPTA 214 with C- or better, junior standing or consent of instructor.

The planning and development of tourism destinations, agencies, and services from a sustainable development perspective. Emphasis on the economic, social and environmental impacts of tourism. Examination of alternative forms of tourism. Emphasis on sustainable tourism. Travel research and planning models. Field visits required. 3 lectures, 1 laboratory.

**RPTA 316. Resort and Lodging Operations. 4 units.**

Prerequisite: RPTA 214 or consent of instructor.

History, economics, and significance of resort and lodging operations. Emphasis on the examination of the technical operations integral to resort and lodging: food, beverage and restaurant; housekeeping and engineering; sales and catering departments; staff management and classification system statewide, nationally, and internationally. Field visits required; students may be required to provide own transportation. 3 lectures, 1 activity.

**RPTA 317. Hospitality, Convention and Meeting Management. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better, junior standing or consent of instructor.

Role of conventions, meetings management, and events in the hospitality and travel industry. Factors involved in meeting planning for small and large groups to include committees, amenities, operations logistics, venue selection, technology, virtual meetings, registration, catering arrangements, sustainable operations and evaluation. Field visits required. 3 lectures, 1 activity.

**RPTA 320. Special Event Planning. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 for RPTA majors or completion of GE Area A for all other majors; and junior standing.

Major trends and successful practices in festival and event planning. Emphasis on conceptualization, analysis, and planning considerations of small to large-scale community events. Exploration of event management field as a profession. 3 lectures, 1 activity.

**RPTA 321. Visitor Services in Recreation, Parks and Tourism. 1-4 units.**

Prerequisite: RPTA 210 or RPTA 260.

Management issues in meeting the needs of recreation, parks, and tourism organizations. Topics to include customer satisfaction, service quality, visitor management, customer service skills and procedures, and creating a customer focused organization. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 1-4 seminars.

**RPTA 325. Outdoor and Adventure Leadership. 4 units.**

Prerequisite: RPTA 205 or RPTA 257; and junior standing or consent of instructor.

Theoretical principles and experience in leadership, judgment, and decision-making in outdoor and adventure settings. Total credit limited to 8 units. The Schedule of Classes will list topic selected. 3 lectures, 1 activity.

**RPTA 330. Directed Field Experience. 3 units.**

CR/NC

Prerequisite: RPTA 210 or RPTA 260 with C- or better and consent of instructor.

Practical work experience in related phases of recreation administration in organization or agency under qualified supervision. Minimum of nine hours per week. Credit/No Credit grading only. Total credit limited to 9 units.

**RPTA 342. Risk Management for Recreation, Parks and Tourism. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better, junior standing.

Legislative and legal aspects of public, private, commercial, and non-profit recreation, parks, and tourism agencies. Emphasis on risk management, including liability, insurance, and negligence. Understanding of legal foundations and the legislative process. Field trips may be required. 3 lectures, 1 laboratory.

**RPTA 350. Recreation Areas and Facilities Management. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better, junior standing or consent of instructor.

Management of recreation areas and facilities: clientele considerations, facility and outdoor area site planning; day-to-day operations of common recreation areas and facilities. Agency visitation required. 3 lectures, 1 laboratory.

**RPTA 360. Assessment and Evaluation of Recreation, Parks and Tourism. 4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better or consent of instructor, STAT 217 or STAT 218 or STAT 251 or STAT 252, junior standing. Recommended: CSC 110 or CSC 113.

Evaluation of recreation, parks, and tourism programs using a variety of research methodologies. Needs assessment, program evaluation, research design, and decision making based on data analysis. 3 lectures, 1 laboratory.

**RPTA 370. Experiential Marketing Strategies for Recreation, Parks, and Tourism Services. 4 units.**

Prerequisite: RPTA 210 or RPTA 260; BUS 346; and Junior standing.

Core principles of experiential marketing within the realm of destination management, recreation programming, environmental interpretation, and special events. Emphasis on strategies to actively engage consumers in recreation, parks, and tourism settings. 4 lectures.

**RPTA 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: RPTA 210 or RPTA 260 with C- or better and consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**RPTA 405. Recreation, Parks and Tourism Management. 4 units.**

Prerequisite: RPTA 205 or RPTA 257; and RPTA 210 or RPTA 260; and senior standing or consent of instructor.

The study, analysis, and practice of management processes as they are applied to recreation organizations: planning, organizing, motivating, and controlling. Emphasis upon application of theories, practices and case studies in specific recreation settings. 4 lectures.

**RPTA 410. Resource Recreation Management. 4 units.**

Prerequisite: FNR 112 or consent of instructor.

Practices of management of resource recreation on private and public lands. Consideration of the following management systems: biophysical, user/visitor, facilities, equipment, fiscal, personnel will be made in the provision of resource recreation services. Case studies in mass recreation and wilderness areas will be examined. 3 lectures, 1 laboratory. Some weekend labs necessary.

**RPTA 412. Tourism and Outdoor Applications Seminar. 2-4 units.**

Prerequisite: RPTA 210 or RPTA 260, or consent of instructor.

Selected topics on aspects of the tourism field. The Schedule of Classes will list topic selected. Field visits may be required. Total credit limited to 12 units, repeatable in same term. 2-4 seminars.

**RPTA 413. Tourism and Protected Area Management. 4 units.**

Prerequisite: RPTA 210 or RPTA 260, or consent of instructor.

Practices of tourism and recreation management in protected areas. History and principles of protected areas. Social, cultural, economic, and environmental benefits of and risks to protected areas and communities. Environmental stewardship in tourism and recreation management worldwide. 3 lectures, 1 laboratory.

**RPTA 414. Commercial Recreation Enterprise. 4 units.**

Prerequisite: BUS 212, BUS 346, RPTA 210 or RPTA 260 with C- or better and senior standing.

Development of the domains of commercial recreation and related services. Role of entrepreneurial activity. Procedures for creating and managing a socially responsible commercial leisure service. 4 lectures.

**RPTA 415. Adventure Programming and Planning. 4 units.**

Prerequisite: RPTA 210 or RPTA 260, or consent of instructor.

Exploration of the history, benefits, characteristics, goals, models, and applications of adventure programs. Emphasis on wilderness and outdoor programs, adventure tourism, inclusive programs, adventure education, planning, management, and implementation. 3 lectures, 1 activity.

**RPTA 420. Festival and Event Management. 4 units.**

Prerequisite: RPTA 210 or RPTA 260, junior standing, or consent of instructor.

Management strategies and practices for small to large scale community festivals and events. Emphasis on sponsorship, marketing, staffing, production, and budgeting. 4 lectures.

**RPTA 424. Financing Recreation, Parks and Tourism Services. 4 units.**

Prerequisite: BUS 212, RPTA 360 with C- or better, or consent of instructor, senior standing. Recommended: ENGL 310.

Financing leisure products and services in public, private, commercial and voluntary settings. Emphasis on sources and methods of financing; operational/ financial cost analysis; forecasting, budgeting, pricing and fiscal master planning through use of computer technology. 4 lectures.

**RPTA 430. Sports Field Construction and Management. 4 units.**

Prerequisite: EHS 343, and junior standing.

Construction and maintenance of sports fields. Basic agronomics including sports field construction, sports turf establishment and maintenance, environmental issues, and personnel management. 3 lectures, 1 laboratory. Crosslisted as EHS/RPTA 430.

**RPTA 450. Resource and Grant Development. 4 units.**

Prerequisite: Junior standing.

Principles of all aspects of grantsmanship; researching grant funding resources from both the private and public sector, preparing the grant proposal, and grant administration. Field visits required. 4 lectures.

**RPTA 460. Senior Project in Recreation, Parks, and Tourism. 4 units.**

Prerequisite: RPTA 360 with a C- or better; ENGL 310; and senior standing.

Selection and completion of an individual senior project. Ability to collect data and/or synthesize and evaluate information and draw conclusions based on that process. Project results are presented in a formal oral and written report. Project design, literature review, information collection and synthesis management, and computer applications. 3 lectures, 1 laboratory.

**RPTA 461. Senior Project. 3 units.**

Prerequisite: Senior standing and completion of RPTA 460 with C- or better or consent of instructor.

Completion, under faculty supervision, of an investigative project typical of problems which graduates must solve in their fields of employment. Required minimum of 90 hours. Analytical, formal report is required.

**RPTA 463. Pre-Internship Seminar. 1 unit.**

CR/NC

Prerequisite: RPTA majors only and senior standing. Recommended: enrollment two quarters prior to RPTA 465.

Exploration of internship opportunities and practices. Internship selection process and procedures introduced. Credit/No Credit grading only. 1 seminar.

**RPTA 465. Internship. 6 units.**

CR/NC

Prerequisite: Minimum GPA of 2.0; 1,000 verified hours of advisor-approved paid and/or volunteer experience subsequent to high school; completion of all university coursework other than Internship; approval of Internship Coordinator.

400 hours of full-time concentration-specific practical work experience over a ten-week period in an approved agency. Comprehensive involvement in agency program. Credit/No Credit grading only.

**RPTA 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to under-graduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.

**RPTA 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to graduate and undergraduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**RPTA 472. Leadership Practice. 1 unit.**

Prerequisite: Junior standing or consent of instructor.

Leadership styles used in the natural resources management and recreation administration professions. Study and practice in setting goals and objectives; developing, evaluating and implementing an entrepreneurial project plan; decision making and problem-solving. Total credit limited to 4 units. 1 laboratory. Crosslisted as NR/RPTA 472.

**RPTA 500. Individual Study. 1-6 units.**

Prerequisite: Graduate standing and consent of department head.

Advanced independent study planned and completed under the direction of a member of the department faculty. Total credit limited to 6 units.

**RPTA 502. Current Issues in Recreation, Parks and Tourism. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Societal issues that influence the management and delivery of recreation, parks, and tourism services. Critical investigation of current research and trends. 4 seminars.

**RPTA 527. Leisure Behavior and Theory. 4 units.**

Prerequisite: Graduate standing.

Theories of recreation and leisure; conceptual and theoretical foundations of leisure; the role of leisure behavior in modern day society. The Schedule of Classes will list topic selected. Constructs that contribute to contemporary understanding of leisure behavior. Connection of theories to individual research. Total credit limited to 8 units. 4 lectures.

**RPTA 539. Graduate Internship in Recreation, Parks and Tourism. 1-9 units.**

Prerequisite: Consent of internship instructor.

Application of theory to the solution of problems of recreation, parks and tourism or related businesses in the field. Analyze specific management problems and perform general management assignments detailed in a contract between the student, the firm or organization, and the faculty advisor before the internship commences. Degree credit limited to 6 units.

**RPTA 570. Selected Topics in Recreation, Parks and Tourism. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1-4 seminars.

**RPTA 571. Selected Advanced Laboratory in Recreation, Parks and Tourism. 1-4 units.**

Prerequisite: Graduate standing and consent of instructor.

Directed group laboratory of selected topics for advanced students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1-4 laboratories.

**RPTA 581. Graduate Seminar in Recreation, Parks and Tourism. 1 unit.**

Prerequisite: Graduate standing.

Group study of selected developments, trends and problems in the field of recreation, parks and tourism. Total credit limited to 4 units. 1 seminar.

**RPTA 599. Thesis in Recreation, Parks and Tourism. 1-9 units.**

Prerequisite: Graduate standing and consent of instructor.

Individual research in recreation, parks and tourism management under the general supervision of faculty, leading to a graduate thesis. Degree credit limited to 9 units. Students must enroll each quarter advisement is received.

## Religious Studies (RELS)

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### Religious Studies Courses

**RELS 201. Religion, Dialogue, and Society. 4 units.**

GE Area D3

The way in which interactions between religious traditions shape society at various levels. Case studies drawn from eastern and western religious traditions during the ancient and modern periods. 4 lectures. Fulfills GE D3.

**RELS 205. Jesus. 4 units.**

Exploration and analysis of the person of Jesus. Includes examination of our sources of knowledge about him, his self-understanding, and various interpretations of him in historical, comparative, and contemporary settings. 4 lectures.

**RELS 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**RELS 301. Religions of Asia. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Comparative study of the religions of Asia, particularly Hinduism, Buddhism, and the religions of China. Topics include historical continuities/discontinuities, worldviews, sacred texts, practices, responses to modernity, the place of women across the traditions. 4 lectures. Fulfills GE C4.

**RELS 302. Monotheisms: Judaism, Christianity, and Islam. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

The monotheistic traditions of Christianity and Islam, with focus on their origins from Judaism. Topics include: Jewish history, the Hebrew Bible, the Christian New Testament, formation of the Church, the Quran and Mohammad. 4 lectures. Fulfills GE C4.

**RELS 304. Judaism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Origins, beliefs and practices of Judaism and central themes in the Hebrew Bible. The development of Judaism in the post-biblical and Talmudic period. Jewish philosophy, life, rituals and customs. The emergence of modern Judaism, Zionism and post-Holocaust philosophy. 4 lectures. Fulfills GE C4.

**RELS 306. Hinduism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Origins, beliefs and practices of Hinduism from the Veda and the Upanishads through the teachings of the Bhagavad Gita and the Puranas. Modern Hindu institutions, saints and sages, and social philosophy contrasted with the ancient. 4 lectures. Fulfills GE C4.

**RELS 307. Buddhism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Buddhist origins, viewpoints and practices will be seen in their development in India, Tibet, China, Japan, South Asia and America. The life of Buddha, Gautama, the rise of Theravada, Mahayana and Tantra. Encounters with Shinto and Confucianism. 4 lectures. Fulfills GE C4.

**RELS 310. Christianity. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

The development of the Christian religion from the story of Jesus, the New Testament, Church formation, the role of St. Paul, dissenting ideas, Protestant and Catholic views, and contemporary issues of conscience, such as the Social Gospel and liberation theologies. 4 lectures. Fulfills GE C4.

**RELS 311. Islam. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

The development of Islamic civilization from the inspiration of the Qur'an and the Prophet Muhammad and the Sunni-Shi'i split to contemporary political and social issues. Emphasis of Sufi literature, art, architecture, and philosophies of Islam. 4 lectures. Fulfills GE C4.

**RELS 344. Approaches to Religion and Spirituality. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A, and D3 or D4. Recommended: Junior standing.

Examination of religion from an academic perspective by surveying the various historical approaches employed within the discipline of religious studies to collect, analyze, and interpret religious phenomena cross-culturally. 4 lectures. Fulfills GE D5.

**RELS 370. Religion, Gender, and Society. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Critical examination of religious ideas and institutions in America in relation to gender, race and politics. Focus on women and religion, the religious experience of minorities, and on politics. 4 lectures. Crosslisted as RELS/WGS 370. Fulfills GE C4 and USCP.

**RELS 372. Spiritual Extremism: Asceticism, Mysticism, and Madness. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Shaping influence of ascetics, mystics and the insane on global religious traditions. Topics may include the relationship between spiritual extremists and society, cultural construction of holiness and insanity, and literary depictions of spiritual extremists. 4 lectures. Fulfills GE C4.

**RELS 374. Religion and Violence. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Historical and contemporary case studies of how various religions have condoned, motivated and justified violence. The place of sacrifice, martyrdom, self-injury and forced conversion in religious doctrines. Representations of religious violence in the media. 4 lectures. Fulfills GE C4.

**RELS 378. Religion and Contemporary Values. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Descriptive analysis of how diverse religious traditions construct moral decisions about a variety of contemporary issues including sexuality, ecology, and justice. Challenges for religious value systems in secular and pluralistic societies. 4 lectures. Fulfills GE C4.

**RELS 380. Religion and Politics in the Israeli-Palestinian Conflict. 4 units.**

Prerequisite: Completion of GE Area A. Recommended: Completion of one class in POLS or RELS.

The root causes of the Israeli-Palestinian conflict and its current manifestation. Possibilities for solutions from the perspectives of religious studies and political science. 4 lectures. Crosslisted as POLS/RELS 380.

**RELS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department chair and instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units.

**RELS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. The Schedule of Classes will list topics selected. Total credit limited to 8 units. 1-4 lectures.

## Social Sciences (SOCS)

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### Social Sciences Courses

**SOCS 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**SOCS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**SOCS 440. Internship. 4-8 units.**

CR/NC

Prerequisite: Senior standing and/or consent of instructor.

Supervised training, research, and work in public and private organizations. Credit/No Credit grading only. Total credit limited to 18 units.

**SOCS 461. Senior Project I. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**SOCS 462. Senior Project II. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**SOCS 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 12 units. Credit/No Credit grading only.



**SOCS 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 4 units; total credit limited to 24 units. Credit/No Credit grading only.

## Sociology (SOC)

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### Sociology Courses

**SOC 110. Comparative Societies. 4 units.**

GE Area D3

Introduction to sociological theory and methods, emphasizing a comparative analysis of social institutions of contemporary societies in major world regions, including the family, religion, politics, and the economy. Direct comparisons made between American social institutions and those of other societies, their histories, social problems and social change. 4 lectures. Fulfills GE D3.

**SOC 111. Social Problems. 4 units.**

An introduction to sociology with an emphasis on problems inherent in selected social institutions. Instruction in social analysis, including theories of social problems, how those problems are studied, and a survey of possible solutions. 4 lectures.

**SOC 200. Special Problems for Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**SOC 218. International Political Economy. 4 units.**

GE Area D2

Principles of international political economy in their social and cultural context. Sociological perspectives on the historical development of the world system and the current patterns of global inequality. Comparison of the political economy of major nations and their relation to the overall world system. 4 lectures. Fulfills GE D2.

**SOC 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**SOC 301. Social Work and Social Welfare Institutions. 4 units.**

Prerequisite: SOC 110. Recommended: Junior standing.

Introduction to the field of social welfare. Development of social work and social welfare services; major issues in social service policy. Scope and diversity of specific programs in the social services. Analysis of current programs and the recipients of welfare services. 4 lectures.

**SOC 305. Social Change and Social Movements. 4 units.**

Prerequisite: Junior standing, or consent of instructor. Recommended: SOC 110, SOC 111.

Description and analysis of social change in contemporary societies as they relate to major revolutionary changes historically and in the present. Analysis of variables producing social change, social movements, and political violence, including terrorism. Impact on society. 4 lectures.

**SOC 306. Sociology of the Family. 4 units.**

Prerequisite: SOC 110. Recommended: Junior standing.

Description and analysis of family relationships; role of family in society, effects of society on family economy, structure and change. Other topics include courtship, marriage, parenting, divorce and alternative family forms. 4 lectures.

**SOC 309. The World System and Its Problems. 4 units.**

Prerequisite: SOC 110. Recommended: Junior standing.

Analysis of the historical background, structure, and dynamics of the world system; examines such issues as the origins of Third World poverty, colonialism, the changes in the world's dominant economic powers, the fall of communism, the growing economic competition between Europe, North America, and Asia; and possible strategies for the economic development of the Third World. 4 lectures.

**SOC 310. Self, Organizations and Society. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Analysis of the interactions relating to the development of self. Examination of the reciprocal interactions between biology, personal environment, and society. 4 lectures.

**SOC 311. Sociology of Gender. 4 units.**

Prerequisite: Junior standing.

Description and analysis of the impact of gender definitions on men and women in society. Special attention is given to the learning process; the creation and perpetuation of gender stereotypes and the way these affect individual life chances and social structure, explored in the areas of work, education, family and abusive relationships. Focus on media presentation of gender and effects of ethnicity and class. 4 lectures. Crosslisted as SOC/WGS 311.

**SOC 313. Urban Sociology. 4 units.**

Prerequisite: SOC 110. Recommended: Junior standing.

Description of the context of urban development; analysis of various forces generating urbanization. Investigation of urban models and spational relationships; urban processes; and problems. 4 lectures.

**SOC 315. Global Race and Ethnic Relations. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A; D3; and junior standing.

Diverse structures of unequal relationships among racial and ethnic groups in several countries including the United States. Theories about sources of economic and social discrimination and colonialism. Focus on the concept of ethnicity. Evaluation methods to restructure race and ethnic relations. International case histories. 4 lectures. Fulfills GE D5 except for Social Sciences or Sociology majors.

**SOC 316. American Ethnic Minorities. 4 units.**

USCP

Prerequisite: Junior standing.

Exploration of the issues and problems facing the four major ethnic minorities in American society: Native Americans, Afro-Americans, Hispanics and Asian Americans. Dynamics of intergroup relations focusing on the concepts of ethnocentrism, stereotyping, pluralism and assimilation. Sources and manifestations of economic and social discrimination patterns and how they affect the individual's life course. 4 lectures. Fulfills USCP.

**SOC 323. Social Stratification. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Social class and the distribution of income, wealth, status and power in society, with emphasis on contemporary United States; social mobility; race, gender, and ethnic inequalities; political power and the nature of welfare; the nature, causes and solutions to poverty. A comparative perspective also taken with a focus on Japan and Europe. 4 lectures.

**SOC 326. Sociology of the Life Cycle. 4 units.**

GE Area D5

Prerequisite: Completion of GE Areas A and D3. Recommended: Junior standing.

Change and continuity of the self through the life course. Impact of aging on the physical, emotional, intellectual and social aspects of well being, and how this knowledge can be applied to enhance the quality of life. 4 lectures. Fulfills GE D5 except for Social Sciences or Sociology majors.

**SOC 350. Social Organization of Modern Japan. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Social and cultural features of modern Japan. Japanese group processes. Investigation of contemporary Japanese institutions: family, education, mass media, industry, politics, including an overview of popular culture. 4 lectures.

**SOC 354. Qualitative Research Methods. 4 units.**

Prerequisite: STAT 217 with a C- or better and two sociology courses, or consent of instructor.

Qualitative data collection for social research. The relationship among theory research and hypothesis testing. Data collection techniques, including content analysis, face to face interviews, and ethnographic methods. 3 lectures, 1 activity.

**SOC 355. Quantitative Research Methods. 4 units.**

Prerequisite: STAT 217 and Junior standing.

The basics of how to do quantitative social research. Includes topics on data collection techniques such as surveys, experiments, and the use of existing data. Also includes topics on univariate, bivariate, and multivariate analysis and the use of SPSS for data analysis. 3 lectures, 1 activity.

**SOC 377. Sociology of Religion. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Area A, and two courses from two categories in Area D.

Religion from a sociological perspective. Topics may include the nature of religious experience, the role of religion in politics, economics, and social change, and the role that social forces have in influencing religious beliefs and practices. 4 lectures. Fulfills GE D5 except for Social Sciences or Sociology majors.

**SOC 395. Sociology of Complex Organizations. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Bureaucracies and informal organizations from a sociological perspective. Organizational networks within and between organizations, relationship between organizations and their environment, and organizational socialization and career patterns, and gender and race or ethnic differences in organizational patterns. 4 lectures.

**SOC 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 8 units, with a maximum of 4 units per quarter.

**SOC 402. Crime and Violence. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Criminal behavior of individuals and groups; special categories include drug use, sex offenders, property crime, syndicated crime, interpersonal violence, and white-collar criminality. Legal definitions of crime and their implications, theories of causation, the sources of criminological data, and possible responses to the problems posed by criminal behavior. 4 lectures.

**SOC 406. Juvenile Delinquency. 4 units.**

Prerequisite: One course in sociology.

Sociological examination of juvenile delinquency as a social and legal concept, covering the nature, volume and social distribution of juvenile crime; the formal structure of juvenile justice; and how justice for juveniles is applied in practice. 4 lectures.

**SOC 412. Criminal Justice. 4 units.**

Prerequisite: Junior standing or consent of instructor.

Approaches to the control and rehabilitation of adult and juvenile offenders; philosophy of treatment strategies; history and analysis of probation, imprisonment, parole and preventive programs. 4 lectures.

**SOC 413. Methods of Social Work. 4 units.**

Prerequisite: SOC 301 and junior standing.

Skills, values and knowledge emphasized in social work. The generic perspective. Methods in social case work, group work, community organization, and social action. Alternative models. Settings of social work practice. Discussion of case material and professional literature. Case work management. Traditional and innovative therapy techniques. 4 seminars.

**SOC 421. Social Theory. 4 units.**

Prerequisite: SOC 111 or consent of instructor.

Concepts and theories in sociology. Development and history of social theory in the classical period. Development of the predominant perspectives in sociology: positivist/functionalist, conflict, symbolic interactionist. Importance of theories for understanding of present social arrangements and problems. 4 lectures.

**SOC 440. Internship. 4-8 units.**

CR/NC

Prerequisite: Senior standing and/or consent of instructor.

Supervised training, research, and work in public and private organizations. Credit/No Credit grading only. Total credit limited to 18 units.

**SOC 461. Senior Project I. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**SOC 462. Senior Project II. 2 units.**

Prerequisite: Senior standing or consent of instructor.

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 120 hours total time.

**SOC 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

## Soil Science (SS)

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### Soil Science Courses

**SS 110. Orientation in Earth and Soil Sciences. 1 unit.**

CR/NC

Understanding the depth and breadth of earth and soil sciences. Examine potential career opportunities. Introduction to both student and professional organizations. Credit/No Credit grading only. 1 activity. Crosslisted as ERSC/SS 110.

**SS 121. Introductory Soil Science. 4 units.**

GE Area B5

Prerequisite: College chemistry and passing score on ELM examination, or an ELM exemption, or credit in MATH 104.

Biological, chemical, physical and genetic properties of soils. Application of scientific principles to solving land use, water management, and soil conservation problems. Interpretation of soils data for making environmental decisions, applying management practices, and sustainable food production. 3 lectures, 1 laboratory. Fulfills GE B5.

**SS 131. Soils in Environmental and Agricultural Systems. 4 units.**

Soils' ecological functions; soil and the water cycle; soil in production of food, fiber, and forest materials; techniques and reports of soil analyses with agricultural and environmental applications; soil quality; introductory overview of soils and civilizations. Not open to students with credit in SS 121. 3 lectures, 1 activity.

**SS 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 12 units, with a maximum of 2 units per quarter. Crosslisted as ERSC/SS 200.

**SS 221. Fertilizers and Plant Nutrition. 4 units.**

Prerequisite: SS 121.

Plant nutrient requirements. Composition, value, and use of fertilizer materials, conditioners and agricultural minerals. Methods of manufacturing, distributing, and applying fertilizers. 3 lectures, 1 laboratory.

**SS 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 lectures. Crosslisted as ERSC/SS 270.

**SS 301. Earth Sciences/Soils Science Practicum. 1-2 units.**

CR/NC

Prerequisite: SS 110 or SS 121.

Supervised practice in technical, educational, professional, and operational applications related to earth sciences or soil science. Students participate in faculty-supervised group or individual activities that support educational and professional goals. Credit/No Credit grading only. Total credit limited to 12 units. 1-2 activities. Crosslisted as ERSC/SS 301.

**SS 321. Soil Morphology. 4 units.**

Prerequisite: SS 121.

Identification of soil morphological and site properties. Correlation of soil physical and chemical properties with soil taxonomy and land use. Techniques of interpretations for agriculture, forest lands, wetlands, range lands and urban development. 3 lectures, 1 laboratory.

**SS 322. Soil Plant Relationships. 4 units.**

Prerequisite: SS 221, CHEM 111 or CHEM 128.

Investigation and evaluation of the nutrient supplying ability of soils. Conditions and transformations involved in the transfer of mineral nutrients from soils to plants. Effects of cultural treatments on soil fertility. Diagnostic techniques and data interpretation in soil and plant analysis. 3 lectures, 1 laboratory.

**SS 339. Soil Science Internship. 1-12 units.**

CR/NC

Prerequisite: Consent of internship instructor.

Selected students will spend up to 12 weeks with an approved firm or agency engaged in work and study related to their major. A detailed written proposal and written interim and final reports required. One unit of credit may be allowed for each full week of internship. Credit/No Credit grading. Crosslisted as ERSC/SS 339.

**SS 345. Soil Interpretations and Management. 4 units.**

Prerequisite: SS 121, CHEM 129, MATH 119 or MATH 141, PHYS 121 or PHYS 131, or consent of instructor.

Calculate, graph, and interpret physical, chemical, and microbiological data from soils and reports. Apply laboratory results to field conditions. Debate efficacy of soil management and environmental practices considering social, economic and political implications of soil science. 2 lectures, 2 activities.

**SS 400. Special Problems for Advanced Undergraduates. 2-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 12 units, with a maximum of 2 units per quarter. Crosslisted as ERSC/SS 400.

**SS 402. Soil, Compost, and Water Testing Enterprise. 3 units.**

Prerequisite: CHEM 111, CHEM 125 or CHEM 128; SS 221; and junior standing.

Experience in soil, compost, and water testing. Sampling rationale and protocol. Analyses of compost feedstocks and finished compost; monitoring for consistency. Theory and practice in use of analytical instrumentation. Interpretation of results for soil, compost, and water management. Total credit limited to 6 units for SS or ERSC majors. Total credit limited to 3 units for Soil Science minor.

**SS 421. Wetlands. 4 units.**

Prerequisite: BOT 121 or BIO 162, CHEM 111 or CHEM 127, and SS 121 or SS 131. Recommended: BOT 313, NR 306 or BIO 325.

The formation, characteristics, and functions of wetlands. Genesis of hydric soils. Plant adaptations to saturated soils. Wetlands as wildlife habitat. Policies and social issues associated with wetlands. The procedures of wetland delineations. 3 lectures, 1 laboratory. Crosslisted as BIO/NR/SS 421.

**SS 422. Soil Microbiology and Biochemistry. 4 units.**

Prerequisite: SS 221, CHEM 313, or consent of instructor.

Biochemical activities, ecology and environmental implications of soil organisms. Effects on the formation, characteristics, and productivity of soils. Methods of studying soil organisms. 3 lectures, 1 laboratory.

**SS 423. Soil and Water Chemistry. 5 units.**

Prerequisite: ERSC 223, CHEM 129, CHEM 212/312 or CHEM 216/316, MATH 118 or MATH 141.

Chemical processes governing weathering, soil mineral formation and stability, common solubility equilibria. Use of chemical principles to explain surface chemical properties of soils and environmental problems in water and soil chemical systems. Preparation of professional quality reports based on laboratory data and library research. 3 lectures, 1 laboratory, 1 activity.

**SS 431. Soil Resource Inventory. 4 units.**

Prerequisite: ERSC 223, SS 321.

Development and production of soil surveys for interpretive purposes. Use of soil taxonomy and land classification systems to evaluate land for best management practices. 2 lectures, 2 laboratories.

**SS 432. Soil Physics. 5 units.**

Prerequisite: SS 121, PHYS 121 or PHYS 141, CHEM 128, MATH 118 or MATH 141, or consent of instructor.

Matter and energy in soils, with emphasis on properties and behavior of solids, water, air, and heat. Applications to agriculture, forestry, range management, engineering, and environmental sciences. Preparation of professional reports based on laboratory data and library research. 3 lectures, 1 laboratory, 1 activity.

**SS 433. Land Use Planning. 3 units.**

Prerequisite: SS 121.

Development of plans and practices for management of agricultural, recreational and urban land use by evaluating the soil capabilities through the use of Soil Survey Reports. 2 lectures, 1 laboratory.

**SS 440. Forest and Range Soils. 4 units.**

Prerequisite: SS 121, SS 321 or consent of instructor.

Ecosystem approach to chemical, biological, physical and mechanical properties of forest and range soils. Site quality, nutrient cycling, erosion and mass movement, fire effects. Preparation of soil management reports similar to those required by various land management organizations. Overnight field trips. 3 lectures, 1 laboratory.

**SS 442. Soil Vadose Zone and Groundwater Processes. 4 units.**

Prerequisite: CHEM 212/312 or CHEM 216/CHEM 316, GEOL 201; SS 121 or consent of instructor.

Fate and transport of water and pollution in soil and groundwater. Redox transformations and removal or immobilization of pollutants. Monitoring and predicting management strategies for vadose zone and groundwater enhancement. Reclamation of disturbed lands. 3 lectures, 1 activity.

**SS 444. Soil Judging. 2 units.**

Prerequisite: SS 321 or consent of instructor.

Morphological description of soils in the field. Taxonomic determination of classifications and interpretive properties from soil descriptions. Participation in collegiate soil judging contests. Total credit limited to 12 units. 1 lecture, 1 laboratory.

**SS 453. Tropical Soils. 4 units.**

Prerequisite: SS 121, CHEM 111 or CHEM 128.

Nature and properties of soils occurring in the tropics, their origin, morphology, classification, fertility, management and conservation. Examine social implications in international agriculture. 3 lectures, 1 laboratory.

**SS 461. Senior Project I. 1 unit.**

Prerequisite: MATH 118 or MATH 141, STAT 218 or CRSC 411.

Senior project topic selection and contract development with project advisor. Statement of problems, subproblems, assumptions, objectives, hypothesis, methods of analysis and statistical design. Development of literature review and budget of time and finances. Proper format and presentation of tabular and graphic information. 1 activity.

**SS 462. Senior Project II. 3 units.**

Prerequisite: SS 461.

Implementation of materials and methods. Collection, analysis and interpretation of data. Completion of formal written report under advisor supervision. Minimum 90 hours.

**SS 463. Undergraduate Seminar. 2 units.**

Prerequisite: SS 461.

Review of current research, experiments, and problems related to the student's major field of interest. Preparation and presentation of reports on problems or research activities. 2 seminars.

**SS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 12 units. 1 to 4 lectures. Crosslisted as ERSC/SS 470.

**SS 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories. Crosslisted as ERSC/SS 471.

**SS 500. Individual Study in Soil Science. 1-6 units.**

Prerequisite: Consent of instructor.

Advanced independent study planned and completed under the direction of a member of the Earth and Soil Sciences faculty. Total credit limited to 6 units.

**SS 501. Research Planning. 4 units.**

Prerequisite: Graduate standing or consent of instructor.

Problem solving and research planning for agriculture, natural resources and related sciences. Preparation of study plans that identify problems, review appropriate literature, formulate objectives, develop methods and provide for presentation and interpretation of results. Oral reports. 4 lectures.

**SS 508. Environmental Assessment for Erosion Control. 3 units.**

Prerequisite: SS 121 or equivalent and graduate standing, or consent of instructor.

Assessment techniques for the development of soil erosion control and the dispersal of surface runoff water on urban, agriculture, riparian, and rangelands. Development of a water quality management plan for a specific land use. 3 lectures.

**SS 522. Advanced Soil Fertility. 3 units.**

Prerequisite: SS 322, graduate standing or consent of instructor.

Current research frontiers in soil fertility. Evaluating soil testing philosophy, theories and interpretation. Optimizing soil conditions for maximizing crop production. Consequences of environmental pollution, trace elements and organic amendments. Chemical reactions including solubility and chelate equilibria, adsorption phenomena, nutrient mobility, soil mineralogy and weathering. Use of foliar fertilization. Radioisotopes in soil fertility. 3 lectures.

**SS 570. Selected Topics in Soil Science. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 12 units. 1 to 4 seminars.

**SS 571. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 laboratories.

**SS 581. Graduate Seminar in Forestry and Environmental Sciences. 3 units.**

Prerequisite: Consent of instructor.

Student study and presentation of selected developments, trends and problems in the field of forest and natural resources. 3 seminars. Crosslisted as NR/SS 581.

**SS 582. GIS in Advanced Land Management. 3 units.**

Prerequisite: Graduate standing, NR/LA 318, or consent of instructor.

Development of plans and practices for the management of crop, range, urban and wood land. 2 seminars, 1 laboratory.

**SS 599. Thesis. 1-6 units.**

Prerequisite: Graduate standing and consent of instructor.

Individual research in soil science under faculty supervision, leading to a scholarly written presentation exhibiting originality, clarity, critical and independent thinking, proper analysis of data, appropriate organization and format, and accurate and thorough documentation. Six units required for the M.S. degree.

## Spanish (SPAN)

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### Spanish Courses

**SPAN 101. Elementary Spanish I. 4 units.**

Beginning Spanish. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. Credit not available for students who have completed SPAN 104 or SPAN 111. 3 lectures, 1 activity.

**SPAN 102. Elementary Spanish II. 4 units.**

Prerequisite: SPAN 101, SPAN 111, or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. Not open to students with credit in SPAN 104. To be taken in numerical sequence. 3 lectures, 1 activity.

**SPAN 103. Elementary Spanish III. 4 units.**

Prerequisite: SPAN 102 or appropriate score on placement exam or consent of instructor.

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. Not open to students with credit in SPAN 104. To be taken in numerical sequence. 3 lectures, 1 activity.

**SPAN 104. Intensive Elementary Spanish. 12 units.**

Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation. Language taught in its intercultural context. Offered in summer only. Not open to students who have credit in SPAN 102 and/or SPAN 103. 9 lectures, 3 activities.



**SPAN 111. Elementary Hispanic Language and Culture. 4 units.**  
USCP

Beginning Spanish. Class practice and assigned outside work in pronunciation, sentence structure, reading, writing, and conversation with special focus on vocabulary and culture from American agribusiness and the Hispanic cultures of the United States and Latin America. Not open to students who have credit in SPAN 101. 3 lectures, 1 activity. Fulfills USCP.

**SPAN 201. Intermediate Spanish I. 4 units.**

GE Area C5

Prerequisite: SPAN 103 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Spanish within an intercultural context. To be taken in numerical sequence. Not open to students with credit in SPAN 204. 3 lectures, 1 activity. Fulfills GE C5. Formerly SPAN 121.

**SPAN 202. Intermediate Spanish II. 4 units.**

GE Area C5

Prerequisite: SPAN 201 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Spanish within an intercultural context. To be taken in numerical sequence. Not open to students with credit in SPAN 204. 3 lectures, 1 activity. Fulfills GE C5. Formerly SPAN 122.

**SPAN 203. Intermediate Spanish III. 4 units.**

GE Area C5

Prerequisite: SPAN 202 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Spanish within an intercultural context. To be taken in numerical sequence. Not open to students with credit in SPAN 206. 3 lectures, 1 activity. Fulfills GE C5.

**SPAN 204. Intensive Intermediate Spanish. 8 units.**

Prerequisite: SPAN 103 or SPAN 104 or appropriate score on placement exam or consent of instructor.

Development of presentational, interpersonal, and interpretive intermediate-level language skills in Spanish within an intercultural context. Not open to students who have credit in SPAN 201 or SPAN 202. 6 lectures, 2 activities. Formerly SPAN 125.

**SPAN 206. Spanish for Heritage Speakers. 4 units.**

USCP

Prerequisite: SPAN 202 or appropriate score on placement exam or consent of instructor.

Focus on the grammatical, cultural and linguistic needs of Spanish speakers in the United States who have not had formal study of the language. Emphasis on morphological, lexical and cultural understanding of the Spanish language. Designed to prepare students for upper-division Spanish coursework in language and culture. Not open to students with credit in SPAN 203. 3 lectures, 1 activity. Fulfills USCP. Formerly SPAN 123.

**SPAN 207. Introduction to Spanish Linguistics. 4 units.**

Prerequisite: SPAN 203, SPAN 206, or consent of instructor.

Introduction to the scientific study of the Spanish language with an overview of theoretical and applied linguistics and special emphasis on Spanish phonetics and phonology. Conducted in Spanish. 3 lectures, 1 activity. Formerly SPAN 205.

**SPAN 233. Introduction to Hispanic Readings. 4 units.**

GE Area C1

Prerequisite: Completion of GE Area A and SPAN 203.

Selected readings from Hispanic authors that show the Hispanic literary tradition from the Middle Ages to the present in Spain, Latin America, and of Latino/a writers in the United States. May include film and other media. Conducted in Spanish. 4 lectures. Fulfills GE C1.

**SPAN 270. Selected Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics. Open only to undergraduate students. The Schedule of Classes will list topic selected. Conducted in Spanish. Total credit limited to 8 units. 1 to 4 lectures.

**SPAN 301. Advanced Composition in Spanish. 4 units.**

Prerequisite: SPAN 203, SPAN 206 or consent of instructor.

Oral and written development of structural grammar, syntax, and complex components of Spanish. Vocabulary expansion and idiomatic construction. Written compositions. May include Spanish/English translation. Conducted in Spanish. 4 lectures.

**SPAN 302. Advanced Conversation and Composition in Spanish. 4 units.**

Prerequisite: SPAN 203, SPAN 206, or consent of instructor.

Formal discussion of, and writing on selected cultural topics from the Spanish-speaking world. Focus on individual and group presentations and in-class writing and speaking assignments to enhance students' vocabulary and critical thinking skills in Spanish. Conducted in Spanish. 3 lectures, 1 activity.

**SPAN 303. Introduction to English-Spanish Translation. 4 units.**

Prerequisite: Completion of GE Area A; and SPAN 207 or SPAN 301 or SPAN 302 or consent of instructor.

Developing basic knowledge, skills, theories and techniques required for translation both from Spanish to English and from English to Spanish. Translating news articles, legal documents, commercial advertisements, formal letters, and literary works. Conducted in Spanish. 4 lectures.

**SPAN 305. Significant Works in Spanish. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and SPAN 233 or consent of instructor.

Critical analysis and oral discussion of poetry, essays, novels, plays, films, and other media by selected Hispanic authors. Conducted in Spanish. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors.

**SPAN 307. Spanish and Latin American Film. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and SPAN 233 or consent of instructor.

Study, analysis, and critique of films from Spain and/or Latin America, organized around such topics as individual film directors or genres, national and international film traditions, migration, gender, ethnicity, and politics. Evaluation of works in their cultural contexts. The Schedule of Classes will list topic selected and language of instruction (English or Spanish). Total credit limited to 8 units. Course may be offered in classroom-based or online format. 3 lectures, 1 activity. Fulfills GE C4 except for Modern Languages and Literatures majors.

**SPAN 340. Chicano/a Authors. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Area A and SPAN 233.

Introduction to Chicano/a literary accomplishments to facilitate appreciation of Chicano/a literary aesthetics and increase understanding of Chicano/a cultural values and lifestyles. Conducted in Spanish. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors. Fulfills USCP.

**SPAN 350. Hispanic Literature in English Translation. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one course in Area C1.

Selected works to be read by students in English translation. Critical analysis, interpretation, and comparison of works by Hispanic authors. Course may include film and other media. Discussion in English. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors.

**SPAN 351. Chicano/Latino Writers in the United States. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Area A and one course in Area C.

Analysis and exploration of the major themes of Chicano/Latino literature in the United States today. Emphasis on Chicano/a, Puerto Rican, Cuban American and other U.S. Latino/a writers. All readings and discussions in English. 4 lectures. Fulfills GE C4 except for Modern Languages and Literatures majors. Fulfills USCP.

**SPAN 390. Introduction to Creative Writing in Spanish. 4 units.**

Prerequisite: SPAN 301 or consent of instructor.

Directed practice with writing narrative, poetry and/or drama writing in Spanish. An examination of plot, character and theme development. Crafting of creative literature for potential publication. Conducted in Spanish. 4 lectures.

**SPAN 402. Advanced Linguistics in Spanish. 4 units.**

Prerequisite: SPAN 207 or consent of instructor.

Aspects of Spanish linguistics today. Topics may include morphology, semantics, syntax, phonetics, phonology, theoretical linguistics, history of the language, and teaching methodology and applied linguistics in Spanish. Conducted in Spanish. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**SPAN 410. Advanced Literature in Spanish. 4 units.**

Prerequisite: SPAN 233 or consent of instructor.

In-depth study of literature in Spanish. Specific genre, literary period, authorial group, region, or country. Chicano/Latino literature, Latin American literature, and Spanish literature. Course may include film and other media. Conducted in Spanish. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

**SPAN 416. Don Quixote. 4 units.**

Prerequisite: SPAN 233 or consent of instructor.

Intensive reading of Cervantes' novel, Don Quixote (Part 1, 1605 and Part 2, 1615) in the context of Cervantes' life and the history and social context of Spanish renaissance and baroque culture. Conducted in Spanish. 4 lectures.

**SPAN 470. Selected Advanced Topics. 4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Conducted in Spanish. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures.

## Statistics (STAT)

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### Statistics Courses

**STAT 130. Statistical Reasoning. 4 units.**

GE Area B1

Prerequisite: Passing score on the ELM examination, or an ELM exemption, or credit in MATH 104.

Survey of statistical ideas and philosophy. Emphasis on concepts rather than in-depth coverage of statistical methods. Topics include sampling, experimentation, data exploration, chance phenomena, and methods of statistical inference. Not open to students with credit in any statistics course. 4 lectures. Fulfills GE B1.

**STAT 150. Introduction to Statistical Investigations. 4 units.**

Prerequisite: Freshman statistics major.

Orientation to the statistics program. Introduction to the discipline of statistics and the nature of statistical reasoning. Design of surveys and experiments, graphical and numerical summaries, statistical models, and interpretation of results. Development of discussion, writing, presentation, and evaluation skills. 4 lectures.

**STAT 200. Special Problems for Undergraduates. 1-2 units.**

Prerequisite: Consent of department chair.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**STAT 217. Introduction to Statistical Concepts and Methods. 4 units.**

GE Area B1

Prerequisite: Passing score on the ELM examination, or an ELM exemption, or credit in MATH 104.

Sampling and experimentation, descriptive statistics, confidence intervals, two-sample hypothesis tests for means and proportions, Chi-square tests, linear and multiple regression, analysis of variance. Substantial use of statistical software. Not open to students with credit in STAT 218 or STAT 251. Course may be offered in classroom-based or online format. 4 lectures. Fulfills GE B1.

**STAT 218. Applied Statistics for the Life Sciences. 4 units.**

GE Area B1

Prerequisite: Passing score on the ELM examination, or an ELM exemption, or credit in MATH 104.

Data collection and experimental design, descriptive statistics, confidence intervals, parametric and non parametric one and two-sample hypothesis tests, analysis of variance, correlation, simple linear regression, chi-square tests, relative risk and odds. Applications of statistics to the life sciences. Substantial use of statistical software. Not open to students with credit in STAT 217 or STAT 251. 4 lectures. Fulfills GE B1.

**STAT 251. Statistical Inference for Management I. 4 units.**

GE Area B1

Prerequisite: Completion of the ELM requirement and a passing score on appropriate Mathematics Placement Examination for MATH 221 eligibility, or MATH 118 or equivalent.

Descriptive statistics. Probability and counting rules. Random variables and probability distributions. Sampling distributions and point estimation. Confidence intervals and tests of hypotheses for a single mean and proportion. 4 lectures. Fulfills GE B1.

**STAT 252. Statistical Inference for Management II. 5 units.**

GE Area B1

Prerequisite: STAT 251 with a minimum grade of C- or consent of instructor.

Confidence intervals and tests of hypotheses for two means and two proportions. Introduction to ANOVA, regression, correlation, multiple regression, time series, and forecasting. Statistical quality control. Enumerative data analysis. Substantial use of statistical software. 5 lectures. Fulfills GE B1.

**STAT 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**STAT 301. Statistics I. 4 units.**

Corequisite: MATH 142.

Introduction to statistics for mathematically inclined students, focused on process of statistical investigations. Observational studies, controlled experiments, randomization, confounding, randomization tests, hypergeometric distribution, descriptive statistics, sampling, bias, binomial distribution, significance tests, confidence intervals, normal model, t-procedures, two-sample procedures. Substantial use of statistical software. 4 lectures.

**STAT 302. Statistics II. 4 units.**

Prerequisite: STAT 301.

Continued study of the process, concepts, and methods of statistical investigations. Association, chi-square procedures, one-way ANOVA, multiple comparisons, two-way ANOVA with interaction, simple linear regression, correlation, prediction, multiple regression. Substantial use of statistical software. 4 lectures.

**STAT 312. Statistical Methods for Engineers. 4 units.**

GE Area B6

Prerequisite: MATH 142.

Descriptive and graphical methods. Discrete and continuous probability distributions. One and two sample confidence intervals and hypothesis testing. Single factor analysis of variance. Quality control. Introduction to regression and to experimental design. Substantial use of statistical software. 4 lectures. Fulfills GE B6.

**STAT 313. Applied Experimental Design and Regression Models. 4 units.**

GE Area B1

Prerequisite: STAT 217 or STAT 218 or STAT 312 or STAT 542.

Analysis of variance and regression analysis for students not majoring in statistics or mathematics. Includes one-way classification, randomized blocks, Latin squares, factorial designs, multiple regression, diagnostics, and model comparison. 4 lectures. Fulfills GE B1.

**STAT 321. Probability and Statistics for Engineers and Scientists. 4 units.**

GE Area B6

Prerequisite: MATH 142.

Tabular and graphical methods for data summary, numerical summary measures, probability concepts and properties, discrete and continuous probability distributions, expected values, statistics and their sampling distributions, point estimation, confidence intervals for a mean and proportion. Use of statistical software. 4 lectures. Fulfills GE B6.

**STAT 323. Design and Analysis of Experiments I. 4 units.**

Prerequisite: STAT 252 or STAT 302 or STAT 312 or STAT 313.

Principles, construction and analysis of experimental designs. Completely randomized, randomized complete block, Latin squares, Graeco Latin squares, factorial, and nested designs. Fixed and random effects, expected mean squares, multiple comparisons, and analysis of covariance. 4 lectures.

**STAT 324. Applied Regression Analysis. 4 units.**

Prerequisite: STAT 252 or STAT 302 or STAT 312 or STAT 313.

Simple linear regression and associated special topics, multiple linear regression, indicator variables, influence diagnostics, assumption analysis, selection of 'best subset', nonstandard regression models, logistic regression, nonlinear regression models. 4 lectures.

**STAT 325. Introduction to Probability Models. 4 units.**

Prerequisite: MATH 206, and CSC/CPE 101 or CSC 232 or CSC/CPE 235.

Introduction to probability and applied probability models. Topics include basic probability rules, counting rules, conditional probability, discrete and continuous random variables, and expectation. Applied models include Poisson processes, Markov chains, and reliability models. Not open to students with credit in STAT 321 or STAT 425. 4 lectures.

**STAT 330. Statistical Computing with SAS. 4 units.**

Prerequisite: STAT 252 or STAT 302 or STAT 312 or STAT 313 or STAT 322.

Techniques available to the statistician for efficient use of computers to perform statistical computations and to analyze large amounts of data. Use of SAS throughout the course. Includes data preparation, report writing, and basic statistical methods. 4 lectures.

**STAT 331. Statistical Computing with R. 4 units.**

Prerequisite: STAT 252 or STAT 302 or STAT 312 or STAT 313, and CPE/CSC 101 or CPE/CSC 235 or BUS 290 or STAT 330.

Data acquisition, cleaning, and management; use of regular expressions; functional and object-oriented programming; graphical, descriptive, and inferential statistical methods; random number generation; Monte Carlo methods including resampling, randomization, and simulation. 4 lectures.

**STAT 350. Probability and Random Processes for Engineers. 4 units.**

GE Area B6

Prerequisite: MATH 241, EE 228.

Random events, random variables, and random processes, with emphasis on probabilistic treatment of signals and noise. Specific topics include: sample spaces, probability, distributions, independence, moments, covariance, time/ensemble averages, stationarity, common processes, correlation and spectral functions. 4 lectures. Fulfills GE B6.

**STAT 400. Special Problems for Advanced Undergraduates. 1-2 units.**

Prerequisite: Consent of department head.

Individual investigation, research, studies or surveys of selected problems. Total credit limited to 4 units, with a maximum of 2 units per quarter.

**STAT 416. Statistical Analysis of Time Series. 4 units.**

Prerequisite: STAT 324 or STAT 524.

Time series components, descriptive smoothing methods, regression models for time series data, forecasting via exponential smoothing, evaluation of forecasts, autocorrelation, ARIMA models and Box-Jenkins methods, combining forecasts, frequency domain analysis, filtering. 4 lectures.

**STAT 417. Survival Analysis Methods. 4 units.**

Prerequisite: STAT 302.

Parametric and nonparametric methods for analyzing survival data. Topics include Kaplan-Meier and Nelson-Aalen estimates, Cox regression models, accelerated failure time models. Use of statistical software to implement methods throughout course. 4 lectures.

**STAT 418. Analysis of Cross-Classified Data. 4 units.**

Prerequisite: STAT 324 or STAT 524.

Discrete multivariate statistics, including analysis of cross-classified data, log-linear models for multidimensional contingency tables, goodness of fit statistics, measures of association, model selection, and hypothesis testing. 4 lectures.

**STAT 419. Applied Multivariate Statistics. 4 units.**

Prerequisite: Two courses in statistics. Recommended: MATH 206.

Continuous multivariate statistics. Multivariate linear model, principal components and factor analysis, discriminant analysis, clustering, and canonical correlation. Use of statistical software throughout the course. 4 lectures.

**STAT 421. Survey Sampling and Methodology. 4 units.**

Prerequisite: One of the following: STAT 252, STAT 302, STAT 313, STAT 512, or STAT 513.

Survey planning, execution, and analysis. Principles of survey research, including non-sampling and sampling error topics. Survey sample designs, including simple random, systematic, stratified, cluster, and multi-stage. Estimation procedures and sample size calculations. 4 lectures.

**STAT 423. Design and Analysis of Experiments II. 4 units.**

Prerequisite: STAT 323 or STAT 523.

Continuation of STAT 323. 2k factorial designs, 3k factorial designs, balanced and partially balanced incomplete block designs, nested designs, split-plot designs, response surface methodology, confounding, repeated measures, and other design approaches. 4 lectures.

**STAT 425. Probability Theory. 4 units.**

Prerequisite: MATH 241 and MATH 248. Recommended: STAT 301 and STAT 325.

Basic probability theory, combinatorial methods, independence, conditional and marginal probability, probability models for random phenomena, random variables, probability distributions, distributions of functions of random variables, mathematical expectation, covariance and correlation, conditional expectation. 4 lectures.

**STAT 426. Estimation and Sampling Theory. 4 units.**

Prerequisite: STAT 425. Recommended: STAT 302.

Continuation of STAT 425. Properties of statistics obtained from samples. Sample mean properties, convergence in probability, law of large numbers, and central limit theorem. Selected probability distributions. Theory of estimation. Sampling distribution of estimators. 4 lectures.

**STAT 427. Mathematical Statistics. 4 units.**

Prerequisite: STAT 426.

Continuation of STAT 426. The theory of hypothesis testing and its applications. Power and uniformly most powerful tests. Categorical data and nonparametric methods. Other selected topics. 4 lectures.

**STAT 440. SAS Certification Preparation. 2 units.**

Prerequisite: STAT 330.

Preparation and discussion of programming, data management, and data analysis topics related to the Certified Base Programmer Exam offered by the SAS Institute. 2 lectures.

**STAT 461. Senior Project I. 1 unit.**

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 90 hours total time.

**STAT 462. Senior Project II. 2 units.**

Selection and completion of a project under faculty supervision. Projects typical of problems which graduates must solve in their fields of employment. Project results are presented in a formal report. Minimum 90 hours total time.

**STAT 465. Statistical Communication and Consulting. 4 units.**

Prerequisite: Open only to statistics majors with senior standing.

Blending of the theoretical and practical aspects of statistical consulting. Development of tools necessary to conduct effective consulting sessions, present oral arguments and written reports, work collaboratively to solve problems, and utilize professional publications in statistics. 4 lectures.

**STAT 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1-4 lectures.

**STAT 485. Cooperative Education Experience. 6 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Part-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 6 units; total credit limited to 12 units. Credit/No Credit grading only.

**STAT 495. Cooperative Education Experience. 12 units.**

CR/NC

Prerequisite: Sophomore standing and consent of instructor.

Full-time work experience in business, industry, government, and other areas of student career interest. Positions are paid and usually require relocation and registration in course for two consecutive quarters. Formal report and evaluation by work supervisor required. Major credit limited to 12 units; total credit limited to 24 units. Credit/No Credit grading only.

**STAT 512. Statistical Methods. 4 units.**

Prerequisite: Graduate standing and intermediate algebra or equivalent.

Statistical methods in research for graduate students not majoring in mathematical sciences. Probability distributions, confidence intervals, hypothesis testing, contingency tables, linear regression and correlation, multiple regression, analysis of variance. Substantial use of statistical software. 4 seminars.

**STAT 513. Applied Experimental Design and Regression Models. 4 units.**

Prerequisite: Graduate standing and one of the following: STAT 512, STAT 542, STAT 217, STAT 218, STAT 252, STAT 312, or equivalent.

Applications of statistics for graduate students not majoring in mathematics. Analysis of variance including the one-way classification, randomized blocks, Latin squares, and factorial designs. Introduction to multiple regression and to analysis of covariance. Substantial use of statistical software. 4 lectures. Not open to students with credit in STAT 313.

**STAT 523. Design and Analysis of Experiments I. 4 units.**

Prerequisite: STAT 513 or STAT 542.

Principles, construction and analysis of experimental designs. Completely randomized, randomized complete block, Latin squares, Graeco-Latin squares, factorial, and nested designs. Fixed and random effects, expected mean squares, multiple comparisons, and analysis of covariance. Not open to students with credit in STAT 323. 4 lectures.

**STAT 524. Applied Regression Analysis. 4 units.**

Prerequisite: STAT 513 or STAT 542.

Simple linear regression and associated special topics, multiple linear regression, indicator variables, influence diagnostics, assumption analysis, selection of best subset, nonstandard regression models, logistic regression, nonlinear regression models. Not open to students with credit in STAT 324. 4 lectures.

**STAT 530. Statistical Computing with SAS. 4 units.**

Prerequisite: STAT 512 or STAT 513 or STAT 542 or equivalent.

Techniques available to the statistician for efficient use of computers to perform statistical computations and to analyze large amounts of data. Use of the SAS software system. Includes data preparation, report writing, basic statistical methods, and a research project. Not open to students with credit in STAT 330. 4 lectures.

**STAT 531. Statistical Computing with R. 4 units.**

Prerequisite: Graduate standing, STAT 513 or STAT 542, and one computer programming course; or consent of instructor.

Obtain, manage, and clean data; use of regular expressions; functional and object-oriented programming; graphical, descriptive, and inferential statistical methods; random number generation; Monte Carlo methods including resampling, randomization, and simulation. Not open to students with credit in STAT 331. 4 lectures.

**STAT 542. Statistical Methods for Engineers. 4 units.**

Prerequisite: MATH 142 and graduate standing.

Descriptive and graphical methods. Discrete and continuous probability distributions. One and two sample confidence intervals and hypothesis testing. Single factor analysis of variance. Quality control. Introduction to regression and to experimental design. Substantial use of statistical software. Not open to students with credit in STAT 312. 4 lectures.

**STAT 570. Selected Advanced Topics. 1-4 units.**

Prerequisite: Graduate standing or consent of instructor.

Directed group study of selected topics for graduate students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1-4 lectures.



# Systems Integration Engineering (SIE)

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## Systems Integration Engineering Courses

### **SIE 509. Systems Integration Overview. 1 unit.**

Prerequisite: Admission to the graduate certificate program in Systems Integration Engineering.

Orientation and overview of the Systems Integration Engineering graduate certificate program, including introduction to systems integration, learning technologies, teamwork, personality types, leadership, desired attributes of an engineer, and presentations by visiting system experts. 1 lecture.

### **SIE 510. Introduction to Systems. 4 units.**

Prerequisite: SIE 509.

Introduction to man-made and socio-technical systems, including life cycle concepts, needs analysis, requirements discovery, models, complexity, project management, life cycle costing, risk management, and decision making. Verification, validation, and virtual collaboration of teams. Course offered online only. 4 lectures.

### **SIE 511. Systems Analysis. 4 units.**

Prerequisite: SIE 510.

Analysis topics and techniques within the systems context, including functional analysis, systems simulation, design analysis, financial analysis, schedule analysis, manufacturability, reliability, maintainability, and usability. Course offered online only. 4 lectures.

### **SIE 512. Systems Synthesis. 4 units.**

Prerequisite: SIE 511.

Systems synthesis and integration through systems thinking, interface management, configuration management, lean systems, A3 Thinking, commercial versus government systems, system verification and validation, and internal versus external subsystem development. Course offered online only. 4 lectures.

## Theatre (TH)

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## Theatre Courses

### **TH 210. Introduction to Theatre. 4 units.**

GE Area C3

Principles of theatre and production process, including theatrical terminology, methods, dramatic literature, aesthetics, and technology. 4 lectures. Fulfills GE C3.

### **TH 220. Acting Methods. 4 units.**

Prerequisite: TH 210.

Contemporary acting techniques focused on character building, objectives and tactics, with a focus on the development and implementation of various interactive methods of vocal work, images and actor resources. 3 lectures, 1 activity.

### **TH 227. Theatre History I. 4 units.**

GE Area C3

Highlights of European theatrical history - Greeks, Romans, Medieval English and French theatre through the 17th century. Production methods, acting styles, playwriting theories and representative plays. 4 lectures. Fulfills GE C3.

### **TH 228. Theatre History II. 4 units.**

GE Area C3

Highlights of European and American theatrical history from the 18th to 20th century. Production methods, acting styles, playwriting theories and representative plays. 4 lectures. Fulfills GE C3.

### **TH 230. Stagecraft I. 4 units.**

Basic stagecraft technique used in the entertainment industry. Construction and painting of scenery, building and gathering properties, hanging and focusing lighting instruments, assisting with costumes and acting as running crew for department production each term. May not be taken concurrently with TH 250. 4 laboratories.

### **TH 240. Improvisational Theatre. 4 units.**

Objectives and techniques of improvisational theatre. Participation in a series of exercises designed to develop skills in dramatic structure formatting, interactive problem solving, spontaneous scripting, dynamic communications, and applied performance styles. 2 lectures, 2 activities.

### **TH 250. Costume Construction. 4 units.**

Basic costume construction techniques used in the entertainment industry. Building of all costumes and special craft projects for main stage theatre productions. Total credit limited to 12 units. May not be taken concurrently with TH 230 or TH 330. 4 laboratories.

### **TH 260. Voice and Diction for the Stage. 4 units.**

Theory and practice in developing command of oral techniques for the stage including breath support, resonance and articulation. 4 lectures.

### **TH 270. Stage Make-Up. 4 units.**

Introduction to the art of theatrical make-up design and application. Techniques for producing character, old age, fantasy and special effects make-up. Demonstration and discussion of various design and application styles. 3 lectures, 1 activity.

### **TH 275. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

### **TH 280. Body Awareness and Expression. 4 units.**

Directed group study of movement techniques and exercises to facilitate expressive physical performance for the actor. Body effectiveness, alignment and conditioning practice integrated with creative exploration and movement analysis of effort, spatial awareness and detailed body usage. 4 lectures. Crosslisted as TH/DANC 280.

### **TH 290. Script Analysis. 4 units.**

Prerequisite: TH 210, TH 227 or TH 228.

Script analysis taught as an essential applied skill for actors, designers and directors. Students read a variety of plays and learn how to examine their structure, theme and context. 4 seminars.

**TH 295. Foundations in Theatrical Design. 4 units.**

Prerequisite: TH 210 or consent of instructor.

Exploration of the fundamental principles and practices of designing for the stage. Emphasis placed upon the creative and collaborative process of theatre; development of the visual world of the play via language, color, drawing, analysis, and peer evaluation. 3 lectures, 1 activity.

**TH 300. Topics in Diversity on the American Stage. 4 units.**  
USCP

Prerequisite: Completion of GE Areas A and C3 (TH 210 recommended); TH 210, TH 227, or TH 228 for Theatre majors.  
Recommended: Junior standing.

Critical analysis of traditionally underrepresented groups in the American theatre - as writers, practitioners, story subjects. Investigation of dramatic literature and performance trends related to special interest topics. The Schedule of Classes will list topic selected. Total credit limited to 8 units. 4 lectures. Fulfills USCP.

**TH 310. Women's Theatre. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C3 (TH 210 recommended); TH 210, TH 227, or TH 228 for Theatre majors.  
Recommended: Junior standing.

Examination of a variety of female theatre artists from the Greeks to the present and the socio-political contexts from which they emerged. Analysis of a variety of classic and contemporary playscripts emphasizing evolving visions of women. 4 lectures. Fulfills GE C4 except for Theatre Arts majors. Fulfills USCP.

**TH 320. Black Theatre. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C3 (TH 210 recommended); TH 210, TH 227, or TH 228 for Theatre majors.  
Recommended: Junior standing.

African-American theatre artists from the 17th-20th century, and the socio-political contexts from which they emerged. Particular emphasis on 20th century African-American plays and playwrights: Hansberry, Baldwin, Shange, Baraka, Gordone, and Wilson. 4 lectures. Fulfills GE C4 except for Theatre Arts majors. Fulfills USCP.

**TH 330. Stagecraft II. 4 units.**

Prerequisite: Junior standing.

Basic stagecraft technique used in the entertainment industry. Students construct and paint scenery, build and gather properties, hang and focus lighting instruments, assist on costumes and act as running crew for department production each term. Total credit limited to 8 units. May not be taken concurrently with TH 250. 4 laboratories.

**TH 341. Advanced Acting Studio. 4 units.**

Prerequisite: TH 210 and TH 220 or consent of instructor.

Selected acting techniques with focus on specific advanced modes of training. The Schedule of Classes will list topic selected. Total credit limited to 12 units. 3 lectures, 1 activity.

**TH 345. Rehearsal and Performance. 4 units.**

Prerequisite: By audition only.

Preparation of a play for public presentation, including acting, stage management, publicity, or serving as a key member of the artistic team. Total credit limited to 12 units. Major credit limited to 4 units; repeated units are free electives. 4 laboratories.

**TH 350. Seminar in Playwriting. 4 units.**

Prerequisite: TH 210, completion of GE Area A.

Examines dramatic structure, techniques of dialogue, and means of characterization in variety of plays. Relates dramatic writing to technical, design, directorial and acting demands. Compositions of monologues, scenes and one-act play; works read and critiqued in class. 4 seminars.

**TH 360. Theatre in the United States. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C3 (TH 210 recommended); TH 210, TH 227, or TH 228 for Theatre majors.  
Recommended: Junior standing.

Examination of American plays, playwrights, organizations and movements, applying them as portraits of the United States' historical, philosophical and cultural make-up. Topical emphasis focuses on the definition and development of an 'American' identity via the context of theatre. 4 lectures. Fulfills GE C4 except for Theatre majors.

**TH 370. Costume History. 4 units.**

Prerequisite: TH 210 or consent of instructor.

Dress worn in Western society from Ancient Egypt through AD 2000. Silhouette; how, when, and why particular garments were worn; emphasis on social, political, and economic context. 4 lectures.

**TH 380. Children's Drama. 4 units.**

Prerequisite: TH 210 or upper-division Liberal Studies, Child Development or Psychology course.

Techniques for teaching theatre performance skills to children. Creation of small group seminar performance projects that are performed before an audience of elementary school children. 3 lectures, 1 activity.

**TH 390. Global Theatre and Performance. 4 units.**

GE Area C4

Prerequisite: Completion of GE Areas A and C3 (TH 210 recommended); TH 210, TH 227, or TH 228 for Theatre majors.  
Recommended: Junior standing.

Investigation of non-western/underrepresented theatre and dramatic performance; emphasis on plays, playwrights, and movements as portraits of philosophical/national make-up. Topical emphasis focuses on the definition and development of a cultural identity via the context of historical and contemporary theatre practices. 4 lectures. Fulfills GE C4 except for Theatre majors.

**TH 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of department head.

Individual investigation, research, or project centering around theatre. Total credit limited to 4 units.

**TH 430. Scenic Design. 4 units.**

Prerequisite: TH 290 and TH 295 or consent of instructor.

Scenic design process used in the entertainment industry, including collaboration, concept development, research, sketching, drafting, color rendering using a variety of media, 3D model building, and the presentation of design material. 3 lectures, 1 activity.

**TH 432. Costume Design. 4 units.**

Prerequisite: TH 290 and TH 295 or consent of instructor.

Costume design process used in the entertainment industry, including collaboration, concept development, research, sketching, color rendering using a variety of media, and the presentation of design material. 3 lectures, 1 activity.

**TH 434. Lighting Design. 4 units.**

Prerequisite: TH 290 and TH 295 or consent of instructor.

Lighting design process used in the entertainment industry, including collaboration, concept development, research, functional aspects of lighting equipment, CAD drafting, the development of production paperwork and presentation of design material. 3 lectures, 1 activity.

**TH 450. Directing. 4 units.**

Prerequisite: TH 290 and consent of instructor.

Principles, philosophies, analytical methods, business practices, organizational techniques and interpersonal strategies of directing for the stage. Experiential work includes hands-on, in-class exercises, as well as intensive outside class rehearsals. Culmination in a public production of student-directed one-act plays. 3 lectures, 1 activity.

**TH 461. Senior Project Seminar. 4 units.**

Prerequisite: Senior standing and Theatre majors only or consent of instructor.

Focus on post-graduate career planning options in theatre arts, including resume and portfolio building, preparation for professional work, graduate school and internships. A structure by which students design and submit their senior projects. 4 seminars.

**TH 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. Class Schedule will list topic selected. Total credit limited to 8 units. 1 to 4 lectures.

**TH 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for theatre students. Class Schedule will list topics selected. Total credit limited to 12 units. 1-4 laboratories.

**TH 480. Internship. 4 units.**

CR/NC

Prerequisite: Junior standing with a minimum 3.0 GPA and consent of instructor.

Part-time work experience in the entertainment industry. Ability to work independently; strong verbal and written skills. Faculty approval of job position required. Evaluations by job supervisor and written reports by student required. 120 hours of work experience. Total credit limited to 8 units. Credit/No Credit grading.

## University Studies (UNIV)

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### University Studies Courses

**UNIV 125. First Year Seminar. 2 units.**

CR/NC

Issues associated with the successful transition from high school or community college to Cal Poly. Links fostered between student needs and campus resources. Coverage of academic policies and procedures, university study skills, goal setting, career planning, wellness and other topics relevant to student success. Credit/No Credit grading only. 1 lecture, 1 activity.

**UNIV 321. Undergraduate Research Methods and Practice. 4 units.**

Prerequisite: Completion of GE Areas A and B1, and consent of instructor.

Research methods and tools for sciences and humanities, including formulating a research question, designing a study, using the scientific method to conduct and analyze surveys, and analyzing data. Emphasis on working in interdisciplinary research teams. Total credit limited to 8 units. 2 lectures, 2 activities. Crosslisted as HNRS/UNIV 321.

**UNIV 330. Cal Poly Land: Nature, Technology, and Society. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Scientific investigation of the natural features of the Cal Poly landscape and their transformations by land management technology. Analysis of the environmental, economic, social, and political effects of agriculture, resource extraction, and construction technology on that landscape. Emphasis on the educational, land-use, and long term planning issues of technology presented by this case study. 4 lectures. Crosslisted as AG/HUM/UNIV 330. Fulfills GE Area F.

**UNIV 333. World Food Systems. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B, or consent of instructor.

Integrated, interdisciplinary study of the technologies of global food production, environmental and social issues related to the application of those technologies, and moral and ethical issues associated with global food production and distribution. Emphasis on the politics of change. 4 lectures. Crosslisted as POLS/UNIV 333. Fulfills GE Area F.

**UNIV 350. The Global Environment. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Areas A and B.

Interdisciplinary investigation of how human activities impact the Earth's environment on a global scale. Examination of population, resource use, climate change, and biodiversity from scientific/technical and social/economic/ historical/political perspectives. Use of remote sensing maps. Sustainable solutions. 4 lectures. Crosslisted as AG/EDES/ENGR/ HUM/SCM/UNIV 350. Fulfills GE Area F.

**UNIV 361. Modernism. 4 units.**

GE Area C4

Prerequisite: Completion of GE Area A and one class from Area C. Recommended: Junior standing.

Interdisciplinary survey of the eighteenth, nineteenth and twentieth-century concepts and cultural movements known as modernism throughout Europe, North America and Latin America. Disciplines may include architecture, art, drama, literature, music, philosophy, and photography. 4 lectures. Crosslisted as HUM/UNIV 361. Fulfills GE C4.

**UNIV 391. Appropriate Technology for the World's People: Development. 4 units.**

GE Area D5

Prerequisite: Junior standing; completion of GE Area A, and two courses from GE D1-D4.

A broad overview of international development and appropriate design for sustainability. Besides traditional classroom work, students work in teams to address problems with technical solutions. Collaboration with mentors from the university, private sector, and nonprofits serves to provide diverse background and project mentorship. 4 lectures. Crosslisted as HNRS/UNIV 391. Fulfills GE D5.

**UNIV 392. Appropriate Technology for the World's People: Design. 4 units.**

GE Area F

Prerequisite: Junior standing and completion of GE Area B, or graduate standing. Recommended: UNIV 391, GE Area D2, and GE Area D3.

Addresses the needs of international impoverished communities with technological solutions, which are inexpensive, ecologically sustainable, and socially appropriate. Group study of target communities, and design and construction of an appropriate technology prototype. Not open to students with credit in UNIV 492. 3 lectures, 1 laboratory. Crosslisted as HNRS/UNIV 392. Fulfills GE Area F.

**UNIV 424. Design of Museum Displays of Science, Engineering and Technology. 4 units.**

Prerequisite: GE Area B.

The design and creation of educational museum displays that highlight science, engineering, and technology. Projects done by multidisciplinary teams and for clients in the community. Emphasis on design, teamwork, service learning and project management. 3 lectures, 1 laboratory. Crosslisted as HNRS/UNIV 424.

**UNIV 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**UNIV 491. Appropriate Technology for the World's People: Development. 4 units.**

Prerequisite: Consent of instructor, and senior or graduate standing.

Corequisite: GE Area D5.

A broad overview of international development and appropriate design for sustainability. Besides traditional classroom work, students work in teams to address problems with technical solutions. Collaboration with mentors from the university, private sector, and nonprofits serves to provide diverse background and mentorship. Seminar paper required. Not open to students with credit in UNIV/HNRS 391. 4 lectures.

**UNIV 492. Appropriate Technology for the World's People: Design. 4 units.**

Prerequisite: Junior standing and completion of GE Area B, or graduate standing. Recommended: UNIV 391, GE Area D2, and GE Area D3.

Addresses the needs of international impoverished communities with technological solutions, which are inexpensive, ecologically sustainable, and socially appropriate. Group study of target communities, and design and construction of an appropriate technology prototype. Seminar paper required. Not open to students with credit in UNIV/HNRS 392. 3 lectures, 1 laboratory.

## **Vegetable Science (VGSC)**

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### **Vegetable Science Courses**

**VGSC 190. California Vegetable Production. 4 units.**

Prerequisite: HCS 120.

History, botany, growth characteristics and climatic adaptation, pests, and harvesting methods for the most important vegetable crops grown in California. Use of transplants, plastic mulches and row covers in vegetable production. Current topics in agriculture important to the vegetable industry. Field trip to a major California vegetable production area required. Survey of vegetable production for Agricultural and Environmental Plant Sciences majors or Crop Science majors. 3 lectures, 1 laboratory.

**VGSC 202. Enterprise Project. 2 units.**

CR/NC

Prerequisite: HCS 110, or consent of instructor.

Beginning field experience in production and marketing of a vegetable crop, under faculty supervision. Project participation is subject to approval by the department head and the Cal Poly Corporation. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture and 1 unit of independent study.

**VGSC 230. Introduction to Vegetable Science. 4 units.**

Environmental and cultural principles involved in the production of California vegetable crops; temperature, daylength and fertility effects on production and yield, use of plastic mulches and row covers, and use of transplants. Harvest principles and precooling methods. Not open to Agricultural and Environmental Plant Science majors, Crop Science majors, nor students with credit in VGSC 190. 3 lectures, 1 laboratory.

**VGSC 402. Enterprise Project Management. 2 units.**

CR/NC

Prerequisite: VGSC 202 and consent of instructor.

Advanced experience in the production of vegetable crops. Development of a plan for field operations, a marketing plan, and a budget. Management decision-making. Degree credit limited to 4 units. Credit/No Credit grading only. 1 lecture and 1 unit of independent study.

**VGSC 423. Advanced Vegetable Science. 4 units.**

Prerequisite: VGSC 190 or VGSC 230.

Agricultural land conservation; current laws impacting vegetable production and marketing. Environmental and cultural effects on selected vegetables including specific effects on growth, flowering, fruiting and yield. Field trip to desert vegetable production regions required. 3 lectures, 1 laboratory.

## Wine and Viticulture (WVIT)

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### Wine and Viticulture Courses

**WVIT 101. Orientation to Wine and Viticulture. 1 unit.**

CR/NC

Introduction to the wine and viticulture program. Emphasis on curriculum and career planning. Credit/No Credit grading only. 1 lecture.

**WVIT 102. Global Wine and Viticulture. 4 units.**

Introduction to wine grape growing, winemaking, and wine business. Brief history and overview of major global wine regions, including growing conditions, grape varieties, winemaking styles, and wine business practices. 4 lectures.

**WVIT 202. Fundamentals of Enology. 4 units.**

Prerequisite: CHEM 111 or CHEM 127.

Introduction to the science of winemaking: development of wine components in grapes, grape maturation, harvesting, pre-fermentation wine-making methods, alcoholic fermentation, malolactic fermentation, wine maturation and post fermentation practices, wine spoilage, maintenance of wine integrity. 4 lectures.

**WVIT 203. The Anatomy of a Wine. 2 units.**

Prerequisite: WVIT 202 and sophomore standing.

The role and behavior of compounds in musts, wines, yeasts and oak and their contribution to the color, aromas, flavors, mouthfeel and structure of different wine styles. 2 lectures. Formerly WVIT 103.

**WVIT 210. Viticultural Practices. 2 units.**

Propagation, layout and planting of a new vineyard, including irrigation and trellis system installations and management practices of established vineyards. Total credit limited to 4 units. 2 activities. Crosslisted as FRSC/WVIT 210.

**WVIT 231. Viticulture I. 4 units.**

Understanding of internal and external factors affecting vine productivity. Historical and international perspectives on grape growing. Vineyard production strategies. 3 lectures, 1 laboratory. Crosslisted as FRSC/WVIT 231.

**WVIT 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**WVIT 301. Wine Microbiology. 4 units.**

Prerequisite: MCRO majors must have MCRO 224; WVIT majors must have MCRO 221 and WVIT 202; open to MCRO or WVIT majors only.

Wine yeasts, bacteria, and molds: morphology and methods of identification; successful alcoholic and malolactic fermentations; management and prevention of unwanted microbial growth; micro-organisms and flavor development. 3 lectures, 1 laboratory. Crosslisted as MCRO/WVIT 301.

**WVIT 302. Wine Fermentation Laboratory. 2 units.**

Prerequisite: WVIT 202.

Alcoholic and malolactic fermentation, maturation, stabilization and bottling of finished wines. Students must be 21 years or older. Not open to students with credit in WVIT 404, WVIT 405 or WVIT 406. 1 lecture, 1 laboratory.

**WVIT 311. Survey of Viticulture. 4 units.**

Prerequisite: FRSC/WVIT 210 and completion of GE Area B2.

Introduction to winegrowing including the life cycle of the vine, site selection and the concept of 'terroir', canopy management and cultural practices influencing wine quality. Decision making processes in pest management, irrigation strategies, and organic and sustainable vineyard practices. Current issues in mechanization and its impact on labor management, in the concept of business decisions. Not open to students with credit in FRSC 231. 4 lectures. Formerly FRSC 211. Crosslisted as FRSC/WVIT 311.

**WVIT 331. Viticulture II. 4 units.**

Prerequisite: FRSC/WVIT 231.

Factors influencing vine physiology and winegrape quality. Recent advances in irrigation strategies, canopy management, and pest control. Budgets for profitable operation and mechanized viticulture. Field trip required. 3 lectures, 1 laboratory. Crosslisted as FRSC/WVIT 331.

**WVIT 339. Internship Wine and Viticulture. 1-12 units.**

CR/NC

Prerequisite: WVIT 202, WVIT/FRSC 231 or WVIT 311; junior standing; and consent of internship instructor.

One or two quarters spent with an approved wine industry employer engaged in wine production or related agribusiness and viticulture activities. Applying and developing production and managerial skills and abilities. One unit of credit may be allowed for each full week of completed and reported internship. Total Major credit limited to 6 units. Total credit limited to 12 units. Credit/No Credit grading only.

**WVIT 343. Branded Wine Marketing. 4 units.**

Prerequisite: AGB 212 or ECON 201.

Wine pricing as it relates to quality, packaging, and service. Distribution options with emphasis on the three tier system, promotional strategies, including public relations, mass media advertising, personal selling, and direct marketing. Domestic and international marketplaces. 4 lectures. Formerly AGB 443.

**WVIT 365. Wine Analysis and Amelioration. 4 units.**

Prerequisite: WVIT 202; for WVIT majors only.

Winery laboratory practices. Basic principles, techniques, and interpretation of common analyses for sugars, acidity, nitrogen, alcohol, volatile acidity, sulfur dioxide, phenols and color; wine and must amelioration, amendment effects, usage, calculations and procedures of addition. 3 lectures, 1 laboratory. Formerly FSN 365.



**WVIT 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: Consent of instructor.

Individual investigation, research, studies, or surveys of selected problems. Total credit limited to 6 units, with a maximum of 4 units per quarter.

**WVIT 404. Winemaking I. 4 units.**

Prerequisite: WVIT 202 and FSN 365; students must be at least 21 years in age.

Planning, managing and implementing harvest in the pilot winery; sanitation practices; monitoring grape maturity; handling juices and musts; alcoholic and malolactic fermentation, general cellar practices; sensory and laboratory analyses. 3 lectures, 1 laboratory.

**WVIT 405. Winemaking II. 4 units.**

Prerequisite: WVIT 404; students must be at least 21 years in age.

Planning, managing and implementing harvest in the pilot winery; sanitation practices; monitoring and maintaining wine integrity; planning for bottling; blending trials; general cellar practices; sensory and laboratory analyses. 3 lectures, 1 laboratory.

**WVIT 406. Winemaking III. 4 units.**

Prerequisite: WVIT 405; students must be at least 21 years in age.

Planning, managing and implementing the preparation of wine for bottling; blending; fining; filtration; bottling; conducting general cellar practices; sensory and laboratory analyses. 3 lectures, 1 laboratory.

**WVIT 414. Grape Pest Management. 4 units.**

Prerequisite: PPSC 311; BOT 323; FRSC/WVIT 231 or FRSC/WVIT 311.

Comprehensive survey of major grape pests including diseases, insects, weeds, vertebrates, and nematodes. Identification and biology of grape pests and natural enemies, monitoring, and integrated pest management (IPM) strategies, including cultural, biological, and chemical controls. Guest lectures. Total credit limited to 8 units. 3 lectures, 1 activity. Crosslisted as PPSC/WVIT 414.

**WVIT 415. Grapevine Physiology. 4 units.**

Prerequisite: FRSC/WVIT 231 and FRSC/WVIT 331.

Understanding of grapevine physiology, including anatomy, taxonomy, physiological growth processes, growth cycle phenology, bud break, flowering, fruit set, berry ripening. 3 lectures, 1 laboratory. Crosslisted as FRSC/WVIT 415.

**WVIT 423. Wine Law and Compliance. 4 units.**

Prerequisite: WVIT 343.

Legal aspects of wine making/marketing. Emphasis of both Federal (Tax and Trade Bureau) and State business requirements as well as State and Federal regulations impacting winery and viticultural practices in California. 4 lectures.

**WVIT 424. Winegrape Growing: Fall. 2 units.**

Prerequisite: FRSC/WVIT 231; BRAE 340; SS 221; PPSC 321; and STAT 218.

Management of campus winegrape vineyards in the fall, including harvesting; fertilization; disease, insect, vertebrate and weed management; pruning; soil management; trellis repair; and cover crop planting and maintenance. 1 lecture, 1 laboratory.

**WVIT 425. Winegrape Growing: Winter. 2 units.**

Prerequisite: FRSC/WVIT 231; BRAE 340; SS 221; PPSC 321; and STAT 218.

Management of campus winegrape vineyard in the winter, including pruning; trellis repair; irrigation system maintenance; disease, vertebrate and weed management; cover crop maintenance. 1 lecture, 1 laboratory.

**WVIT 426. Winegrape Growing: Spring. 2 units.**

Prerequisite: FRSC/WVIT 231; BRAE 340; SS 221; PPSC 321; and STAT 218.

Management of campus winegrape vineyards in the spring, including canopy manipulation; planting; training; irrigation; nutrient evaluation; fertilization; crop evaluation; disease, insect, vertebrate and weed management. 1 lecture, 1 laboratory.

**WVIT 427. Winegrape Growing: Summer. 2 units.**

Prerequisite: FRSC/WVIT 231; BRAE 340; SS 221; PPSC 321; and STAT 218.

Management of campus winegrape vineyards in the summer, including canopy manipulation; training; irrigation; crop evaluation; soil management; and disease, insect, vertebrate and weed management. 1 lecture, 1 laboratory.

**WVIT 433. Wine Sales and E-Commerce. 4 units.**

Prerequisite: WVIT 343.

Professional selling in the wine industry. Selling wine through the seven avenues of wine distribution in the 3-tier system. Exploration of aspects of wine selling, from customer relation management to cultural and legal differences among states. How strategies for selling differ for various sized wineries. 4 lectures.

**WVIT 442. Sensory Evaluation of Wine. 4 units.**

Prerequisite: WVIT 202 and STAT 218; students must be at least 21 years in age; for WVIT majors only.

Evaluation of wines using the techniques in sensory evaluation. Difference and rating tests; descriptive analysis and pairing of wine and food. 3 lectures, 1 laboratory. Formerly FSN/WVIT 342.

**WVIT 444. Wine Marketing Research and Market Analysis. 4 units.**

Prerequisite: STAT 217 or STAT 218; and WVIT 343.

Application of statistical theory to design research to examine the wine and grape markets. Research examining the evaluation of appropriate data collection methods, quantitative analyses, and interpretation of primary and secondary wine and grape industry data. 4 lectures.

**WVIT 450. Wine Business Strategies. 4 units.**

Prerequisite: AGB 323; WVIT 343; and WVIT 423.

The strategic planning process for wine businesses. Development of a complete business plan with careful adherence to the unique and complex regulations that apply to wine businesses. The business plan will include specification of the product, distribution, finance, and marketing. 4 lectures.

**WVIT 460. Senior Project - Wine Business. 4 units.**

Prerequisite: Completion of at least two of the following courses: AGB 422, WVIT 343, WVIT 444 and AGB 323; Senior standing; WVIT majors only.

Selection and analysis of wine and viticulture business problems and opportunities in directed group-based projects. Problems typical to those that graduates may encounter in marketing and management in the wine and viticulture industry. Formal report and presentation required. 4 lectures.

**WVIT 461. Senior Project I - Enology and Viticulture. 2 units.**

Prerequisite: STAT 217 or STAT 218; junior standing and consent of instructor; WVIT majors only.

Development of a senior project topic under faculty supervision, review of relevant literature, development of experimental research design. Subject must be relevant to enology and/or viticulture.

**WVIT 462. Senior Project II - Enology and Viticulture. 2 units.**

Prerequisite: WVIT 461; Senior standing and consent of instructor.

Completion of a research project under faculty supervision. Data collection, analysis and formal report preparation. Subject must be relevant to enology and/or viticulture.

**WVIT 463. Issues, Trends and Careers in the Wine Industry. 2 units.**

Prerequisite: Senior standing; WVIT majors only.

Current issues and trends in viticulture, enology and wine business. Career opportunities and planning for WVIT majors nearing graduation. 2 seminars.

**WVIT 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**WVIT 471. Selected Advanced Laboratory. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group laboratory study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 laboratories.

## Women's and Gender Studies (WGS)

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### Women's and Gender Studies Courses

**WGS 201. Introduction to Women's and Gender Studies in the United States. 4 units.**

GE Area D1; USCP

Introduction to theories and research on how genders and sexualities in the US shape and are shaped by historical processes and US institutional formation - specifically social, political, economic, legal, cultural institutions. Emphasis on interlocking systems of gender, sexuality, race and class. 4 lectures. Fulfills GE Area D1 and USCP.

**WGS 270. Selected Topics. 1-4 units.**

Prerequisite: Open to undergraduate students and consent of instructor.

Directed group study of selected topics. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

**WGS 301. Contemporary Issues in Women's and Gender Studies. 4 units.**

GE Area D5; USCP

Prerequisite: Completion of GE Area A and one course from lower division Area D. Recommended: Junior standing.

Exploration of interdisciplinary, feminist theories and research on gender and sexuality, gender stratification, and gender role development. Emphasis on the intersection of gender, sexuality, race, class, age, and able-bodiedness. 4 lectures. Fulfills GE D5 and USCP.

**WGS 311. Sociology of Gender. 4 units.**

Prerequisite: Junior standing.

Description and analysis of the impact of gender definitions on men and women in society. Special attention is given to the learning process; the creation and perpetuation of gender stereotypes and the way these affect individual life chances and social structure, explored in the areas of work, education, family and abusive relationships. Focus on media presentation of gender and effects of ethnicity and class. 4 lectures. Crosslisted as SOC/WGS 311.

**WGS 316. Women as Subject and Object in Art History. 4 units.**

Prerequisite: ART 111, ART 112 or ART 211 or ART 212, or consent of instructor.

Exploration of the role of women in the visual arts. Women as artists, women as portrayed in art, and feminist theory as it applies to the study of the visual arts and art history. 4 lectures. Crosslisted as ART/WGS 316.

**WGS 320. Women in Global Perspective. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from lower division Area D. Recommended: Junior standing.

Similarities and differences in women's lives internationally. Cultural influences such as class, ethnicity, and religion on women's status. Study of global feminism, reproductive rights, women's labor, women in development, women's politics. 4 lectures. Fulfills GE D5.

**WGS 324. Psychology of Gender. 4 units.**

Prerequisite: PSY 201 or PSY 202.

Investigation of psychological gender beyond ideas associated with biological sex. Exploration of sex differences from a social psychological (e.g., socialization) perspective. Implications of both the male and female gender roles for relationships and health. 4 lectures. Crosslisted as PSY/WGS 324.

**WGS 340. Sexuality Studies. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and one course from lower division Area D. Recommended: Junior standing.

Sexuality in a cultural and historical context. Changing definitions of human subjectivity. The cultural and social regimes that control and create sexuality (including the 'invention' of homo/heterosexuality and the social, legal and political systems that define sexual ab/normality). Contemporary issues of sexual orientation and topics of sexuality in relation to gender and race. 4 seminars. Fulfills GE D5. Crosslisted as WGS/HNRS 340.

**WGS 350. Gender, Race, Science and Technology. 4 units.**

GE Area F; USCP

Prerequisite: Completion of GE Area B2 or B3. Recommended: Junior standing.

Interdisciplinary examination of the complex relationships between gender, race, science, and technology in educational, work, knowledge production, policy, and ethical contexts. Topics may include reproductive, medical, genetic, and emerging technologies and exploration of efforts to create more socially responsible science/technology. 3 lectures, 1 activity. Crosslisted as ES/WGS 350. Fulfills GE Area F and USCP.

**WGS 351. Global Engineering: Gender, Race, Class, Nation. 4 units.**

GE Area D5

Prerequisite: Completion of GE Area A and two lower division courses in Area D.

Cross-cultural, comparative analysis of what it means to be an engineer, do engineering work, the structure of engineering education; focus on social, economic, political, legal institutions and 21st century challenges; special attention to interlocking systems of gender, race, class, nation. 4 lectures. Crosslisted as ES/WGS 351. Fulfills GE Area D5 except for Comparative Ethnic Studies majors.

**WGS 370. Religion, Gender, and Society. 4 units.**

GE Area C4; USCP

Prerequisite: Completion of GE Areas A and C2. Recommended: Junior standing.

Critical examination of religious ideas and institutions in America in relation to gender, race and politics. Focus on women and religion, the religious experience of minorities, and on politics. 4 lectures. Crosslisted as RELS/WGS 370. Fulfills GE C4 and USCP.

**WGS 400. Special Problems for Advanced Undergraduates. 1-4 units.**

Prerequisite: WGS 301 or consent of Women's and Gender Studies Chair.

Individual investigation, research studies, or surveys of selected problems. Total credit limited to 4 units, with a maximum of 4 units per quarter.

**WGS 401. Seminar in Women's and Gender Studies. 4 units.**

Prerequisite: WGS 301 or consent of instructor. Recommended: Junior standing.

Intensive study of a selected topic in Women's Studies (such as women and work, women and the law, women in the arts). The Schedule of Classes will list topic selected. Field experience may be required as appropriate. May be repeated for up to 8 units. 3 seminars and a research project.

**WGS 434. American Women's History to 1870. 4 units.**

Prerequisite: HIST 303 or graduate standing.

Female ideology and experience from the colonial period through the American Civil War. Use of a variety of sources, including women's own writing, in order to understand the history of women as it both reflects and shapes American culture and society. 3 lectures and research project. Crosslisted as HIST/WGS 434.

**WGS 435. American Women's History from 1870. 4 units.**

USCP

Prerequisite: HIST 303 or graduate standing.

The female past in the modern period of U.S. history. Considers how transformations in gender roles are reflective of other significant changes in American culture and society. Emphasis on class, race, and ethnic variations in women's experience. 3 lectures and research project. Crosslisted as HIST/WGS 435. Fulfills USCP.

**WGS 450. Feminist Theory. 4 units.**

USCP

Prerequisite: WGS 301 or consent of instructor.

History and evolution of ideas about gender, race/ethnicity and sexual identity. Special attention as to how social, historical, and ideological forces, organized by the central, intertwined concepts of gender and race, shape both our critical thinking and our lives. 3 lectures, 1 activity. Fulfills USCP.

**WGS 467. Women's and Gender Studies Internship. 4 units.**

CR/NC

Prerequisite: WGS 201 and consent of WGS Internship Director.

Corequisite: One additional course in WGS.

Supervised work experience in approved agency. Intern subject to of the duties/responsibilities of employees engaged in comparable work. Focus on genders, sexualities, independent utilization of WGS concepts. 30 hours of internship experience per unit of credit. Minimum of 4 units (120 hours). Total credit limited to 8 units.

**WGS 470. Selected Advanced Topics. 1-4 units.**

Prerequisite: Consent of instructor.

Directed group study of selected topics for advanced students. Open to undergraduate and graduate students. The Schedule of Classes will list title selected. Total credit limited to 8 units. 1 to 4 lectures.

## Zoology (ZOO)

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### Zoology Courses

**ZOO 231. Essentials of Human Anatomy and Physiology I. 5 units.**

See ZOO 331. ZOO 231 accepted in lieu of ZOO 331, but not for upper division credit. Not open for major credit in the Biological Sciences.

**ZOO 232. Essentials of Human Anatomy and Physiology II. 5 units.**

See ZOO 332. ZOO 232 accepted in lieu of ZOO 332, but not for upper division credit. Not open for major credit in the Biological Sciences.

**ZOO 321. Mammalogy. 4 units.**

Prerequisite: BIO 162 or BIO 263 or BIO 427 or ASCI 329.

Ecology, behavior, physiology, functional morphology, and evolution of mammals. Classification and identification of mammals, with emphasis on California species. 2 lectures, 2 laboratories.

**ZOO 322. Ichthyology. 4 units.**

Prerequisite: BIO 162.

Phylogeny, anatomy, functional morphology, physiology, and ecology of marine and freshwater fishes. Special reference to local and economically important species. Laboratory emphasis on taxonomy of California species, especially marine groups. 2 lectures, 2 laboratories.

**ZOO 323. Ornithology. 4 units.**

Prerequisite: BIO 162 or BIO 263 or BIO 427 or ASCI 329.

Classification and identification of birds, with emphasis on California species. Functional morphology, physiology, ecology, behavior and census methods. Field trips may require meeting in the morning before scheduled lab time. 2 lectures, 2 laboratories.

**ZOO 324. Marine Mammals, Birds and Reptiles. 4 units.**

Prerequisite: BIO 162; BIO 263; and STAT 218.

Introduction to the biology, ecology and evolution of mammals, reptiles and birds of the marine environment, with an emphasis on Central California species, diversity patterns, evolutionary relationships, adaptations to the ocean, and conservation issues. Mandatory field trips. 2 lectures, 2 laboratories.

**ZOO 329. Vertebrate Field Zoology. 4 units.**

Prerequisite: Junior standing; BIO 162 or BIO 263 or BIO 427 or ASCI 329.

Identification and natural history of terrestrial vertebrates, with emphasis on field studies and local species. Field trips may require meeting in the morning before scheduled lab time. 2 lectures, 2 laboratories.

**ZOO 331. Human Anatomy and Physiology I. 5 units.**

Prerequisite: BIO 111 or BIO 161; and CHEM 111, CHEM 124, CHEM 127 or PSC 102.

Structural and functional organization of the skeletal, muscular, nervous, endocrine, and integumentary systems. Includes discussion of molecular, cellular, and organ system levels of organization. Activities emphasize histology, cadaver anatomy, physiology of muscle contraction, nerve impulse initiation and conduction, sensory and motor functions. 4 lectures, 1 laboratory. Not open for major credit in Biological Sciences. Not open to students with credit in BIO 432 or ZOO 231.

**ZOO 332. Human Anatomy and Physiology II. 5 units.**

Prerequisite: BIO 111, or BIO 161; CHEM 111, CHEM 124, CHEM 127 or PSC 102.

Structural and functional organization of the circulatory, respiratory, digestive, excretory, and reproductive systems. Includes discussion of molecular, cellular, and organ system levels of organization. Activities emphasize histology, cadaver anatomy, and physiological experiments. 4 lectures, 1 laboratory. Not open for major credit in Biological Sciences. Not open to students with credit in BIO 433 or ZOO 232.

**ZOO 335. General Entomology. 4 units.**

Prerequisite: BIO 160, BIO 211, or PPSC 311. Recommended: BIO 162.

Introduction to the study of insects. Structure, major orders and families of insects, life histories, medical, and economic importance. Insect collection required. 2 lectures, 2 laboratories.

**ZOO 336. Invertebrate Zoology. 4 units.**

Prerequisite: BIO 160 and BIO 162.

Invertebrate groups of animals with emphasis on taxonomy, morphology, distribution, and economic importance. 2 lectures, 2 laboratories, and fieldwork.

**ZOO 341. Herpetology. 4 units.**

Prerequisite: BIO 160 and BIO 162.

Living and extinct reptiles and amphibians; an adaptive approach to their diversity, biology, and classification. 2 lectures, 2 laboratories.

**ZOO 422. Functional Histology. 4 units.**

Prerequisite: BIO 162.

Functional microscopic anatomy of principal tissues and organs of vertebrates, including humans. Structural studies to determine mechanisms underlying physiological processes and their clinical applications in medicine. 2 lectures, 2 laboratories.

**ZOO 425. Parasitology. 4 units.**

Prerequisite: BIO 160 and BIO 161, or MCRO 221, or MCRO 224, or graduate standing in Biological Sciences.

External and internal parasites of man and animals. Life history. Parasite-host relationships. Control and recognition of species of clinical importance. 2 lectures, 2 laboratories.

**ZOO 428. Hematology. 4 units.**

Prerequisite: BIO 351 or BIO 302 or BIO 303 or CHEM 373, or graduate standing in Biological Sciences. Recommended: BIO 361 or ZOO 332 or BMED 460; CHEM 313 or CHEM 371.

Development and function of blood as a tissue. Composition, function, and mechanisms of formation and destruction of blood components in health and disease. Methods for examination of blood. 3 lectures, 1 laboratory.

# Faculty and Staff

## Office of the President

Title	Name
President	Jeffrey D. Armstrong
Chief of Staff	Betsy Kinsley
Executive Assistant	Matthew Walters
University Legal Counsel	Carlos Cordova

## Academic Affairs

Title	Name
Provost and Executive Vice President	Kathleen Enz Finken
Vice Provost/Chief Information Officer for Information Services	Michael D. Miller
Associate Vice Provost for Academic Programs and Planning	Mary Pedersen
Vice Provost for International Education, Graduate, & Extended Education	Brian C. Tietje
Interim Vice Provost for Research & Industry Relations	Bradford Anderson
Interim Dean of Research	Dean Wendt
Associate Vice Provost for Academic Personnel	Albert A. Liddicoat
Associate Vice Provost for Marketing and Enrollment Development	James L. Maraviglia
Assistant Vice President for University/Community Engagement	Dennis "Skip" R. Parks
Associate Vice Provost for Systems and Resources	Kimi M. Ikeda
Registrar, Office of the Registrar	Cem Sunata
Assistant Vice Provost for University Advising	Beth Merritt Miller
Assistant to Provost for Academic Facilities	Charlie Crabb

## Colleges

Title	Name
College of Agriculture, Food and Environmental Sciences, Interim Dean	Andy Thulin
College of Architecture and Environmental Design, Dean	Christine Theodoropoulos
Orfalea College of Business, Dean	Scott Dawson
College of Engineering, Dean	Debra S. Larson
College of Liberal Arts, Dean	Doug Epperson
College of Science and Mathematics, Dean	Philip S. Bailey

## Administration and Finance

Title	Name
Interim Chief Financial Officer and Vice President for Administration and Finance	Karen Webb
Interim Associate Vice President for Commercial Services	Lorlie Leetham
Associate Vice President for Finance	Vacant

## Student Affairs

Title	Name
Vice President for Student Affairs	Keith B. Humphrey
Associate Vice President	Vacant
Associate Vice President	Preston C. Allen
Associated Students, Inc., Executive Director	Marcy Maloney
Dean of Students	Jean DeCosta
Campus Diversity & Inclusivity, Executive Director	Annie Holmes

## University Advancement

Title	Name
Vice President, University Advancement	Deborah A. W. Read
Associate Vice President for Advancement Operations	Grant Trexler
Interim Associate Vice President/Chief Development Officer	Stacy Cannon
Associate Vice President for Strategic Communications	Joseph "Chip" M. Visci
Assistant Vice President for Alumni Outreach and Annual Giving	Ellen Cohune

## Auxiliary Organizations

### Associated Students, Inc.fa

Title	Name
Executive Director	Marcy Maloney

### Cal Poly Corporation

Title	Name
Interim Executive Director	Lorlie Leetham
Director Emeritus	Al Amaral
Associate Executive Director, Administration and Legal Affairs	Starr Lee
Associate Executive Director, Finance and Business Operations	Vacant

## Cal Poly Chief Executive Officers

Cal Poly has been guided by the following chief executive officers.

Name	Year
Leroy Anderson	1902 to 1908
Leroy Burns Smith	1908 to 1914



Robert W. Ryder	1914 to 1921
Nicholas Ricciardi	1921 to 1924
Margaret Chase (acting)	1924
Benjamin Ray Crandall	1924 to 1933
Julian A. McPhee	1933 to 1966
Dale W. Andrews (acting)	1966 to 1967
Robert E. Kennedy	1967 to 1979
Dale W. Andrews (acting)	1979
Warren J. Baker	1979 to 2010
Robert B. Glidden (Interim)	2010 to 2011
Jeffrey D. Armstrong	2011 to Present

The faculty and staff, who have served at least fifteen years of full-time meritorious service at Cal Poly, are awarded emeritus status. A complete list of faculty emeriti is available at: [www.academic-personnel.calpoly.edu/QuickLinks.html](http://www.academic-personnel.calpoly.edu/QuickLinks.html). Contact Human Resources for information regarding staff emeriti. The University appreciates its emeriti members' contributions to the Cal Poly community.

## Distinguished Teacher Award Recipients

In 1963 the University instituted a program of recognizing outstanding teaching efforts through the Distinguished Teacher Awards. Selections for this honor are based upon recommendations of the Academic Senate committee which follows the procedure of soliciting nominations from students and colleagues. Evaluations and recommendations of the nominees are based upon an in-depth review by the committee, including classroom visitations. Recipients of the Distinguished Teacher Awards and their departments are listed below.

1963–64 Robert E. Holmquist, Physics  
John L. Merriam, Agricultural Engineering

1964–65 Joy O. Richardson, Mechanical Engineering  
Milo E. Whitson, Mathematics

1965–66 A. Norman Cruikshanks, Social Sciences  
Richard F. Johnson, Animal Husbandry  
George R. Mach, Mathematics

1966–67 Robert W. Adamson, Mechanical Engineering  
Kenneth G. Fuller, Mathematics  
William D. Curtis, Psychology

1967–68 Rodney G. Keif, Environmental Engineering  
David M. Grant, English  
Wesley S. Ward, Architecture

1968–69 Robert M. Johnson, Mechanical Engineering  
Bruce Kennelly, Chemistry  
Alice E. Roberts, Education

1969–70 Donald W. Hensel, History  
David H. Montgomery, Biological Sciences  
Philip H. Overmeyer, Business Administration  
Willard M. Pederson, English  
Omer K. Whipple, Chemistry

1970–71 Robert L. Cleath, Speech  
Kenneth E. Schwartz, Architecture  
Hewitt G. Wight, Chemistry

1971–72 Stuart E. Larsen, Aeronautical Engineering

Barton C. Olsen, History  
Ronald L. Ritschard, Biological Sciences  
Joseph N. Weatherby, Political Science (Social Sciences)

1972–73 Lyle G. McNeal, Animal Science  
Charles W. Quinlan, Architecture  
James E. Simmons, English

1973–74 William J. Phaklides, Engineering Technology  
Louis D. Pippin, Education  
Duane O. Seaberg, Agricultural Management

1974–75 Peter Jankay, Biological Sciences  
Josephine S. Stearns, Child Development  
George J. Suchand, Social Sciences

1975–76 James Hayes, Journalism  
William V. Johnson, Music  
Erna Knapp, Art

1976–77 Harry L. Fierstine, Biological Sciences  
Grant D. Venerable II, Chemistry  
Ralph M. Warten, Mathematics

1977–78 Timothy M. Barnes, History  
Donald P. Grant, Architecture and Environmental Design  
John C. Syer, Political Science

1978–79 Pat Pendse, Biological Sciences  
Dane Jones, Chemistry  
Adelaide Harmon-Elliott, Mathematics

1979–80 David J. Keil, Biological Sciences  
Thomas Ruehr, Soil Science  
Stephen Weinstein, Mathematics  
Michael D. Zohns, Ornamental Horticulture

1980–81 Sarah E. Burroughs, Food Science and Nutrition (Child Development and Home Economics)  
Christina Orr-Cahall, Art  
Kendrick W. Walker, Philosophy

1981–82 Christina A. Bailey, Chemistry  
Kenneth E. Ozawa, Physics  
Thomas L. Richards, Biological Sciences

1982–83 James Bermann, Agricultural Engineering  
Donald J. Koberg, Architecture  
Jack D. Wilson, Aeronautical and Mechanical Engineering

1983–84 Euel W. Kennedy, Mathematics  
William L. Preston, Social Sciences  
Michael J. Wenzl, English

1984–85 Robert S. Cichowski, Chemistry  
Harvey C. Greenwald, Mathematics  
Max E. Riedlsperger, History

1985–86 Edward H. Baker, Mechanical Engineering  
Sue McBride, Education  
Phillip K. Ruggles, Graphic Communication

1986–87 Boyd W. Johnson, Mathematics  
Craig H. Russell, Music  
Calvin H. Wilvert, Social Sciences

1987–88 James R. Mueller, Mathematics  
Ronald S. Mullisen, Mechanical Engineering  
Robert G. Reynolds, Art and Design

1988–89 Stephen W. Ball, Philosophy

George Cotkin, History  
Abraham B. Shani, Management

1989–90 Lloyd N. Beecher, History  
Talmage E. Scriven, Philosophy  
Jan W. Simek, Chemistry

1990–91 Jay L. Devore, Statistics  
Linda H. Halisky, English  
Ann Morgan, Psychology  
James L. Webb, Physical Education & Recreation Admin.

1991–92 Mary E. Pedersen, Food Science and Nutrition  
John Snetsinger, History  
W. Fred Stultz, Psychology and Human Dev.

1992–93 Susan Duffy, Speech Communication  
Donald K. Maas, University Center for Teacher Education  
Charles M. Slem, Psychology and Human Development

1993–94 William T. Little, Foreign Languages and Literatures  
Steven R. Marx, English  
Raymond M. Nakamura, Physical Education & Kinesiology

1994–95 Ronald F. Brown, Physics  
Lee B. Burgunder, Business Administration  
Nancy Lucas, English

1995–96 David Keeling, Chemistry and Biochemistry  
John Russell, Music  
Richard Simon, English

1996–97 Leonard Davidman, University Center for Teacher Education  
Al Landwehr, English  
Robert Thompson, Agribusiness

1997–98 John Culver, Political Science  
Jay S. DeNatale, Civil and Environmental Engineering  
David R. Henry, Speech Communication

1998–99 Colette Frayne, Global Strategy and Law  
Carol MacCurdy, English  
Leonard Myers, Computer Science

1999–00 J. Michael Geringer, Global Strategy and Law  
Brent G. Hallock, Soil Science  
Clinton A. Staley, Computer Science

2000–01 Sky Bergman, Art and Design  
Phillip M. Doub, Agribusiness  
William Martinez, Jr., Modern Languages and Literatures

2001–02 Kevin Clark, English  
Alyson McLamore, Music  
Mark Zohns, BioResource and Agricultural Engineering

2002–03 Alvin De Jong, Biological Sciences  
Bernard Duffy, Speech Communication  
Linda Vanasupa, Materials Engineering

2003–04 Matthew Moelter, Physics  
Robert Smidt, Statistics  
Nanine A. Van Draanen, Physics

2004–05 Fred DePiero, Electrical Engineering  
John Hampsey, English  
David Headrick, Horticulture and Crop Science

2005–06 Mary Armstrong, English  
Michael Miller, Art and Design  
Yarrow Nelson, Civil and Environmental Engineering

2006–07 William Fitzhenry, English  
Elena Levine Keeling, Biological Sciences  
Donald H. Ryujin, Psychology and Child Development

2007–08 Michael Fahs, Communications Studies  
Michael Lucas, Architecture  
Charles Miller, Accounting

2008–09 Derek Gragson, Chemistry and Biochemistry  
Josh T. Machamer, Theatre and Dance

2009–10 Eric J. Kantorowski, Chemistry and Biochemistry  
J. Kevin Taylor, Kinesiology

2010–11 Thomas H. Davies, Music  
Thomas L. di Santo, Architecture

2011–12 Emily N. Taylor, Biological Sciences  
Umot Toker, City and Regional Planning  
Matthew K Ritter, Biological Sciences

2012–13 Seth Bush, Chemistry & Biochemistry  
Jaymie Noland, Animal Science  
Dylan Retsek, Mathematics

## Distinguished Scholarship Award

In 2003–04 Cal Poly instituted an award program to recognize faculty in the areas of distinguished research, creative activity, and professional development. Nominations are solicited from the faculty, students, and alumni, and the Academic Senate's research and professional development committee, a group of eleven, selects the recipients. The recipients of the award and their departments are listed below:

2003–04 Charles Burt, BioResource and Agricultural Engineering  
Joanne Ruggles, Art and Design

2004–05 Estelle Basor, Mathematics  
Rami Shani, Management

2005–06 Daniel Biezad, Aerospace Engineering  
Andrew Morris, History

2006–07 Mark A. Moline, Biological Sciences  
Craig H. Russell, Music

2007–08 Terry Jones, Social Sciences  
Michael Marlow, Economics

2008–09 Patricia L. Engle, Psychology and Child Development  
Dean E. Wendt, Biological Sciences

2009–10 George Cotkin, History Department  
Rafael Jimenez, Dairy Science

2010–11 Michael Geringer, Management  
Jordi-Puig Suari, Aerospace Engineering

2011–12 Christopher Kitts, Biological Sciences  
William Hendricks, Recreation, Parks, and Tourism

2012–13 Lanny Griffin, Biomedical & General Engineering  
Bernard Duffy, Communication Studies

## Outstanding Faculty Advisor Award

In 2001–02 the University instituted a program of recognizing outstanding achievement by a faculty member in the area of student advising. Nominations are solicited from the faculty and staff and students. Recipients' names will be displayed on a perpetual plaque. The recipients of the Outstanding Faculty Advisor Award and their departments are listed as follows:

2001–02 Kathryn Rummell, English  
 2002–03 Jack Robison, Accounting  
 2003–04 William Preston, Social Sciences  
 2004–05 Lorraine Donegan, Graphic Communication  
 2005–06 Taufik, Electrical Engineering  
 2006–07 Abraham Lynn, Architectural Engineering  
 2007–08 Cynthia Moyer, Recreation, Parks and Tourism Administration  
 2008–09 Curtis Illingworth, Architecture  
 2009–10 Philip Costanzo, Chemistry and Biochemistry  
 2010–11 Ron Den Otter, Political Science  
 2011–12 Andrew Davol, Mechanical Engineering  
 2012–13 Leanne Berning, Dairy Science  
 2013–14 John Oliver, Electrical Engineering

## Provost's Leadership Award for Partnership in Philanthropy

This award was established in 2006 to recognize current or former faculty member's superior achievement in fundraising.

2006 Allan J. Hauck, Construction Management  
 James A. Rodger, Construction Management  
 2007 Andrew J. Thulin, Animal Sciences  
 2008 Harvey Robert Levenson, Graphic Communication  
 2009 Charles M. Burt, BioResource and Agricultural Engineering  
 2010 Philip S. Bailey, College of Science and Mathematics  
 2011 Bruce L. Golden, Dairy Science Department  
 2011 Phillip S. Tong, Dairy Science Department  
 2012 Allen Estes, Architectural Engineering Department  
 2013 Ignatios Vakalis, Computer Science  
 David Wehner, College of Agriculture, Food and Environmental Sciences

## President's Diversity Award

This award recognizes campus units that exhibit a commitment to the value of cultural diversity.

1997 Staff Council Cultural Awareness Committee  
 1998 Staff Council Cultural Awareness Committee  
 1999 Black Faculty & Staff Association  
 2000 26 Hours of Science & Technology in Agriculture  
 2001 Industrial and Manufacturing Engineering  
 2002 Housing and Residential Life  
 2003 Minority International Research Access Program  
 Connections for Academic Success  
 2004 Summer Institute  
 2005 College of Science and Mathematics  
 Career Services  
 2006 PolyCultural Committee  
 Social Sciences Department  
 2007 Counseling Services  
 Student Life and Leadership  
 2008 Department of Psychology & Child Development  
 Omega Xi Delta Fraternity  
 2009 Multicultural Engineering Program  
 Delta Lambda Phi

2010 Cal Poly Society of Women Engineers  
 Ethnic Studies Department

2011 Cal Poly Lion Dance Team  
 Modern Languages and Literatures Department

2012 Cultural Inclusion Committee University Housing  
 Driven Towards Sisterhood

## Outstanding Staff Employee Award

The 1972-73 academic year saw the inception of the Outstanding Staff Employee Award. This honor is bestowed upon permanent, full-time employees of the University, Corporation, or Associated Students, Inc. who are in at least their third year of employment at Cal Poly. In order to be considered for this award, an employee should be truly dedicated and loyal; exhibit expertise in job performance; demonstrate a willingness to assist others enthusiastically; take initiative in making his or her department more efficient and productive; maintain an excellent relationship with co-workers, faculty, and students; and make contributions to both the University and the community. Nominations are solicited from staff employees, faculty members, and department or division heads. Selection of the awardees is made by a committee of former recipients of the award. Outstanding Staff Employees Award recipients are listed here as follows.

1972–73 Everette Dorrough  
 1973–74 Vic Allen  
 Florence Hauge  
 Lionel Middlecamp  
 Jim Neelands  
 1974–75 Robert Baldrige  
 John Lee  
 Gerry Wagner  
 Arthur Young  
 1975–76 Merriam Erickson  
 Viola Hughes  
 Mary Johnson  
 Boyd Wettlaufer  
 1976–77 Trudy Beck  
 Stella Nuncio  
 1977–78 Luther Bertrando  
 Pauline Shaffer  
 Joanna DeRosier  
 1978–79 Harold Miller  
 Doris Anderson  
 Richard Tartaglia  
 Frank Lebens  
 1979–80 Dale Lackore  
 Steven Riddell  
 Joan Roberts  
 1980–81 Joan Cirone  
 Farlin Halsey  
 Irene Lund  
 1981–82 James Neal  
 Connie Jonte  
 Frank Kassak  
 1982–83 Barbara Lund  
 Larry Grimes  
 Norman Johnson  
 1983–84 Jerald (Louie) Budoff  
 Walter Clark  
 Gail Simmons  
 1984–85 Alfred W. Amaral

Ethel Spry  
 Kathleen Lamoree  
 1985–86 James Landreth  
 Geraldine Montgomery  
 Vicki Stover  
 1986–87 Lee Brown  
 Gary Ketcham  
 French Morgan  
 1987–88 Lynette Klooster  
 Judi Pinkerton  
 Nancy Raetz  
 1988–89 Debbie Arseneau  
 June Powell  
 Jacquie Rossi  
 1989–90 Grace Arvidson  
 Janet Carlstrom  
 Ronald Christensen  
 1990–91 Barbara Ciesielski  
 Harriet Clendenen  
 Harriet Ross  
 1991–92 Wanda Bolt  
 Pam Parsons  
 Joe Risser  
 1992–93 Rosemary Bowker  
 Deborah L. Brothwell  
 Andy McMeans  
 1993–94 Connie Davis  
 Jim McLaughlin  
 Richard Tibbetts  
 1994–95 Francesca Fairbrother  
 Joyce Kalicki  
 Lorraine Ridgeway  
 1995–96 George Enriquez  
 Cynthia Jelinek  
 Carol Montgomery  
 1996–97 Kristina Pena  
 Don Shemenske  
 Judy Swanson  
 1997–98 Richard Equinoa  
 Pat Harris  
 Nettie Steels  
 1998–99 Darrell Blankenship  
 Delores Estrada  
 Rosemary Wagner  
 1999–00 Bonnie Krupp  
 Druci Reese  
 Ellen Stier  
 2000–01 Donna Amos  
 Stacey Breitenbach  
 Joyce Haratani  
 2001–02 Margaret Booker  
 Judy Drake  
 Jimmy Ray Motley  
 2002–03 Sue Bethel  
 Jim Gerhardt  
 Bonnie Long  
 2003–04 Carol Erickson  
 Lori La Vine  
 Bob Pinkin  
 2004–05 Sharon Arnold  
 Prisila Johnson  
 Dan Mull

2005–06 Larry Coolidge  
 Alice Gold  
 Mary Whiteford  
 2006–07 Michele Abba  
 Peggy Smith Andersen  
 Joyce McAlexander  
 2007–08 Carson Crain  
 Ben Johnson  
 Emanuel Vieira  
 2008–09 Vera Gee  
 George Leone  
 Colleen Rodriguez  
 2009–10 Christine Cobb  
 Vivian Longacre  
 Terry Vahey  
 2010–11 Patrick Johnstone  
 Nancy Reid  
 Yolanda Tiscareno  
 2011–12 Helen Bailey  
 Shannon Stephens  
 Marcy Maloney  
 2012–13 Nancy Cochran  
 David Harris  
 Mark Rapoport  
 2013–14 Jean DeCosta  
 Tammy Martin  
 Craig Stubler

## Faculty and Staff Emeriti

The faculty and staff, who have served at least fifteen years of full-time meritorious service at Cal Poly, are awarded emeritus status. A complete list of faculty emeriti is available at: <http://www.academic-personnel.calpoly.edu/content/quicklinks> Contact Human Resources for information regarding staff emeriti. The University appreciates its emeriti members' contributions to the Cal Poly community.

## Faculty Directory

NAME	POSITION	EDUCATION
Abercromby, Kira J. (2008) Aerospace Engineering	Associate Professor	B.S., University of California, Los Angeles, 1994; M.S., University of Colorado, Boulder, 1998; Ph.D., 2000.
Adams, Nikki L. (2002) Biological Sciences	Associate Professor	B.A., University of California, Santa Barbara, 1988; M.S., University of Maine, 1995; Ph.D., 2000.
Adan, Elizabeth (2007) Art and Design	Associate Professor	B.A., University of California, Davis, 1993; M.F.A., University of California, Santa Barbara, 1997; M.A., University of California, Berkeley, 2000; Ph.D., University of California, Santa Barbara, 2006.
Agbo, Samuel O. (1991) Electrical Engineering	Professor	B.Sc., University of Nigeria, 1975; M.S.E., University of Michigan, 1978; Ph.D., University of Houston, 1984.
Agronsky, Steven J. (1981) Mathematics	Professor Emeritus	B.A., University of California, Santa Barbara, 1970; M.S., 1972; Ph.D., 1974.
Ahern, James J. (1980) Agribusiness	Professor Emeritus	B.S., California State Polytechnic College, Pomona, 1971; M.S., University of Maryland, 1973; Ph.D., 1980.
Ahlgren, William L. (1999) Electrical Engineering	Associate Professor	S.B., Massachusetts Institute of Technology, 1975; M.S., University of Arizona, 1977; Ph.D., University of Southern California, 1981.
Alaniz, Ryan C. (2011) Social Sciences	Assistant Professor	B.A., California Polytechnic State University, San Luis Obispo, 2000; M.A., University of California, Santa Barbara, 2004; Ph.D., University of Minnesota, 2012.
Allen, Regulus L. (2006) English	Associate Professor	B.A., University of California, Los Angeles, 1994; M.A., 2000; Ph.D., 2006.
Allen, Teresa (2001) Journalism	Professor	B.A., University of Washington at Seattle, 1976; M.A., University of Colorado at Boulder, 1993; additional graduate study.
Alptekin, Sema E. (1994) Industrial and Manufacturing Engineering	Professor	B.Sc., Istanbul Technical University, Istanbul, 1973; M.Sc., 1975; Ph.D., 1981.
Amspacher, William H. (1985) Wine and Viticulture	Professor	B.S., Clemson University, 1978; M.S., 1980; Ph.D. University of California, Davis, 1988.
Anderson, Bing (2004) Finance	Associate Professor	B.Eng., University of Science and Technology of China, 1993; M.A., University of Chicago, 1996; M.S., Stanford University, 2000; Ph.D., 2002.
Anderson, Bradford P. (2006) Orfalea College of Business	Associate Dean and Associate Professor	B.A., Purdue University, 1984; J.D., State University of New York, 1987.
Appel, Christopher S. (2002) Natural Resources Management and Environmental Sciences	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1995; M.S., 1998; Ph.D., University of Florida, 2001.
Arakaki, Dean Y. (2001) Electrical Engineering	Associate Professor	B.S., California State Polytechnic University, Pomona, 1984; M.B.A., California State University, Long Beach, 1989; M.S., 1992; Ph.D., Penn State University, 2000.
Arceneaux, Craig (2001) Political Science	Professor	B.A., California State University, Fullerton, 1989; M.A., Ohio State University, 1991; Ph.D., University of California, Riverside, 1997.
Archer, Graham C. (2002) Architectural Engineering	Professor	B.A.Sc., University of Waterloo, Canada, 1985; M.A.Sc., 1986; Ph.D., University of California, Berkeley, 1996. Professional Engineer, Ontario.
Arens, Robert M. (2005) Architecture	Professor	B.S., University of Michigan, 1981; M.Arch., 1984. Registered Architect, Michigan.
Arrivee, David A. (2004) Music	Associate Professor	B.A., Princeton University, 1993; M.M., Boston University, 1995; D.M.A., Northwestern University, 2004.
Askay, David A. (2013) Communication Studies	Assistant Professor	B.S., University of California at San Diego, 2004; M.A. University of North Carolina at Charlotte, 2011; Ph.D. 2013.
Bailey, Christina Anne (1978) Chemistry and Biochemistry	Professor Emeritus	B.S., College of Saint Elizabeth, New Jersey, 1964; Ph.D., Purdue University, 1970.
Bailey, Philip S. (1969) College of Science and Mathematics, Chemistry and Biochemistry	Dean and Professor	B.S., University of Texas, 1964; Ph.D., Purdue University, 1969.



Ball, Stephen W. (1983) Philosophy	Professor	B.A., Purdue University, 1972; M.A., University of Michigan, 1973; Ph.D., 1978.
Baltimore, Craig V. (2001) Architectural Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1986; M.S., Duke University, 1996; Ph.D., 1998. Registered Structural Engineer and Professional Engineer, California.
Barata, Antonio G. (1985) Music	Professor	B.A., Towson State University, 1977; M.M., Northwestern University, 1979; D.M.A., University of Illinois, 1985.
Barlow, Philip L. (2006) Construction Management	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1987; M.B.A., Golden Gate University, 1993. Licensed General Contractor, Licensed Broker, Certified Professional Constructor (CPC), Certified Cost Consultant (CCC), Designated Design-Build Professional (DBIA), LEED Accredited Professional (LEED AP).
Bass, Beverly J. (2008) Landscape Architecture	Associate Professor	B.F.A., East Carolina University, 1982; M.L.A., University of Arizona, 2003. LEED Accredited Professional. Certified Arborist.
Battenburg, John (1989) English	Professor	B.A., Andrews University, 1982; M.A., Ohio University, 1984; Ph.D., Purdue University, 1989.
Bednarek, Ziemowit K. (2012) Finance	Assistant Professor	Ph.D., University of California, Berkeley, 2010.
Bellardo, John M. (2006) Computer Science, Computer Engineering	Assistant Professor	B.S., California Polytechnic State University, San Luis Obispo, 1999; M.S., University of California, San Diego, 2001; Ph.D., 2006.
Bennert, Vardha N. (2011) Physics	Assistant Professor	B.S., Ruhr-University of Bochum, Germany, 1999; M.S., 2002; Ph.D., 2005
Bennett, Penny K. (2000) College of Liberal Arts, Graphic Communication	Associate Dean and Professor	B.S., Ferris State University, 1986; M.E., University of Nevada, Las Vegas, 1992; Ph.D., University of Idaho, 2002.
Bensky, Thomas J. (2001) Physics	Professor	B.S., California State University, Northridge, 1992; Ph.D., University of Virginia, 1998.
Benson, Bridget G. (2011) Electrical Engineering, Computer Engineering	Assistant Professor	B.S., California Polytechnic State University, San Luis Obispo, 2005; M.S., University of California Santa Barbara, 2007; Ph.D., University of California, San Diego, 2010
Berber-Jimenez, Lola (1995) Liberal Studies	Department Chair	B.S., Universidad LaSalle, 1983; Ph.D., University of California, Davis, 1990.
Bergman, Sky (1995) Art and Design	Professor	B.S., University of South Florida, 1987; M.F.A., University of California, Santa Barbara, 1991.
Bernard, Thomas J. (2008) Theatre and Dance	Associate Professor	B.A., University of Minnesota, 1991; M.F.A., Northern Illinois University, 1995.
Berner, Louise A. (1987) Food Science and Nutrition	Professor	B.S., Pennsylvania State University, 1979; M.S., Cornell University, 1982; Ph.D., 1986.
Berning, Leanne M. (1990) Dairy Science	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1982; M.S., University of Wisconsin, 1985; Ph.D., University of Maryland, 1990.
Besel, Richard D. (2007) Communication Studies	Associate Professor	B.A., North Central College, 1999; M.A., University of Illinois, Chicago, 2001; Ph.D., University of Illinois, Champaign/Urbana, 2007.
Bickel, Christopher (2008) Social Sciences	Associate Professor	B.A., Indiana University, 1997; M.A., University of California, Santa Barbara, 2004; Ph.D., 2008.
Biezd, Daniel J. (1990) Aerospace Engineering	Professor Emeritus	B.S., Illinois Institute of Technology, 1966; M.S., Air Force Institute of Technology, 1972; Ph.D., Purdue University, 1984. Registered Professional Engineer, Ohio.
Birdsong, Charles B. (2003) Mechanical Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1991; M.S., Michigan State University, 1996; Ph.D., 1999.
Bisbing, Sarah M. (2013) Natural Resources Management and Environmental Sciences	Assistant Professor	B.S., University of Montana, 2005; M.S., 2008; Ph.D., Colorado State University, 2013.
Black, Michael W. (2001) Biological Sciences	Associate Professor	B.S., Southwest Missouri State, 1993; Ph.D., Stanford University, 1999.
Blank, Jason M. (2009) Biological Sciences	Assistant Professor	B.S., Duke University, 1996; Ph.D., Stanford University, 2006.

Blau, Jnan A. (2008) Communication Studies	Associate Professor	B.S., Arizona State University West, 1999; M.S., Southern Illinois University, 2002; Ph.D., 2007.
Bohr, Gregory S. (2005) Social Sciences	Associate Professor	B.A., University of California, Berkeley, 1993; M.A., San Diego State University, 1997; Ph.D., Louisiana State University, 2004.
Bonini, Vincent (2008) Mathematics	Assistant Professor	B.A., University of California, Santa Cruz, 2000; M.A., 2001; Ph.D., 2006.
Borin, Norm A. (1992) Marketing	Professor	B.S., University of California, Davis, 1981; M.B.A., California State University, Sacramento, 1987; Ph.D., University of Virginia, Charlottesville, 1992.
Borzellino, Joseph E. (2001) Mathematics	Professor	B.S., University of California, Irvine, 1987; M.A., University of California, Los Angeles, 1989; Ph.D., 1992.
Boswell, Michael R. (1998) City and Regional Planning	Associate Professor	B.A., University of Central Florida, 1989; M.S.P., Florida State University, Tallahassee, 1991; Ph.D., 2000.
Brady, Pamalee (1998) Architectural Engineering	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1979; M.S., University of California, Berkeley, 1980; Ph.D., University of Illinois, Urbana-Champaign, 2004. Registered Civil Engineer, California.
Brammeier, Meredith (2001) Music	Professor	B.A., Princeton University, 1992; M.M., Eastman School of Music, 1995; D.M.A., University of Southern California, 2000.
Braun, David B. (1996) Electrical Engineering, Computer Engineering	Professor	B.S., Stanford University, 1985; M.S., 1986; Ph.D. University of California, Santa Barbara, 1991.
Bridger, Sarah (2011) History	Assistant Professor	B.A., Brown University, 2000; M.A., Columbia University, 2005; M.Phil, 2006; Ph.D., 2011.
Brown, D. Kenneth (2007) Philosophy	Associate Professor	B.A., University of California, Irvine, 1992; M.A., Claremont Graduate University, 1998; Ph.D., University of California, Irvine, 2006.
Brown, J. Wyatt (1990) Horticulture and Crop Science	Professor	B.S., Louisiana State University, 1978; M.S., 1985; Ph.D., Cornell University, 1990.
Brussel, Eric S. (2012) Mathematics	Associate Professor	B.A., University of California, Santa Cruz 1982; Ph.D., University of California, Los Angeles, 1993.
Buckalew, W. Chris (1990) Computer Science	Professor	B.S., North Texas State University, 1980; M.S., 1982; M.S., 1984; Ph.D., University of Texas, 1990.
Burd, Matthew A. (2003) Animal Science	Professor	B.S., University of Wisconsin–Madison, 1987; M.S., San Jose State University, 1991; D.V.M., University of California, Davis, 1996.
Burgunder, Lee B. (1983) Accounting	Professor	B.A., Dartmouth College, 1977; M.B.A., Stanford University, 1981; J.D., 1981.
Burn, Shawn Meghan (1990) Psychology and Child Development	Professor	B.S., Virginia Commonwealth University, 1982; M.A., The Claremont Graduate University, 1984; Ph.D., 1988.
Burnett, Brian M. (2013) Accounting	Assistant Professor	B.S., Biola University, 2000; M.B.A., Pepperdine University, 2005; Ph.D., University of Colorado at Boulder, 2011.
Burt, Charles M. (1978) BioResource and Agricultural Engineering	Professor Emeritus	B.S., California Polytechnic State University, San Luis Obispo, 1973; M.S., Utah State University, 1975; Ph.D., 1983. Registered Civil Engineer and Agricultural Engineer, California. Registered Professional Engineer, Utah.
Bush, Seth (2005) Chemistry and Biochemistry	Associate Professor	B.S., Reed College, 1994; Ph.D., University of California, Berkeley, 1999.
Cabrinha, Mark (2003) Architecture	Associate Professor	B.Arch., California Polytechnic State University, San Luis Obispo, 1995; M.Arch., University of Illinois, 2001; Ph.D., Rensselaer Polytechnic Institute, 2010. Registered Architect, Illinois.
Cai, Xiaowei (2008) Agribusiness	Associate Professor	B.S., M.S., Nanjing Agricultural University, 2001; M.S., Ph.D., University of Wisconsin, 2009.
Caldwell, Roslyn M. (2007) Psychology and Child Development	Associate Professor	B.A., University of California, Irvine, 1995; M.A., University of California, Santa Barbara, 1997; Ph.D., 2000.
Call, Lewis W. (1996) History	Associate Professor and Department Chair	B.A., University of California, San Diego, 1990; M.A., University of California, Irvine, 1992; Ph.D., 1996.
Camp, Charles D. (2007) Mathematics	Associate Professor	B.A., University of California, San Diego; 1989; Ph.D., California Institute of Technology, 2004.

Campbell, Brad (2007) English	Associate Professor	B.A., St. Mary's College of California, 1997; M.A., University of Illinois at Urbana-Champaign, 1999; Ph.D., 2007.
Campos Chillon, Fernando (2011) Animal Science	Associate Professor	B.S., California State Polytechnic University, Pomona, 1997; M.S., 2000; DVM, Colorado State University, 2004; Ph.D., 2009; Diplomate American College of Theriogenologists, 2009.
Cardinal, Kristen O'Halloran (2007) Biomedical and General Engineering	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 2003; Ph.D., University of Arizona, 2007.
Cardinal, Trevor (2007) Biomedical and General Engineering	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 2003; Ph.D., University of Arizona, 2007.
Carlton, Matthew A. (1999) Statistics	Professor	B.A., University of California, Berkeley, 1994; M.A., University of California, Los Angeles, 1996; Ph.D., 1999.
Carr, Chris A. (1998) Accounting	Associate Dean and Professor	B.A., University of Nebraska, 1987; M.A., University of California, Los Angeles, 1998; J.D., Santa Clara University, 1990.
Carroll, Jennifer (2006) Chemistry and Biochemistry	Associate Professor	B.S., Sonoma State University, 1996; Ph.D., University of California, Santa Cruz, 2001.
Cavaletto, Richard A. (1990) College of Agriculture, Food and Environmental Sciences	Associate Dean	B.S., California Polytechnic State University, San Luis Obispo, 1981; M.S., University of California, Davis, 1983; Ph.D., 1987. Registered Mechanical Engineer, California.
Cerf, Douglas C. (1990) Accounting	Professor and Area Chair	B.S., University of California, Berkeley, 1978; M.A., University of California, Davis, 1987; Ph.D., 1991.
Chadwell, Charles (2003) Civil and Environmental Engineering	Professor	B.S., University of California, Berkeley, 1997; M.S., 1998; Ph.D., 2003. Registered Professional Engineer, California.
Champney, Danielle (2013) Mathematics	Assistant Professor	B.S., Bowling Green State University, 2007; M.A., University of California, Berkeley, 2010; Ph.D., 2013.
Chance, Beth L. (1999) Statistics	Professor	B.S., Harvey Mudd College, 1990; M.S., Ph.D., Cornell University, 1994.
Chatziioanou, Alypius E. (1992) Civil and Environmental Engineering	Professor Emeritus	B.S., Athens Polytechnic, 1980; M.S., University of California, Berkeley, 1982; Ph.D., 1989. Registered Professional Engineer, Greece.
Chen, Sophia (2010) Modern Languages and Literatures	Assistant Professor	Ph.D., Florida State University, 2007.
Chen, John (2008) Mechanical Engineering	Professor	B.S. University of Virginia, 1984; M.S., Stanford University, 1987; Ph.D., 1991.
Chen, Katherine C. (1999) Materials Engineering	Professor and Department Chair	B.S., B.A., Michigan State University, 1990; Ph.D., Massachusetts Institute of Technology, 1996.
Chi, Peter B. (2013) Statistics	Assistant Professor	B.S., University of Michigan, 2003; M.H.S. Johns Hopkins Bloomberg School of Public Health, 2006; Ph.D., University of Washington, 2012.
Choboter, Paul F. (2005) Mathematics	Associate Professor	B.Sc., Simon Fraser University, 1995; M.Sc., McGill University, 1997; Ph.D., University of Alberta, 2002.
Choudhury, Gour (2011) Food Science and Nutrition	Professor and Department Head	B.S., University of Gauhati, India, 1972; M.S., University of Mysore, India, 1977; Ph.D., University of Alberta, Canada, 1987.
Christiansen, Jodi (2006) Physics	Associate Professor	B.A., Harvey Mudd College, 1985; M.S., University of Wisconsin, Madison, 1988; Ph.D., 1993.
Clague, David (2007) Biomedical and General Engineering	Associate Professor	B.S., University of California, Santa Barbara, 1987; M.S., University of California, Davis, 1993; Ph.D., 1997.
Clark, Kevin (1988) English	Professor Emeritus	B.A., University of Florida, 1972; M.A., 1979; Ph.D., University of California, Davis, 1986.
Clark, Robert D. (1998) Kinesiology	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1992; M.S., Louisiana State University, 1996; Ph.D., 1998.
Clay, Gary R. (1995) Landscape Architecture	Professor	B.L.A., Utah State University, 1974; M.L.A., University of Illinois, 1986; Ph.D., University of Arizona, 1996.
Clement, Sandra L. (2011) Biological Sciences	Assistant Professor	B.S., Doane College, 1995; Ph.D., Michigan State University, 2004.

Clements, John (2005) Computer Science	Assistant Professor	B.A., Princeton University, 1996; M.S., Rice University, 2001; Ph.D., Northeastern University, 2005.
Coget, Jean-Francois Axel Hugues (2006) Management	Assistant Professor	M.B.A., HEC School of Management, Paris, France, 1998; Ph.D., University of California, Los Angeles, 2004.
Coleman, James W. (1973) Social Sciences	Professor Emeritus	B.A., California State University, Northridge, 1969; M.A., University of California, Santa Barbara, 1971; Ph.D., 1975.
Colvin, Kurt (1999) Industrial and Manufacturing Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1991; M.S., Oregon State University, 1997; Ph.D., 1999. Registered Professional Engineer, California.
Conn, W. David (1999) City and Regional Planning	Professor	B.A., Oxford University, 1968; M.A., 1972; D. Phil., 1973.
Conway, James R. (1969) Communication Studies	Professor Emeritus	B.A., California State College, Los Angeles, 1966; M.A., 1968; Ph.D., University of Southern California, 1977.
Cooper, James Burgess (2012) Wine and Viticulture	Professor	B.S., Lebanon Valley College, 1977; Ph.D., Washington University, St. Louis, 1982
Cooper, Kevin (2005) Graphic Communication	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1980; M.B.A., University of Southern California, 1990.
Costanzo, Philip (2007) Chemistry and Biochemistry	Associate Professor	B.S., Carnegie Mellon University, 2001; Ph.D., University of California, Davis, 2005.
Costello, Enrica Lovaglio (2002) Art and Design	Associate Professor	M.A., University of California, Santa Barbara, 2001; M.F.A. equivalent, University of Studies of Genova, Italy, 1996.
Costello, Michael J. (1999) Wine and Viticulture	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1981; Ph.D., University of California, Berkeley, 1992. Pest Control Advisor. Pest Control Advisor.
Crockett, Robert (2003) Biomedical and General Engineering	Professor	B.S., University of California, Berkeley, 1989; M.B.A., Pepperdine University, 1992; Ph.D., University of Arizona, 1997.
D'Avignon, India (2007) Music	Associate Professor	B.M.E., Wittenberg University, 1974; M.A., The Ohio State University, 1980.
Dandekar, Hemalata (2009) City and Regional Planning	Professor and Department Head	B.Arch., University of Bombay, India, 1967; M.Arch, University of Michigan, 1969; Ph.D., University of California, Los Angeles, 1978. Registered Architect, California.
Danes, Jeffrey E. (1986) Marketing	Professor	B.A., San Jose State University, 1972; M.A., 1974; Ph.D., Michigan State University, 1976.
Dang, Li (2007) Accounting	Associate Professor	Ph.D., Drexel University, 2004.
Daniels, Denise H. (2003) Psychology and Child Development	Professor	B.A., University of California, Santa Barbara, 1982; M.A., Pacific Oaks College, 1983; Ph.D., University of California, Los Angeles, 1992.
Davies, Thomas H. (1983) Music	Professor	B.M.E., Bowling Green State University, 1975; M.A., 1977; D.M.A., University of Southern California, 1983.
Davis, Steven C. (1987) Kinesiology	Professor	B.S., University of California, Davis, 1979; M.S., San Diego State University, 1983; Ph.D., Pennsylvania State University, 1986.
Davol, Andrew I. (1999) Mechanical Engineering	Professor	B.S.M.E., California Polytechnic State University, San Luis Obispo, 1987; M.S.M.E., University of California, San Diego, 1993; Ph.D., 1998. Registered Professional Engineer, California.
Dawson, Scott A. (2014) Orfalea College of Business	Dean	B.S., University of Oregon, 1978; M.B.A., University of Arizona, 1981; Ph.D., University of Arizona, 1984.
de Hahn, Henri T. (2006) Architecture	Professor	Baccalaureat Scientifique, Collège Saint-Michel, Switzerland, 1979; M.Arch., Ecole Polytechnic Fédérale de Lausanne, Switzerland, 1979.
de la Fuente, Javier (2013) Industrial Technology	Assistant Professor	B.S., University of Buenos Aires, Argentina, 1998; M.S., Michigan State University, 2006; Ph.D., Michigan State University, 2013.
De Lay, Ann M. (2008) Agricultural Education and Communication	Assistant Professor	B.S., California State University, Fresno, 1997; M.S., California Polytechnic State University, San Luis Obispo, 2002; Ph.D., University of Florida, 2008.
Dekhtyar, Alexander (2007) Computer Science	Associate Professor	Ph.D., University of Maryland College Park, 2000.

Del Rio Nascimento, Vicente (2001) City and Regional Planning	Professor	B.Arch., Federal University of Rio de Janeiro, 1978; Graduate Diploma in Urban and Regional Planning, State University of Rio de Janeiro, 1979; M.A., Oxford Polytechnic, 1981; Ph.D., University of São Paulo, 1991. Registered Architect, Brazil.
Den Hartog, Christopher (2006) Political Science	Associate Professor	B.A., University of California, San Diego, 1996; Ph.D., 2004.
Den Otter, Ronald (2005) Political Science	Associate Professor	B.A., University of California, Davis, 1989; J.D., University of Pennsylvania, 1992; Ph.D., University of California, Los Angeles, 2003.
DePiero, Fred W. (1996) College of Engineering, Electrical Engineering, and Computer Engineering	Associate Dean and Professor	B.S., Michigan State University, 1985; M.S., 1987; Ph.D., University of Tennessee, 1996.
Derelian, Doris (2004) Food Science and Nutrition	Professor	B.S., California State University, Fresno, 1968; M.S., University of California, Davis, 1975; Ph.D., University of California, Los Angeles, 1994; J.D., University of California, Davis, 2001. Registered Dietitian.
Derickson, Dennis (2005) Electrical Engineering	Associate Professor and Department Chair	B.S., South Dakota State University, 1981; M.S., University of Wisconsin–Madison, 1988; Ph.D., University of California, Santa Barbara, 1992.
DeTurris, Dianne J. (1998) Aerospace Engineering	Professor	B.S., Georgia Institute of Technology, 1984; M.S., Pennsylvania State University, 1986; Ph.D., Virginia Polytechnic Institute and State University, 1992.
Dicus, Christopher A. (2001) Natural Resources Management and Environmental Sciences	Professor	B.S., Louisiana Tech University, 1992; M.S., Utah State University, 1995; Ph.D., Louisiana State University, 2000. Registered Professional Forester, California. Certified Fire Ecologist.
Dietterick, Brian C. (1994) Natural Resources Management and Environmental Sciences	Professor and Director, Swanton Pacific Ranch	B.A., University of Pennsylvania, 1980; M.S., University of Arizona, 1982; Ph.D., Penn State University, 1994.
Disanto, Thomas L. (2003) Architecture	Associate Professor	M.Arch., California State Polytechnic University, Pomona, 1989; B.Arch, 1997; Ecole D'Architecture De Paris, La Defense, 1999.
Djassemi, Manocher (2003) Industrial Technology	Associate Professor	B.S., University of Science and Technology, Tehran, 1977; M.S., University of Wisconsin–Milwaukee, 1990; Ph.D., 1994.
Dobson, John (1990) Finance	Professor	B.A., University of Lancaster, England, 1979; M.A., University of South Carolina, 1981; Ph.D., 1988.
Doi, Jimmy A. (2003) Statistics	Professor	B.A., California State University, Northridge, 1995; M.S., North Carolina State University, 1998; Ph.D., 2003.
Dolan, Dale S. L. (2009) Electrical Engineering	Associate Professor	B.S., University of Toronto, Ontario, Canada, 2003; M.S., 2005; Ph.D., 2008.
Donegan, Lorraine D. (2002) Graphic Communication	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1997; M.A., 2001.
Dong, Kevin J. (2001) Architectural Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1986; M.S., University of California, Berkeley, 1988. Registered Structural Engineer and Professional Engineer, California.
Dove, Daniel (2005) Art and Design	Professor	B.F.A., University of Texas at Austin, 1994; M.F.A., Yale University, 1996.
Duffy, Bernard K. (1988) Communication Studies	Professor and Department Chair	B.A., San Jose State College, 1970; M.A., 1971; Ph.D., University of Pittsburgh, 1976.
Duffy, Susan (1988) Theatre and Dance	Professor	B.A., Seton Hill College, 1973; M.A., University of Pittsburgh, 1974; Ph.D., 1979.
Dugan, Timothy J. (1999) Theatre and Dance	Professor	B.A., California State University, Sacramento, 1993; M.F.A., Temple University, 1996.
Easton, Robert W. (2011) Mathematics	Assistant Professor	B.S., University of Michigan, 2002; Ph.D., Stanford University, 2007.
Echols, Robert (1999) Physics	Professor	B.S., University of California, Davis, 1992; M.S., 1994; M.S., University of California, Santa Cruz, 1996; Ph.D., 1999.
Edwards, Mark S. (2007) Animal Science	Professor	B.A., Miami University, 1987; Ph.D., Michigan State University, 1995.



Egan, Matthew Jude (2012) Political Science	Assistant Professor	B.A., University of California, Santa Cruz, 1995; J.D., University of California, Berkeley, 2004; Ph.D., 2008.
Eller, Dan (2006) Journalism	Assistant Professor	B.S. California State University, Northridge, 1984; M.P.H., 1987; Ed.D., University of California, Santa Barbara, 2010.
Ellis, Rebecca (1987) Management	Professor	B.A., University of Wisconsin, Madison, 1969; M.A., 1971; M.S., 1981; Ph.D. 1984.
Epperson, Douglas L. (2012) College of Liberal Arts	Dean	B.S., University of Utah, 1973; M.S., University of Utah, 1976. Ph.D., Ohio State University, 1979.
Eriksson, Katherine A. (2013) Economics	Assistant Professor	B.S., Virginia Tech, 2004; B.A. Somerville College, University of Oxford, 2006; M.S. Virginia Tech, 2007; M.A., UCLA, 2008; Ph.D., UCLA, 2013.
Erisen, Elif (2008) Political Science	Assistant Professor	B.A., Bogazici University, Istanbul, 1999; M.Sc., London School of Economics and Political Science, Merit, 2000; Ph.D., Stony Brook University, 2008.
Estes, Allen C. (2007) Architectural Engineering	Professor and Department Head	B.S., United States Military Academy, 1978; M.S., Stanford University, 1987; M.B.A., Long Island University, 1989; Ph.D., University of Colorado, 1997. Registered Civil Engineer, Virginia.
Estrada, Aaron R. (2012) Psychology and Child Development	Assistant Professor	B.A., University of California, Santa Cruz, 2001; M.S., San Francisco State University, 2006; M.A., University of California, Santa Barbara, 2008; Ph.D., 2011.
Fagan, Kevin (2001) Modern Languages and Literatures	Associate Professor	B.A., Gregorian University, Rome, 1972; M.A., 1977; M.A., Texas Tech University, 2000; Ph.D., University of Dallas, 1998; Ph.D., Texas Tech University, 2003.
Fahs, Michael L. (1983) Communication Studies	Professor	A.B., California State University, Long Beach, 1972; M.A., University of Southern California, 1974; Ph.D., 1976.
Farkye, Nana Y. (1990) Dairy Science	Professor	B.Sc. (Hon), University of Ghana, 1980; M.S., Utah State University, 1985; Ph.D., 1986.
Faruque, Omar (1989) Landscape Architecture	Professor	B.S.L.A., Texas A M University, 1971; M. Arch., 1972. Registered Architect, Texas, and Landscape Architect, Texas and Indiana.
Fernando, Raymond (2002) Chemistry and Biochemistry	Professor	B.S., University of Sri Jayewardenepura, Sri Lanka; Ph.D., North Dakota State University, Fargo, 1986.
Fernflores, Francisco (2000) Philosophy	Associate Professor	B.Sc., University of Toronto, 1992; M.A., University of Western Ontario, 1993; Ph.D., 1998.
Fernflores, Rachel (2006) Philosophy	Associate Professor	B.A., University of Regina, 1993; M.A., University of Saskatchewan, 1995; Ph.D., Queens University, 2006.
Fernsler, Jonathan (2006) Physics	Associate Professor	B.S., College of William and Mary, 1996; M.S., University of Colorado, Boulder, 1999; Ph.D., 2004.
Fidopiastis, Pantelis M. (2006) Biological Sciences	Associate Professor	B.A., California State University, Fullerton, 1992; M.A., 1995; Ph.D., University of Hawaii, Manoa, 2001.
Fiegel, Gregg L. (1995) Civil and Environmental Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1990; M.S., University of California, Davis, 1992; Ph.D., 1995. Registered Professional Engineer and Geotechnical Engineer, California.
Fiorenza, Giancarlo (2008) Art and Design	Associate Professor and Department Chair	B.A., University of California, Santa Cruz, 1991; M.A., Johns Hopkins University, 1993; Ph.D., 2000.
Firpo, Christina E. (2006) History	Associate Professor	B.A., The George Washington University, 2000; M.A., University of California, Los Angeles, 2002; Ph.D., 2007.
Fisher, Eric (2007) Economics	Professor	M.A., John Hopkins School of Advanced International Studies, 1979; Ph.D., University of California, Berkeley, 1985.
Fisher, Gene L. (1991) Computer Science	Professor	B.S., University of California, Irvine, 1973; Ph.D., 1985.
Fitzhenry, William (1997) English	Associate Professor	B.A., State University of New York at Buffalo, 1984; M.A., University of Colorado, 1991; Ph.D., Duke University, 1997.
Fleishon, Neil L. (1985) Physics	Professor	S.B., Massachusetts Institute of Technology, 1973; M.A., University of California, Berkeley, 1975; Ph.D., 1979.
Flores, Robert A. (1983) Agricultural Education and Communication	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1977; M.S., 1978; Ph.D., Texas A M University, 1989.

Flores, Carlos A. (2013) Economics	Associate Professor	B.A., Monterey Institute of Technology, Mexico, 1998; M.A., UC Berkeley, 2003; Ph.D., UC Berkeley, 2005.
Floyd, Barry (1990) Management	Professor	B.S., Michigan State University, 1973; M.S., 1974; M.B.A., University of Michigan, 1983; Ph.D., 1985.
Flushman, Tanya R. (2012) School of Education	Assistant Professor	B.A., University of California, Santa Cruz, 1998; M.S., State University of New York, College at Buffalo, 2006; Ph.D., Vanderbilt University, 2012.
Fogle, Emily (2007) Chemistry and Biochemistry	Associate Professor	B.A., Sonoma State University, 2000; Ph.D., University of California, Davis, 2005.
Foroohar, Manzar (1987) History	Professor	B.A., National University of Iran; M.A., California State University, Northridge, 1973; Ph.D., University of California, Los Angeles, 1984.
Forster, Sophia (2008) English	Assistant Professor	B.A., York University, 1998; M.A., University of Victoria, 2001; Ph.D., State University of New York at Buffalo, 2008.
Fowler, Thomas , IV (1995) Architecture	Professor	B.Arch., New York Institute of Technology/Old Westbury, 1984; M.Arch., Cornell University, 1994. Registered Architect, New York.
Frame, Samuel (2007) Statistics	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 2001; M.S., University of California, Santa Barbara, 2004; Ph.D., 2007.
Freberg, Laura A. (1987) Psychology and Child Development	Professor	B.A., University of California, Los Angeles, 1974; M.A., 1975; Ph.D., 1979.
Freed, Tali (2001) Industrial and Manufacturing Engineering	Professor	B.Sc., Technion-Israel Institute of Technology, Israel, 1983; M.Sc., 1988; Ph.D., University of California, Berkeley, 1995. Registered Professional Engineer, California.
Funston-Timms, Benjamin F. (2007) Social Sciences	Associate Professor	B.A., University of New Mexico, 1997; M.A., Indiana University, 1999; Ph.D., 2007.
Galanti, Tera (2008) Art and Design	Associate Professor	B.F.A., California State University, Long Beach, 1986; M.F.A., 1995.
Garcia, Antonio F. (2001) Physics	Professor	B.A., University of California, Los Angeles, 1988; B.S., San Jose State University, 1994; M.S., The University of New Mexico, 1996; Ph.D., University of California, Santa Barbara, 2001.
Garcia, Julie A. (2007) Psychology and Child Development	Associate Professor	B.A., California State University, San Bernardino, 1996; Ph.D., University of Michigan, Ann Arbor, 2005.
Garner, Lauren C. (2005) Horticulture and Crop Science	Associate Professor	B.S., The College of William and Mary, 1992; M.S., Cornell University, 1996; Ph.D., University of California, Riverside, 2004.
Gearhart, Richard O. (2006) Journalism	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1991.
Gentilucci, James L. (2003) School of Education	Professor	B.A., California State University, Northridge, 1980; M.A., California Polytechnic State University, San Luis Obispo, 1985; Ph.D., University of California, Santa Barbara, 2001.
Geringer, J. Michael (1992) Management	Professor	B.S., Indiana University, 1980; M.B.A., University of Washington, 1983; Ph.D., 1986.
Gharibyan, Hasmik (2000) Computer Science	Professor	M.S., Yerevan State University, Republic of Armenia, USSR, 1981; Ph.D., 1991.
Giberti, Bruno (1994) Architecture, Center for Teaching and Learning	Professor	B.S. Arch., California Polytechnic State University, San Luis Obispo, 1980; M.Arch., University of California, Berkeley, 1989; Ph.D., 1994. Registered Architect, California.
Gill, Samantha J. (1997) Natural Resources Management and Environmental Sciences, BioResource and Agricultural Engineering	Professor	B.S., Humboldt State University, 1991; M.S., 1993; Ph.D., University of California, Berkeley, 1997. Registered Professional Forester, California.
Gillen, Glen D. (2006) Physics	Associate Professor	B.S., Denison University, 1994; M.S., Miami University, 1996; M.A.T., 1997; M.S., The Ohio State University, 2001; Ph.D., 2002.
Gillen, Katharina (2006) Physics	Associate Professor	Vordiplom, Rheinische Friedrich-Wilhelms Universität Bonn, 1998; M.S., The Ohio State University, 2000; Ph.D., 2005.
Gillette, David (2001) English	Professor	B.A., University of Iowa, 1985; M.A., University of New Mexico, 1992; Ph.D., 1995. Co-Director, Liberal Arts and Engineering Studies.
Glick, Mary M. (2012) Journalism	Department Chair	B.A., State University of New York at Oswego, 1972; M.A., California State University, Fullerton, 1982.

Goel, Rakesh K. (1997) College of Engineering, Civil and Environmental Engineering	Associate Dean and Professor	B.Tech, Indian Institute of Technology, New Delhi, 1982; M.S., University of California, Berkeley, 1985; Ph.D., 1990. Registered Professional Engineer, California.
Golden, Bruce L. (2007) Dairy Science	Professor	B.S., Washington State University, Pullman, 1981; M.S., 1983; Ph.D., Colorado State University, 1991.
Goldenberg, Marni (2003) Recreation, Parks, and Tourism Administration	Professor	B.S., California State University, Sacramento, 1995; M.S., Purdue University, 1997; Ph.D., University of Minnesota, 2002.
Goodman, Anya (2005) Chemistry and Biochemistry	Associate Professor	B.S., Florida Atlanta University, 1996; Ph.D., Massachusetts Institute of Technology, 2003.
Gorman, Larry R. (1997) Finance	Professor	B.S., Washington State University, 1985; M.B.A., Western Washington University, 1988; Ph.D., Northwestern University, 1998.
Gragson, Derek E. (1999) Chemistry and Biochemistry	Professor	B.S., California State University, Hayward, 1991; M.S., University of Oregon, 1995; Ph.D., 1997.
Granger, Brian E. (2008) Physics	Associate Professor	B.S., Westmont College, 1994; Ph.D., University of Colorado at Boulder, 2001.
Greenwood, Jerusha B. (2006) Recreation, Parks, and Tourism Administration	Associate Professor	B.S., University of Utah, 1998; M.S., 2002; Ph.D., North Carolina State University, 2006.
Greenwood, P. Brian (2006) Recreation, Parks, and Tourism Administration	Associate Professor	B.A., University of North Carolina at Chapel Hill, 1996. M.S., North Carolina State University, 2001; Ph.D., 2007.
Greve, Adrienne I. (2006) City and Regional Planning	Associate Professor	B.S., Cornell University, 1996; M.S., Colorado State University, Ft. Collins, 1999; Ph.D., University of Washington, Seattle, 2007.
Griffin, Lanny (1997) Biomedical and General Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1992; Ph.D., University of California, Davis, 1996.
Griggs, Kenneth A. (1999) Management	Professor	B.A., University of Maryland, 1972; M.S., 1975; M.B.A., 1979; Ph.D., 1989.
Grundmeier, Todd A. (2004) Mathematics	Professor	B.S., University of New Hampshire, 1997; M.S., 2000; Ph.D., 2003.
Gu, Caixing (1998) Mathematics	Professor	B.S., Zhejiang University, 1982; M.S., China Textile University, 1986; Ph.D., Indiana University, 1994.
Guisse, Megan (2009) English	Associate Professor	B.S., Millersville University, 2002; M.Ed., 2004; Ph.D., University of Pittsburgh, 2009.
Guthrie, James (2009) Architectural Engineering	Assistant Professor	B.S., University of California, Davis, 1972; M.S., University of California, Berkeley, 1973. Registered Structural Engineer and Civil Engineer, California.
Gutierrez, Thomas D. (2006) Physics	Associate Professor	B.S., San José State University, 1991; M.S., 1994; Ph.D., University of California, Davis, 2000.
Habib, Kenneth (2006) Music	Associate Professor	B.A., University of California, Los Angeles, 1983; M.A., University of California, Santa Barbara, 1995; Ph.D., 2005.
Hagen, John (2001) Chemistry and Biochemistry	Associate Professor	B.S., University of Nevada, Las Vegas, 1992; Ph.D., Stanford University, 1996.
Hagobian, Todd A. (2009) Kinesiology	Associate Professor	B.A., University of Southern California, 1991; M.A., San Francisco State University, 2002; Ph.D., University of Massachusetts at Amherst, 2007.
Halisky, Linda H. (1984) English	Professor Emeritus	B.A., Whittier College, 1968; M.A., University of California, Riverside, 1978; Ph.D., 1984.
Hall, Garrett J. (2002) Civil and Environmental Engineering	Professor	B.S., Worcester Polytechnic Institute, 1992; M.S., University of Washington, 1993; Ph.D., University of California, Berkeley, 2001.
Hall, Kellie G. (1990) Kinesiology	Professor	B.S., Rocky Mountain College, 1977; M.S., Eastern Washington University, 1987; Ph.D., Louisiana State University, 1990.
Hall, Laura M. (2009) Food Science and Nutrition	Assistant Professor	B.S., California Polytechnic State University, San Luis Obispo, 2003; Ph.D., University of California, Davis, 2008. Registered Dietitian.

Hallock, Brent G. (1979) Natural Resources Management and Environmental Sciences	Professor Emeritus	B.S., University of California, Davis, 1970; M.S., 1972; Ph.D., 1976. Certified Professional Soil Scientist; Certified Professional Soil Erosion and Sediment Control Specialist.
Hamilton, Lynn (1996) Agribusiness	Professor	B.S., Ohio State University, 1988; M.S., University of Minnesota, 1995; Ph.D., 1996.
Hamilton, Margaret E. (2012) Mathematics	Associate Professor	B.S., University of Chicago 1989; M.A., University of California, Los Angeles, 1991; Ph.D., 1995.
Hamilton, Stephen (2004) Economics	Professor and Area Chair	B.A., University of California, Santa Barbara, 1991; M.S., University of California, Berkeley, 1994; Ph.D., 1996.
Hampsey, John C. (1992) English	Professor	B.A., Holy Cross College, 1976; Ph.D., Boston College, 1982.
Hannings, David W. (1974) Horticulture and Crop Science	Professor Emeritus	B.S., Auburn University, 1972; M.S., Cornell University, 1974.
Hanson, James L. (2005) Civil and Environmental Engineering	Professor	B.S., University of Wisconsin, Madison, 1990; M.S., University of Minnesota, Minneapolis, 1992; Ph.D., University of Wisconsin, Madison, 1996. Registered Professional Engineer, California and Wisconsin.
Harding, Trevor S. (2006) Materials Engineering	Professor	B.S., University of Michigan, 1995; M.S., 1997; Ph.D., 2000.
Hardy, Kristina (2011) Biological Sciences	Assistant Professor	B.S., Tulane University, 2003; Ph.D., University of North Carolina Wilmington, 2009.
Harris, James G. (1982) Electrical Engineering, Computer Engineering	Professor Emeritus	B.S., University of California, Berkeley, 1961; M.S., 1962; Ph.D., Syracuse University, 1968.
Harris, John H. (1977) Natural Resources Management and Environmental Sciences	Professor Emeritus	B.S., Humboldt State College, 1968; M.S., 1970; Ph.D., Utah State University, 1972.
Harris, Kathleen C. (2003) School of Education	Associate Professor	B.A., Douglass College, Rutgers University, 1971; M.Ed., Rutgers University, 1972; Ph.D., Temple University, 1981.
Hartig, Donald G. (1979) Mathematics	Professor	B.S., Rensselaer Polytechnic Institute, 1964; M.S., University of Wisconsin, Milwaukee, 1966; Ph.D., University of California, Santa Barbara, 1970.
Hauck, Allan J. (2002) Construction Management	Professor and Department Head	B.A., Kalamazoo College, 1973; M.Ed., Bowling Green State University, 1979; Ph.D., University of Maryland, 1990. Certified Professional Constructor (CPC).
Haungs, Michael L. (2003) Computer Science	Professor	B.S., University of California, Berkeley, 1992; M.S., Clemson University, 1998; Ph.D., University of Davis, 2002. Co-Director, Liberal Arts and Engineering Studies.
Hazelwood, Scott (2007) Biomedical and General Engineering	Professor	B.S., Harvey Mudd College, 1985; M.E., 1986; M.S., University of California, Davis, 1992; Ph.D., 1998.
Headrick, David H. (1998) Horticulture and Crop Science	Professor	B.S., California State Polytechnic University, Pomona, 1986; M.S., University of California, Riverside, 1988; Ph.D., 1992. Pest Control Advisor, California.
Helmbrecht, Brenda (2004) English	Associate Professor	B.A., Truman State University, 1997; M.A., Miami University, 1999; Ph.D., 2004. Director of Writing.
Helms, Eleanor D. (2011) Philosophy	Assistant Professor	B.A., Wheaton College, 2002; M.A., Fordham University, 2007; Ph.D., 2011.
Henderson, Stanley L. (1990) Dairy Science	Professor Emeritus	B.S., Iowa State University, 1973; M.S., Southern Illinois University, 1976; Ph.D., Utah State University, 1990.
Hendricks, William W. (1994) Recreation, Parks, and Tourism Administration	Professor	B.A., California State University, Chico, 1980; M.B.P.A., John F. Kennedy University, 1984; Ph.D., University of Utah, 1993.
Herron, Julie Kathleen (2011) School of Education	Assistant Professor	B.A., University of Oregon, 1996; M.A. San Diego State University, 2002; Ph.D., Utah State University, 2007.
Herter, Roberta J. (1998) School of Education	Professor	B.A., Michigan State University, 1969; M.A., 1979; Ph.D., University of Michigan, 1998.

Hess, Jeffrey (2007) Marketing	Associate Professor	B.A., Biola University, 1986; M.B.A., Pepperdine, 1988; Ph.D., University of Colorado-Boulder, 1998.
Hey, David W. (2008) Kinesiology	Assistant Professor	B.S., University of Wisconsin, La Crosse, 1987; M.S., 1993; Ph.D., Southern Illinois University, 2004.
Higgins, Lindsey M. (2012) Agribusiness	Assistant Professor	B.S., California Polytechnic State University, San Luis Obispo, 2002; M.S., Texas AM University, 2005; Ph.D., 2009.
Hill, Margarita M. (2005) Landscape Architecture	Professor	B.S.L.A., University of California, Davis, 1986; M.S.C.D., 1989.
Hillers, Kenneth J. (2004) Biological Sciences	Associate Professor	B.S., Western Washington University, 1980; Ph.D., University of Oregon, 1998.
Hiltpold, Paul (1989) History	Professor	B.A., University of Texas, 1974; M.A., 1976; Ph.D., 1981.
Himelblau, Edward T. (2005) Biological Sciences	Associate Professor	B.S., University of California San Diego, 1992; Ph.D., University of Wisconsin, 2000.
Hoellwarth, Chance (1997) Physics	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1991; M.S., University of California, Davis, 1994; Ph.D., 1997.
Holtz, Andrew J. (2008) BioResource and Agricultural Engineering	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1999; D.E., University of California, Davis, 2005. Registered Professional Engineer, California.
Holtzapple, Robert (2008) Physics	Professor	B.A., University of California, Berkeley, 1988; M.S., Stanford University, 1991; Ph.D., 1996.
Hoover, Benjamin K. (2013) Horticulture and Crop Science	Assistant Professor	B.S., Temple University, 2005; M.S., The Pennsylvania State University, 2007; Ph.D., 2012
Hopper, Matthew S. (2006) History	Associate Professor	B.A., Pepperdine University, 1996; M.A., Temple University, 1998; M.A., University of California, Los Angeles, 2000; Ph.D., 2006.
Horney, Marc R. (2009) Animal Science	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1990; M.S., Oregon State University, 1992; Ph.D., University of Nebraska-Lincoln, 1999.
Howard, Wayne H. (1999) Agribusiness	Professor	B.A., California State University, 1974; M.Sc., University of Florida, 1982; Ph.D., Texas AM University, 1987.
Howe, Patrick C. (2011) Journalism	Assistant Professor	B.A., University of Minnesota, 1993; M.A., University of Missouri-Columbia, 2011.
Howell, Robert (1974) Art and Design	Professor	B.A., Brooks Institute, 1973; M.A., Pepperdine University, 1976.
Howes, Daniel J. (2011) BioResource and Agricultural Engineering	Assistant Professor	B.S., University of California, Davis, 1997; M.S., California Polytechnic State University, San Luis Obispo, 2001; Ph.D., University of California, Irvine, 2010. Registered Professional Engineer, California..
Hughes, Gary B. (2008) Statistics	Assistant Professor	B.A., Northwestern University, 1986; M.A., University of California, Santa Barbara, 1992; Ph.D., University of Pennsylvania, 1999.
Hunt, Herb (2013) Accounting	Associate Professor	B.A., University of Vermont, 1974; M.B.A., University of Vermont, 1978; Ph.D., University of Colorado at Boulder, 1982.
Hurley, Sean P. (2002) Agribusiness	Professor	B.A., University of San Francisco, 1994; Ph.D., Iowa State University, 2000.
Hurt, Shelley L. (2008) Political Science	Associate Professor	B.A., University of California, Berkeley, 1995; M.A., New School for Social Research, New York, 2001; Ph.D., 2010.
Immoos, Chad E. (2004) Chemistry and Biochemistry	Associate Professor	A.B., Occidental College, 1996; Ph.D., University of California, Irvine, 2002.
Inchausti, Robert L. (1984) English	Professor	B.A., California State University, Sacramento, 1974; M.A., 1976; Ph.D., University of Chicago, 1981.
Isom, Denise A. (2008) Ethnic Studies	Professor and Department Chair	B.S., B.A., University of California, Davis, 1989; M.A., 1992; Ph.D., Loyola University, Chicago, 2003.
Ivors, Kelly L. (2014) Horticulture and Crop Science	Associate Professor	B.S., Texas AM University, 1992; M.S., 1995; Ph.D., Penn State University, 2002; Post-doc, UC Berkeley, 2004.
Jackson, Douglas (2008) Architecture	Associate Professor	B.Arch., Virginia Polytechnic Institute and State University, 1993; M.Arch., Princeton University, 2000. Registered Architect, California.
Jackson, Lorraine D. (1992) Communication Studies	Professor	B.A., University of Western Ontario, 1987; M.A., Pennsylvania State University, 1989; Ph.D., 1992.



Jaggia, Sanjiv (2007) Economics, Finance	Professor	B.A., Panjab University, India, 1981; Ph.D., Indiana University, Bloomington, 1990.
James, Jennifer (2007) Agribusiness	Professor	B.S., University of California, Davis, 1994; M.S., 1996; Ph.D., 2000.
James, Jonathan (2013) Economics	Assistant Professor	B.A., UCLA, 2003; M.A., Duke University, 2007; Ph.D., Duke University, 2011.
Jankovitz, Kristine Z. (1996) Kinesiology	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1984; M.S., 1989; Ph.D., University of Nebraska-Lincoln, 1995. Graduate Coordinator.
Jansen, Daniel (2003) Civil and Environmental Engineering	Professor and Department Chair	B.S., University of California, San Diego, 1988; Ph.D., Northwestern University, 1996.
Janzen, David S. (2006) Computer Science	Professor	B.A., Tabor College, 1990; M.S., University of Kansas, 1993; Ph.D., 2006.
Jaques, Jodi D. (2001) School of Education	Associate Professor	B.A., Saint Mary's College of California, 1986; M.Ed., Virginia Polytechnic Institute and State University, 1993; Ph.D., University of Virginia, 2000.
Jasbinsek, John J. (2008) Physics	Associate Professor	B.S., California State Polytechnic University, Pomona, 1992; M.A., University of California, Santa Barbara, 1994; Ph.D., University of Wyoming, 2008.
Javadpour, Roya (2003) Industrial and Manufacturing Engineering	Professor	B.S., Isfahan University of Technology, 1993; M.S., Louisiana State University, 1996; M.S., 2000; Ph.D., 2001.
Jimenez-Flores, Rafael (1995) Dairy Science	Professor	B.S., U. La Salle, Mexico City, 1981; M.S., Cornell University, 1984; Ph.D., University of California, Davis, 1989.
Jin, Xiaomin (2004) Electrical Engineering	Associate Professor	B.S., Tsinghua University, Beijing, China, 1992; M.S., 1996; Ph.D., University of Illinois at Urbana-Champaign, 2001.
Jipson, Jennifer (2005) Psychology and Child Development	Associate Professor	B.A., Smith College, 1993; M.S., University of California, Santa Cruz, 1996; Ph.D., 2000.
Johnson, Eric B. (1980) Art and Design	Professor	B.A., University of Oregon, 1971; M.A., University of New Mexico, 1975; M.F.A., 1978.
Johnston, Scott C. (2008) Physics	Associate Professor	B.S., Stanford University, 1999; M.S., 2000; Ph.D., University of California, Santa Barbara, 2006.
Jones, Barry K. (2001) Construction Management	Professor	M.Sc., University of Aston, U.K., 1980; Ph.D., University of Southampton, U.K., 1999. Chartered Builder (FCIOB); Fellow American Society of Civil Engineers.
Jones, Dane R. (1976) Chemistry and Biochemistry	Professor	B.A., University of Utah, 1969; Ph.D., Stanford University, 1974.
Jones, Eric (2012) Chemistry and Biochemistry	Assistant Professor	B.S., Case Western Reserve University, Cleveland, 2000; Ph.D., 2006
Jones, R. Thomas (2003) Architecture	Professor	B.Arch., Cornell University, 1969. AIA, Registered Architect, California.
Jones, Terry L. (1998) Social Sciences	Professor and Department Chair	B.A., University of California, Santa Cruz, 1978; M.A., Sonoma State University, 1982; M.A., University of California, Davis, 1989; Ph.D., 1995.
Jovanovic, Jasna (2005) Psychology and Child Development	Professor and Department Chair	B.S., University of Illinois, 1985; M.S., Pennsylvania State University, 1987; Ph.D. 1991.
Kachlakev, Damian I. (2000) Civil and Environmental Engineering	Professor	B.S., University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria, 1986 and 1988; M.S., 1988; Ph.D., Oregon State University, Corvallis, 1997. Registered Professional Engineer, Bulgaria.
Kane, Steven (1994) School of Education	Professor	B.A., California State Polytechnic University, Pomona, 1985; M.A., University of California, Los Angeles, 1989; Ph.D., 1993. Licensed Psychologist, California.
Kann, David J. (1969) English	Professor	B.A., Brandeis University, 1964; M.A., New York University, 1966; Ph.D., Occidental College, 1971. Postdoctoral study, State University of New York, Buffalo; M.F.A., Vermont College of Fine Arts; Ph.D., 2009.
Kantorowski, Eric J. (2004) Chemistry and Biochemistry	Professor	B.S., California State University, Fullerton, 1993; Ph.D., University of California, Davis, 1998.

Kasper, Eric P. (1997) Civil and Environmental Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1991; M.S., University of California, Davis, 1992; Ph.D., University of California, Berkeley, 1997. Registered Professional Engineer, California.
Kato, Goro C. (1981) Mathematics	Professor	B.S., Shizuoka University, Japan, 1972; M.A., West Virginia University, 1974; Ph.D., University of Rochester, 1979.
Kauffmann, Krista J. (2012) English	Assistant Professor	B.A., Goshen College, 1999; M.A., University of Wisconsin-Madison, 2001; Ph.D., 2009.
Kaul, Anton (2003) Mathematics	Professor	B.S., University of California, Davis, 1994; M.S., Oregon State University, 1996; Ph.D., 2000.
Kean, Andrew J. (2004) Mechanical Engineering	Professor	B.E., The Cooper Union, 1997; M.S., University of California, Berkeley, 1999; Ph.D., 2003.
Kearns, Timothy J. (1985) Computer Science	Associate Professor	B.A., Boston College, 1969; M.S., University of Notre Dame, 1970; Ph.D., 1976.
Keeling, Elena L. (1997) Biological Sciences	Professor	B.S., Yale University, 1989; Ph.D., University of California, San Francisco, 1996.
Keen, Aaron W. (2002) Computer Science	Associate Professor	B.S., University of California, Davis, 1997; M.S., 2000; Ph.D., 2002.
Keese, James R. (2003) Social Sciences	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1987; M.A., American Graduate School of International Management, 1989; Ph.D., University of Arizona, 1996.
Keese, Douglas (1988) English	Professor	B.A., University of California, Berkeley, 1982; M.A., 1984; Ph.D., Princeton University, 1988.
Keif, Malcolm G. (1989) Graphic Communication	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1986; M.A., California State University, Long Beach, 1989; Ph.D., University of Missouri, 1995.
Keil, David J. (1976) Biological Sciences	Professor Emeritus	B.S., Arizona State University, 1968; M.S., 1970; Ph.D., Ohio State University, 1973.
Keller, Earl C. (1987) Accounting	Professor	B.B.A., University of Houston, 1963; M.B.A., University of Washington, 1970; Ph.D., University of Washington, 1973. Certified Public Accountant.
Keller, John M. (2006) Physics	Associate Professor	B.S., Stanford University, 1991; M.A., 1992; M.S., University of Colorado, Boulder, 1999; Ph.D., University of Arizona, 2006.
Kellogg, William C. (1983) Agricultural Education and Communication	Professor and Department Head	B.S., California Polytechnic State University, San Luis Obispo, 1976; M.S., 1983; Ph.D., Colorado State University, 1987.
Kelting, Scott D. (2007) Construction Management	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 2000; M.S., 2003; Ed.D., University of California Santa Barbara, 2011. Certified Green Professional (CGP), Certified Aging-in-Place Specialist (CAPS), LEED Accredited Professional (LEED AP).
Kennelly, Brian (2006) Modern Languages and Literatures	Professor	B.A., University of California, Davis, 1986; M.A., University of Virginia, 1989; Ph.D., New York University, 1996.
Kerbo, Harold R. (1977) Social Sciences	Professor Emeritus	B.A., University of Oklahoma, 1970; M.A., 1972; Ph.D., Virginia Polytechnic Institute and State University, 1975.
Khalil, Hany M. (1987) Food Science and Nutrition	Professor	B.S., University of Alexandria, Egypt, 1973; M.S. University of Illinois, Champaign-Urbana, 1983; Ph.D., 1987.
Khosmood, Foaad (2011) Computer Science, Computer Engineering	Assistant Professor	B.S., California State Polytechnic University, San Luis Obispo, 1999; M.S., 2005; Ph.D., University of California, Santa Cruz, 2011.
Kingsbury, Kevin B. (1996) Chemistry and Biochemistry	Professor	B.S., College of William and Mary, 1986; Ph.D., Stanford University, 1993.
Kirk, Colleen M. (2001) Mathematics	Professor	B.S., Stanford University, 1994; M.S., Southern Illinois University, Carbondale, 1995; Ph.D., Northwestern University, 1999.
Kiste, Alan L. (2011) Chemistry and Biochemistry	Assistant Professor	B.S., Calvin College, 1993; Ph.D., University of Michigan, 2009.
Kitts, Christopher L. (1995) Biological Sciences	Professor and Department Chair	B.Sc., University of Auckland, New Zealand, 1984; Ph.D., University of California, Santa Cruz, 1992.

Klay, Jennifer L. (2006) Physics	Associate Professor	B.S., University of California, Los Angeles, 1994; M.S., University of California, Davis, 1998; Ph.D., 2001.
Klisch, Stephen M. (2001) Mechanical Engineering	Professor	B.S., University of Virginia, 1991; M.S., 1994; Ph.D., University of California, Berkeley, 1999.
Knight, Charles A. (2003) Biological Sciences	Professor	B.S., Western Washington University, 1996; Ph.D., Stanford University, 2002.
Kolkailah, Faysal A. (1984) Aerospace Engineering	Professor	B.S., Cairo University, Egypt, 1969; M.S., University of Cincinnati, 1978; Ph.D., Louisiana State University, 1982; additional graduate study, Cairo University. Registered Professional Engineer, Egypt.
Kolluru, Gita R. (2008) Biological Sciences	Associate Professor	B.Sc., Queen's University, Kingston, Canada, 1991; M.A., University of California, Riverside, 1994; Ph.D., 1999.
Korman, Thomas M. (2005) Construction Management	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1995; M.S., Stanford University, 1997; Ph.D., 2001. Registered Professional Engineer and Land Surveyor, California, Cal-EMA Safety Assessment Evaluator, ACI Concrete Flatwork and Field Testing Technician.
Kuhn-Choi, Don H. (2003) Architecture	Associate Professor	A.B., Princeton University, 1988; M.Arch., Rice University, 1993; Ph.D., U.C. Berkeley, 2003.
Kuhn-Choi, Devin (2007) Philosophy, Women's and Gender Studies	Assistant Professor	B.A., Georgetown University, 2000; M.A., Claremont Graduate University, 2006; Ph.D., 2007.
Kurfess, Franz J. (2000) Computer Science	Professor	M.S., Technical University of Munich, 1984; Ph.D., 1990.
Laiho, Lily (2007) Biomedical and General Engineering	Associate Professor	B.S., Stanford University, 1995; M.S., 1996; Ph.D., Massachusetts Institute of Technology, 2004.
Lammert, Amy (2008) Food Science and Nutrition	Assistant Professor	B.S., Michigan State University, 1991; M.S., University of Illinois, 1993; Ph.D., 1997.
Lange, John H. (1975) Architecture	Professor	B.S., University of Cincinnati, 1968; M.Arch., Stanford University, 1972; Ph.D., University of Pennsylvania, 1975. Registered Architect, California.
Lange, Karen F. (1989) Architecture	Professor	B.Arch., California Polytechnic State University, San Luis Obispo, 1980; M.Arch., Columbia University, 1982. Registered Architect, California.
Langner, Carrie A. (2008) Psychology and Child Development	Associate Professor	B.A., University of Michigan, 1997; Ph.D., University of California, Berkeley, 2005.
LaPorte, Mary L. (1985) Art and Design	Professor	B.A., Washington State University, 1975; M.F.A., 1980.
Larson, Debra S. (2011) College of Engineering, Civil and Environmental Engineering	Dean and Professor	B.S., Michigan Technological University, 1978; M.S., 1981; Ph.D., Arizona State University, 1994. Registered Professional Engineer, Arizona, Oregon.
Lascano, Gustavo Jose (2011) Dairy Science	Assistant Professor	B.S., Zamorano University, 2004; M.S., Pennsylvania State University, 2007; Ph.D., 2011.
Lathrop, Amanda A. (2009) Food Science and Nutrition	Assistant Professor	B.S., California Polytechnic State University, San Luis Obispo, 1999; M.S., Purdue University, 2002; Ph.D., 2005.
Latner, Michael (2008) Political Science	Associate Professor	B.A., California State University, Chico, 1995; M.A., University of California, Irvine, 2006; Ph.D., 2008.
Laursen, Peter T. (2007) Architectural Engineering	Associate Professor	M.S., University of California, San Diego; Ph.D., University of Auckland, New Zealand, 2003. Registered Civil Engineer, California.
Laver, Gary D. (1998) Psychology and Child Development	Professor	B.A., University of California, Santa Cruz, 1983; M.A., Claremont Graduate University, 1987; Ph.D., 1992.
Lawler, Brian P. (2007) Graphic Communication	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1976; M.S., 2006.
Lawson, John W. (2009) Architectural Engineering	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1983; M.S., Stanford University, 1986. Registered Structural Engineer and Civil Engineer, California, Arizona.
Lee, Linda (2009) Psychology and Child Development	Assistant Professor	B.A., University of California, Los Angeles, 1999; M.Ed., Harvard Graduate School of Education, 2000; Ph.D., University of California, Los Angeles, 2007.

Lehr, Corinne (2006) Chemistry and Biochemistry	Associate Professor	B.S.C., University of Calgary, 2003; Ph.D., Montana State University, 2006.
Lehr, Jane L. (2007) Ethnic Studies, Women's and Gender Studies	Associate Professor	B.A., University of Rochester, 1997; M.S., Virginia Polytechnic Institute and State University, 2002; Ph.D., 2006.
Leithner, Anika (2006) Political Science	Associate Professor	Vordiplom, Friedrich-Alexander-Universität Erlangen-Nuremberg, Germany, 1999; M.A., University of Colorado, 2002; Ph.D., 2006.
Lema, Sean C. (2011) Biological Sciences	Assistant Professor	B.S., University of California, Davis, 1999; M.S., 2001; Ph.D., 2004.
Lemieux, Patrick (2007) Mechanical Engineering	Professor	B.Sc.Eng., University of New Brunswick, Fredericton, Canada, 1991; M.Sc., Cranfield Institute of Technology, Bedford, England, 1992; Ph.D., California Institute of Technology, 1999.
Lepore, Jason (2007) Economics	Associate Professor	B.A., University of California, Irvine, 2002; M.A., University of California, Davis, 2003; Ph.D., 2007.
Lertwachara, Kevin (2004) Management	Associate Professor	B.S., King Monkut's Institute of Technology, Thonburi, Bangkok, Thailand, 1994; M.B.A., Westminster College, 1996; Ph.D., University of Connecticut, 2004.
Levenson, Harvey Robert (1983) Graphic Communication	Professor Emeritus	B.S., Rochester Institute of Technology, 1967; M.S., South Dakota State University, 1968; Ph.D., University of Pittsburgh, 1980.
Levi, Daniel J. (1982) Psychology and Child Development	Professor	B.A., Lehigh University, 1973; M.S., University of Arizona, 1979; Ph.D., 1981.
Liddicoat, Albert A. (2002) Academic Personnel, Computer Engineering, Electrical Engineering	Associate Vice Provost for Academic Personnel, and Professor	B.S., California Polytechnic State University, San Luis Obispo, 1989; M.S., Stanford University, 1996; M.S., 1999; Ph.D., 2002.
Liese, Jeffrey E. (2008) Mathematics	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 2000; M.A., University of California, San Diego, 2004; Ph.D., 2008.
Lin, Patrick (2007) Philosophy	Associate Professor	B.A., University of California, Berkeley, 1990; M.A., University of California, Santa Barbara, 1995; Ph.D. 1997.
Lin, Joyce T. (2013) Mathematics	Assistant Professor	B.A., University of Virginia, 2004; Ph.D., University of North Carolina at Chapel Hill, 2009.
Lindert, Lisa M. (2002) Chemistry and Biochemistry	Associate Professor	B.S., University of Michigan, 1997; M.S., University of California, Santa Barbara, 2000; Ph.D., 2002.
Lindsey-Mulliken, Joan M. (2007) Marketing	Associate Professor	B.S., University of Missouri, 1983; M.B.A., University of Arizona, 1996; Ph.D., 1999.
Livingston, Kimberly Ann (2012) Animal Science	Assistant Professor	B.S., University of Illinois Urbana-Champaign, 2002; M.S., 2004; Ph.D., University of California, Davis, 2009.
Lloyd-Moffett, Stephen (2005) Philosophy	Associate Professor	B.A., Claremont McKenna College, 1994; M.Th., St. Vladimir's Orthodox Seminary, 2004; M.A., University of California, Santa Barbara, 2001; Ph.D., 2005.
Lo, Kurt Chien-Kuo (1983) Civil and Environmental Engineering	Professor Emeritus	B.S., National Cheng Kung University, Taiwan, 1969; M.S., 1973; Ph.D., University of Iowa, 1981.
Loberg, Molly J. (2007) History	Associate Professor	B.A., Pacific Lutheran University, 1998; M.A., Princeton University, 2002; Ph.D., 2006.
Locascio, James Gaspare (1981) Mechanical Engineering	Associate Professor	B.S., Newark College of Engineering, 1970; M.S., University of California, Santa Barbara, 1971; Ph.D., 1988.
London, Blair (1993) Materials Engineering	Professor	B.S. Drexel University, 1981; M.S., Stanford University, 1983; Ph.D., 1986.
Long, Todd (2004) Philosophy	Professor	B.A., University of Southern Mississippi, 1986; M.A., 1995; M.A., University of Wales, 2000; M.A., University of Rochester, 2002; Ph.D., 2003.
Loving, Bill (2008) Journalism	Professor	B.A., University of Texas, El Paso, 1979; J.D., Southern Methodist University, 1991.
Lowham, Elizabeth A. (2007) Political Science	Associate Professor	B.A., Carlton College, 2001; M.A., University of Colorado, 2003; Ph.D., 2007.
Lucas, Michael A. (1998) Architecture	Professor and Associate Dean	B.Arch., University of Cincinnati, 1979; M.Arch, Morgan State University, 1995. Registered Architect, Maryland.

Lund, Ulric J. (2001) Statistics	Professor	B.S., University of California, San Diego, 1990; M.S., University of California, Santa Barbara, 1993; Ph.D., 1998.
Lundquist, Tryg J. (2006) Civil and Environmental Engineering	Associate Professor	B.A., University of California, Berkeley, 1989; M.S., 1992; Ph.D., 2006. Registered Civil Engineer, California.
Lupo, Christopher (2008) Computer Engineering, Computer Science	Associate Professor	B.S., California State University, Fresno, 1997; M.S., University of California, Davis, 2007; Ph.D., 2008.
Lynch, Joseph (2001) Philosophy	Professor	B.A., Virginia Commonwealth University, 1982; M.A., Claremont Graduate School, 1985; Ph.D., 1989.
Lynn, Abraham C. (1996) Architectural Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1986; M.S., University of California, Berkeley, 1991; Ph.D., 2001.
Maas, Donald K. (1976) School of Education	Professor	B.A., University of California, Los Angeles, 1966; M.Ed., State University of New York at Buffalo, 1969; Ed.D., 1971.
MacCarley, Arthur (1988) Electrical Engineering, Computer Engineering	Professor	B.S., University of California, Los Angeles, 1976; M.S., 1978; Ph.D., Purdue University, 1987. Registered Professional Engineer, Colorado.
MacCurdy, Carol A. (1987) English	Professor Emeritus	B.A., Southwestern at Memphis, 1972; M.A., University of South Carolina, 1975; Ph.D., 1980.
MacDougall, Neal A. (1997) Agribusiness	Associate Professor	B.A., Williams College, 1984; Ph.D., University of California, Berkeley, 1999.
Macedo, Jose (2002) Industrial and Manufacturing Engineering	Professor and Department Chair	B.S., Catholic University of Peru, Peru, 1982; M.S., University of California, Berkeley, 1984; Ph.D., Lehigh University, 1991. Registered Professional Engineer, Texas.
Machamer, Joshua T. (2003) Theatre and Dance	Professor and Department Chair	B.A., Whittier College, 1993; M.F.A., The Pennsylvania State University, 2000. Director, General Education Program. Governance Board.
Mackenzie, Susan (2013) Recreation, Parks, and Tourism Administration	Assistant Professor	B.A., Pomona College, 2002; Ph.D., University of Otago, 2009.
Mackey, Alison (2007) Management	Assistant Professor	B.A., Brigham Young University, 1999; M.B.A., 2001; Ph.D., Ohio State University, 2006.
Mackey, Tyson (2007) Management	Assistant Professor	B.S., Brigham Young University, 2000; M.B.A., 2002; Ph.D., Ohio State University, 2006.
Mackin, Thomas J. (2005) Mechanical Engineering	Professor	B.S., The Pennsylvania State University, 1980; M.S., 1987; Ph.D., 1991.
Macro, Kenneth L. (2000) Graphic Communication	Professor and Department Chair	B.A., Pennsylvania State University, University Park, 1993; M.A., The University of Akron, 2000; Ph.D., Walden University, 2011.
Maddren, Jesse (1999) Mechanical Engineering	Professor	B.S., University of California, Santa Barbara, 1985; M.S., 1988; Ph.D., 1994. Registered Professional Engineer, California.
Magnusson, Shirley J. (2004) School of Education	Professor	B.S., University of Missouri, Columbia, 1980; M.S., University of Iowa, 1986; Ph.D., University of Maryland, College Park, 1991.
Main, Kelly D. (2007) City and Regional Planning	Associate Professor	B.A., University of California, Davis, 1982; M.A., Brown University, 1983; Ph.D., University of California, Los Angeles, 2007.
Marchbanks, Paul (2007) English	Associate Professor	B.S., Centre College of Kentucky, 1993; M.A., University of North Carolina at Chapel Hill, 2000; Ph.D., 2006. Graduate Director.
Marella, Chenchaiiah (2013) Dairy Science	Assistant Professor	B.S., ANGR Agricultural University, India, 1988; M.S., Guj Agricultural University, India, 1991; Ph.D., South Dakota State University, 2009.
Margerum-Leys, Jon (2013) School of Education	Dean	B.Mus., University of Wisconsin, 1988; M.A., California Polytechnic State University, San Luis Obsipo, 1995, Ph.D., University of Michigan, Ann Arbor, 2001.
Mark, Walter R. (1972) Natural Resources Management and Environmental Sciences	Professor Emeritus	B.S., Utah State University, 1968; M.S., Colorado State University, 1970; Ph.D., 1972. Registered Professional Forester, California.
Marlier, John F. (1981) Chemistry and Biochemistry	Professor	B.S., University of Wisconsin, Stevens Point, 1972; Ph.D., University of Wisconsin, Madison, 1978.
Marlow, Michael L. (1988) Economics	Professor	B.A., George Washington University, 1975; Ph.D., Virginia Polytechnic Institute, 1978.



Marshall, David D. (2004) Aerospace Engineering	Professor	B.S., Worcester Polytechnic Institute, 1994; M.S., Georgia Institute of Technology, 1995; Ph.D., 2003.
Marshall, Kathryn G. (2007) Economics	Assistant Professor	B.A., University of Texas, 1980; Ph.D., University of California, Berkeley, 1990.
Martin, Kathleen J. (2002) Ethnic Studies	Associate Professor	B.A., California State University, Northridge, 1992; M.A., University of California, Santa Barbara, 1993, 1996; Ph.D., 1997.
Martinez, Andres W. (2010) Chemistry and Biochemistry	Assistant Professor	B.S., Stanford University, 2003; Ph.D., Harvard University, 2009.
Martinez, Charmaine (2006) Art and Design	Associate Professor	B.F.A., University of Notre Dame, 1993; M.F.A., University of Wisconsin-Madison, 2003.
Mase, Tom (2007) Mechanical Engineering	Professor	B.S.M.E., Michigan State University, 1980; M.S.M.E., University of California, Berkeley, 1982; Ph.D., 1987.
Mastoridis, Themistoklis (2013) Physics	Assistant Professor	B.S., Brandeis in Physics, 2003; M.S., Stanford University in Electrical Engineering, 2005; Ph.D. Stanford University in Electrical Engineering, 2010.
McCormick, Kathryn E. (2003) Art and Design	Professor	B.S., University of Cincinnati, 1996; M.S., 2001.
McCullough, Michael (2008) Agribusiness	Associate Professor	B.S., Boise State University, 2003; M.S., Washington State University, 2007; Ph.D., 2008.
McDaniel, Cole C. (2005) Architectural Engineering	Professor	B.S., University of California, San Diego, 1996; M.S., 1997; Ph.D., 2002. Registered Civil Engineer, California.
McDonald, Ashley (2013) Chemistry and Biochemistry	Assistant Professor	B.S., Mississippi College, 2004; Ph.D. Georgia Institute of Technology, 2009
McDonald, Margot K. (1992) Architecture	Professor and Interim Department Head	B.A., B.S., University of California, Santa Barbara, 1980; M.Arch., University of Oregon, 1987. AIA, Registered Architect, Oregon. NCARB Certificate.
McDonald, Robert A. (2006) Aerospace Engineering	Associate Professor	B.S., University of Missouri-Rolla, 1999; M.S., Georgia Institute of Technology, 2001; Ph.D., 2006.
McGaughey, Karen J. (2003) Statistics	Associate Professor	B.A., Kansas State University, 1991; M.S., 1999; Ph.D., 2003.
McKinlay, Kristina I. (2002) Orfalea College of Business	Assistant Dean	B.A., Westmont College, 1979; M.Div., San Francisco Theological Seminary, 1985; M.B.A., California Polytechnic State University, San Luis Obispo, 2001.
McLamore, Alyson (1991) Music	Professor	B.A., University of California at Los Angeles, 1982; M.A., 1985; Ph.D., 1991.
McMahan, Andrew (2010) Music	Assistant Professor	B.S., Western Carolina University, 1996; M.M., University of Wisconsin, 1998; D.M.A., University of Minnesota, 2008.
McNeil, Christina J. (2012) Theatre and Dance	Assistant Professor	B.F.A., Cornish College of the Arts, 2000; M.F.A., University of Washington, 2012.
McQuaid, Patricia (1996) Management	Professor	B.S., Case-Western Reserve University, 1978; M.B.A., Eastern Michigan University, 1982; M.S., Auburn University, 1988; Ph.D., Auburn University, 1996.
Meagher, James M. (1988) Mechanical Engineering	Professor and Department Chair	B.S., University of Akron, 1978; M.S., 1981; Ph.D., University of California, Berkeley, 1987.
Mealy, Bryan J. (2003) Electrical Engineering, Computer Engineering	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1990; M.S., 1993; M.S., University of California, Santa Cruz, 1999; Ph.D., 2002.
Medina, Elsa (2000) Mathematics	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1994; M.S., 1996; Ph.D., University of Northern Colorado, 2000.
Medizade, Mason (1984) Mechanical Engineering	Professor	B.S., Abadan Institute of Technology, 1978; M.S., University of Southern California, 1980; Ph.D., 1984.
Mehiel, Eric A. (2004) Aerospace Engineering	Associate Professor and Department Chair	B.S., University of California, Santa Barbara, 1998; M.S., University of Colorado, 2001; Ph.D., 2003.
Meisenheimer, Kristen (2009) Chemistry and Biochemistry	Assistant Professor	B.S., California Polytechnic State University, San Luis Obispo, 1992; Ph.D., University of Colorado, Boulder, 1998.
Mello, Joseph D. (1998) Mechanical Engineering	Professor	B.S., California Polytechnic State University, 1983; M.S., 1989; Ph.D., University of California, Davis, 1996.

Mendes, Anthony A. (2004) Mathematics	Associate Professor	B.S., University of California, Irvine, 2000; M.A., University of California, San Diego, 2001; Ph.D., 2004.
Metcalfe, Lynn E. (1986) Marketing	Professor and Area Chair	B.A., University of Oregon, 1978; M.I.M., American Graduate School of International Management, 1981; Ph.D., University of South Carolina, 1986.
Meyer, Elizabeth Jacson (2011) School of Education	Assistant Professor	B.A., Tulane University, 1992; M.A., University of Colorado, Boulder, 1997; Ph.D., McGill University, 2007.
Miklowitz, Paul S. (1988) Philosophy	Professor	B.A., University of California, Santa Cruz, 1977; M.A., University of Chicago, 1979; M.Phil., Ph.D., Yale University, 1988.
Miller, Charles (Tad) R. (1987) Accounting	Professor	B.A., College of Wooster, 1970; M.B.A., University of Arizona, 1980; Ph.D., 1987. Certified Public Accountant.
Miller, Michael Barton (1997) Art and Design	Professor	B.A., University of California, Irvine, 1986; M.F.A., University of Southern California, 1988.
Mintz, Steven (2006) Accounting	Professor	B.S., Long Island University, 1967; M.B.A., Syracuse University, 1969; D.B.A., George Washington University, 1978.
Mitchell, David (2004) Physics	Associate Professor	B.S., George Washington University, 1998; M.A., University of California, San Diego, 2001; Ph.D., 2004.
Moazzami, Sara (1991) Civil and Environmental Engineering	Professor	B.S., George Washington University, 1981; M.S., University of California, Berkeley, 1982; Ph.D., 1987.
Mock, Rodney (2008) Accounting	Professor	J.D., University of Oregon School of Law, 2002; L.L.M., University of Washington School of Law, 2004.
Moelter, Matthew J. (1998) Physics	Professor and Department Chair	B.S., University of California, Irvine, 1981; Sc.M., Brown University, 1983; Ph.D., 1989.
Montecalvo, Joseph (1983) Food Science and Nutrition	Professor Emeritus	B.S., University of Rhode Island, 1972; M.S., 1975; Ph.D., 1979.
Moody, Lynn E. (1999) Natural Resources Management and Environmental Sciences	Professor Emeritus	B.S., University of Cincinnati, 1974; M.S., California Polytechnic State University, San Luis Obispo, 1989; Ph.D., University of California, Riverside, 1993.
Moore, Matthew J. (2006) Political Science	Associate Professor	B.A., Eugene Lang College, 1997; Ph.D., Johns Hopkins University, 2004.
Moreno, J. Kelly (1991) Psychology and Child Development	Professor	B.S., University of California, Santa Barbara, 1980; M.S., University of Utah, 1985; Ph.D., 1988. Licensed Psychologist, California.
Morris, Andrew D. (2000) History	Professor	B.S., Harvey Mudd College, 1991; M.A., University of California, San Diego, 1996; Ph.D., 1998.
Moss, Robb E. S. (2006) Civil and Environmental Engineering	Associate Professor	B.S., North Carolina State University, 1995; M.S., Utah State University, 1997; Ph.D., University of California, Berkeley, 2003. Registered Professional Engineer, California.
Mottmann, John (1974) Physics	Professor Emeritus	B.A., University of California, Los Angeles, 1966; M.A., 1967; Ph.D., 1972.
Mueller, James R. (1980) Mathematics	Professor Emeritus	B.A., University of Wisconsin, 1975; Ph.D., California Institute of Technology, 1982.
Muleta, Misgana (2008) Civil and Environmental Engineering	Associate Professor	B.S., Arbaminch University, 1996; M.S., National University of Ireland, Galway, 1999; Ph.D., Southern Illinois University, Carbondale, 2003. Registered Professional Engineer, California.
Mulligan, Patricia A. (1988) School of Education	Professor	B.A., Arizona State University, 1971; M.Ed., Kent State University, 1977; M.A., Northern Arizona University, 1978; Ph.D., Arizona State University, 1987.
Munoz-Christian, Karen (2007) Modern Languages and Literatures	Associate Professor	B.S., Iowa State University, 1981; M.A., Wichita State University 1985; Ph.D., University of California, Irvine, 1994.
Murphy, Kathleen S. (2007) History	Associate Professor	B.A., University of Virginia, 2001; M.A., Johns Hopkins University, 2003; Ph.D., 2007.
Murray, William R. (1999) Mechanical Engineering	Professor	B.S., University of Texas, Austin, 1975; M.S., 1976; Ph.D., Massachusetts Institute of Technology, 1988.
Mwangi, James (2003) Architectural Engineering	Professor	B.Sc., University of Nairobi, Kenya, 1984; MSc., University of Lagos, Nigeria; Ph.D., University of California, Davis, 2001. Registered Structural Engineer and Professional Engineer, California.

Nafisi, Ahmad (1983) Electrical Engineering	Professor	B.S., Arya Mehr University of Technology, Iran, 1975; M.S., University of Southern California, 1977; Ph.D., 1983.
Nakamura, Royden (1978) Biological Sciences	Professor	B.A., University of Hawaii, 1961; M.S., 1965; Ph.D., University of British Columbia, 1970.
Navarro, José A., Jr. (2012) English	Assistant Professor	B.A., University of California, Berkeley, 2002; M.A., University of Southern California, 2008; Ph.D., 2012.
Nazmi, Aydin (2009) Food Science and Nutrition	Associate Professor	B.S., University of California, Davis, 1998; M.S., University of London, U.K.; 2004; Ph.D., Federal University of Pelotas, Brazil, 2007.
Neff, Grace Ann (1995) Chemistry and Biochemistry	Associate Professor	B.S., New Mexico State University, 1989; Ph.D., University of Oregon, 1998.
Neill, Dawn (2008) Social Sciences	Associate Professor	B.A., Louisiana State University, 1996; M.A., 1999; M.A., University of Washington, 2004; Ph.D., 2007.
Neill, Stern (2008) Marketing	Associate Professor	B.A., Louisiana State University, 1992; M.B.A., Southeastern Louisiana University, 1994; Ph.D., Louisiana State University, 2000.
Nelson, Jill (2008) Architectural Engineering	Associate Professor	B.S., University of Nevada, Reno, 1978; M.S., University of Washington, 1982. Registered Structural and Civil Engineer, California and Washington; LEED AP.
Nelson, Yarrow M. (1999) Civil and Environmental Engineering	Professor	B.S., University of California, Berkeley, 1979; M.S., Cornell University, 1992; Ph.D., 1997.
Neuenhofer, Ansgar (2001) Architectural Engineering	Associate Professor	B.S., Technical University at Aachen, Germany, 1988; M.S., University of California, Berkeley, 1991; Ph.D., Technical University at Aachen, Germany, 1994. Registered Civil Engineer, California.
Neuhaus, Tom (1998) Food Science and Nutrition	Associate Professor Emeritus	B.S., Oberlin College, 1975; M.S., University of Maryland, 1982; Ph.D., Cornell University, 2000.
Nicholson, Lisa M. (2001) Food Science and Nutrition	Professor	B.S., California State University, Northridge, 1985; M.S., 1987; Ph.D., University of Southern California, 1999. Registered Dietitian.
Nico, Phillip L. (2000) Computer Science, Computer Engineering	Professor	B.A., University of California, Berkeley, 1991; M.S., University of California, Davis, 1994; Ph.D., 2000.
Niku, Saeed B. (1983) Mechanical Engineering	Professor	B.S., Tehran Polytechnic University, 1975; M.S., Stanford University, 1976; Ph.D., University of California, Davis, 1982. Registered Professional Engineer, California.
Noel, Jay E. (1990) Agribusiness	Professor and Department Chair	B.S., University of California, Davis, 1973; M.S., 1974; Ph.D., 1979.
Noland, Jaymie J. (1999) Animal Science	Professor and Interim Department Head	B.S., Colorado State University, 1981; D.V.M., Colorado State University, 1987.
Noori, Mohammad (2005) Mechanical Engineering	Professor	B.S., University of Illinois at Urbana-Champaign, 1977; M.S., Oklahoma State University, 1980; Ph.D., University of Virginia, 1984.
Nuttall, Brent (2003) Architectural Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1986; M.S., University of California, Berkeley, 1987. Registered Structural and Civil Engineer, California.
Nuworsoo, Cornelius K. (2005) City and Regional Planning	Associate Professor	B.S., University of Science and Technology, Ghana, 1981; M.S., Morgan State University, 1986; MCP, University of California, Berkeley, 2002; Ph.D., 2004. American Institute of Certified Planners. Institute of Transportation Engineers.
O'Bryant, Camille P. (1999) Kinesiology	Professor	A.B., Smith College, 1983; M.S., 1986; Ph.D., Ohio State University, 1996.
O'Hara, Christine E. (2008) Landscape Architecture	Associate Professor	B.A., Stanford University, 1987; M.L.A. University of Washington, 2002. Certificate in Preservation Planning.
Oliver, John Y. (2007) Computer Engineering, Electrical Engineering	Associate Professor, Director of Computer Engineering	B.S., Boston University, 1998; M.S., University of California, Davis, 2006; Ph.D., 2007.
Olsen, Eric (2004) Industrial Technology	Professor	B.S., University of Maine at Orono, 1979; M.B.A., Virginia Polytechnic Institute and State University, 1987; Ph.D., The Ohio State University, 2004.

Olsen, Clare (2011) Architecture	Assistant Professor	B.A., Brown University, 1997; M.Arch., University of California, Los Angeles, 2003.
Orij, John (1987) History	Professor	B.A., University of Nigeria, 1967; M.A., Johns Hopkins University, 1972; M.A., Rutgers University, 1975; Ph.D., 1977.
Orth, Joel J. (2003) History	Associate Professor	B.A., California Polytechnic State University, San Luis Obispo, 1996; M.A., Iowa State University, 1998; Ph.D., 2004.
Oulton, Rebekah L. (2013) Civil and Environmental Engineering	Assistant Professor	B.S., Harvey Mudd College, 1993; M.S., 1994; Ph.D., University of Iowa, 2013. Registered Professional Engineer, California. Leed Accredited Professional.
Owen, Franklin C. (1998) Mechanical Engineering	Professor	BSME, Mississippi State University, 1978; MSME, Oregon State University, 1983; Ph.D., University of Texas, 1998. Registered Professional Engineer, Maine.
Pal, Nirupam (1995) Civil and Environmental Engineering	Professor	B. Tech, Calcutta University, India, 1984; M. Tech, 1986; Ph.D., New Jersey Institute of Technology, 1993.
Pal, Saikat (2014) Biomedical and General Engineering	Assistant Professor	B.S., 2002; M.S., 2004; Ph.D., University of Denver, 2008.
Palandoken, Hasan (2009) Chemistry and Biochemistry	Assistant Professor	B.S., California State University, Chico, 1993; M.S., University of California, Davis, 1997; Ph.D., 2006.
Pan, Jianbiao (2003) Industrial and Manufacturing Engineering	Professor	B.E., Xidian University, Xian, China, 1990; M.S., Tsinghua University, Beijing, China, 1996; Ph.D., Lehigh University, 2000. Certified Quality Engineer. Certified Reliability Engineer.
Pande, Anurag (2008) Civil and Environmental Engineering	Associate Professor	B.Tech., Indian Institute of Technology, Bombay, 2002; M.S., University of Central Florida, 2003; Ph.D., 2005.
Papathakis, Peggy (2006) Food Science and Nutrition	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1977; M.S., University of California, Davis, 2000; Ph.D., 2005. Registered Dietitian.
Paquin, Dana (2008) Mathematics	Assistant Professor	B.S., Davidson College, 2002; Ph.D., Stanford University, 2007.
Pascual, Christopher C. (2000) Mechanical Engineering	Professor	B.S., Cornell University, 1985; M.S., Georgia Institute of Technology, 1996; Ph.D., 1999. Registered Professional Engineer, California.
Patel, Pratish A. (2013) Finance	Assistant Professor	B.S., Georgia Institute of Technology, 2002; M.S., UC Berkeley, 2005; Ph.D., UC Berkeley, 2013.
Patton, Linda J. (1991) Mathematics	Professor	B.A., University of California, San Diego, 1985; M.A., 1987; Ph.D., 1991.
Pearse, Erin Peter James (2012) Mathematics	Assistant Professor	B.S., University of California, Riverside, 1998; M.S., 2001; Ph.D., 2006.
Pedrotti, Jennifer Teramoto (2003) Psychology and Child Development	Professor	B.A., University of California, Davis, 1996; M.S., University of Kansas, 2000; Ph.D., 2003.
Pendergast, William R. (2000) Management	Professor	B.A., University of Notre Dame, 1966; M.A., Columbia University, 1968; Ph.D., 1971.
Perrine, John D. (2008) Biological Sciences	Associate Professor	B.S., Vanderbilt University, 1991; M.S., Miami University, Ohio, 1995; Ph.D., University of California, Berkeley, 2005.
Peterson, Daniel G. (2003) Animal Science	Professor	B.S., University of California, Davis, 1999; Ph.D., Cornell University, 2003.
Peterson, John C. (2007) Horticulture and Crop Science	Professor	B.S., University of Rhode Island, 1974; Ph.D., Rutgers University, 1978.
Peterson, Zachary (2013) Computer Science	Assistant Professor	B.S., Univ of CA, Santa Cruz, 2000; M.S., 2002; M.S., The Johns Hopkins University Information Security Institute, 2005; Ph.D., The Johns Hopkins University, 2006.
Peuker, Steffen (2014) Mechanical Engineering	Assistant Professor	M.S., University of Illinois at Urbana-Champaign, 2006; Ph.D., 2010.
Phelan, Suzanne (2008) Kinesiology	Associate Professor	B.A./B.S., University of Colorado at Boulder, 1989; M.A., MCP Hahnemann University, 1999; Ph.D., 2001.

Phillips, Stephen J. (2005) Architecture	Associate Professor	B.A.Arch., Yale, 1991; M.Arch., University of Pennsylvania Graduate School of Architecture, 1994; M.A., Princeton, 2003; Ph.D., 2008. Registered Architect., California.
Pierce, Todd J. (2005) English	Professor	B.A., Southern California College, 1988; M.A., Oregon State University, 1992; M.F.A., University of California, Irvine, 1995; Ph.D., Florida State University, 2003.
Piirto, Douglas D. (1985) Natural Resources Management and Environmental Sciences	Professor	B.S., University of Nevada, Reno, 1970; M.S., Colorado State University, 1971; Ph.D., University of California, Berkeley, 1977. Registered Professional Forester, California.
Pilkington, Wayne (2005) Electrical Engineering	Associate Professor	B.S., Lafayette College, 1981; M.S., Rochester Institute of Technology, 1989; M.S., University of Rochester, 1999; Ph.D., 2005.
Plummer, William E. (1979) Animal Science	Professor	B.S., North Carolina State University, 1970; M.S., 1976; Ph.D., Utah State University, 1979.
Poling, John E. (1976) Physics	Professor Emeritus	B.A., University of Chicago, 1965; M.S., University of Iowa, 1969; Ph.D., 1975.
Ponitz, Jeffrey A. (2011) Architecture	Assistant Professor	B.S., University of Michigan, 2002; M.Arch., 2004; M.Arch., University of Virginia, 2008
Porumamila, Hemanth (2008) Mechanical Engineering	Associate Professor	B.E., BMS College of Engineering, Bangalore, India, 2000; M.S., Iowa State University, 2003; Ph.D., 2007.
Potter, Gail Elizabeth (2012) Statistics	Assistant Professor	B.A., Oberlin College, 1997; Ph.D., University of Washington, 2010.
Pouraghabagher, A. Reza (1979) Industrial and Manufacturing Engineering	Professor	B.S., University of Colorado, 1972; M.S., University of California, 1973; Ph.D. University of Iowa, 1977. Certified in Production and Inventory Management (CPIM).
Preston, William L. (1980) Social Sciences	Professor	B.A., Fresno State College, 1971; M.A., California State University, Fresno, 1973; Ph.D., University of Oregon, 1979.
Prodanov, Vladimir (2009) Electrical Engineering	Assistant Professor	M.S., State University of New York, Stony Brook, 1995; Ph.D., 1997.
Puig-Suari, Jordi (1998) Aerospace Engineering	Professor	B.S., Purdue University, 1988; M.S., 1990; Ph.D., 1993.
Pulitano, Elvira (2006) Ethnic Studies	Associate Professor	Laurea (B.A.), Università di Messina, Italy, 1993; University of New Mexico, 1997; Ph.D., 2002.
Puntar, Diana (2012) Art and Design	Assistant Professor	B.A., University of Maryland, 1991; M.F.A., School of the Museum of Fine Arts, Boston, 1996
Qenani-Petrela, Eivis (2002) Agribusiness	Professor	B.S., University of Tirana, Albania, 1987; M.A., Washington State University, 1998; Ph.D., 2002.
Qu, Bing (2008) Civil and Environmental Engineering	Associate Professor	B.S., Tongji University (China), 2001; M.S., 2004; Ph.D., State University of New York at Buffalo, 2008.
Ragsdale, Joseph J. (2002) Landscape Architecture	Associate Professor	B.A., University of California, Berkeley, 1991; M.L.A., University of Virginia, 2000. Registered Landscape Architect, California.
Rahim, Ashraf (2003) Civil and Environmental Engineering	Professor	B.S., University of Mansoura, Egypt, 1986; M.S., 1991; Ph.D., University of Mississippi, Oxford, 2001. Registered Professional Engineer, California.
Rahman, Shikha (2007) Civil and Environmental Engineering	Associate Professor	B.S., Bangladesh University of Engineering and Technology (BUET), 1995; M.S., 1998; Ph.D., Georgia Institute of Technology, 2002. Registered Professional Engineer, Mississippi.
Rainey, Paul E. (1987) Industrial and Manufacturing Engineering, Materials Engineering	Professor Emeritus	B.S.M.E., B.S.Met.E., Purdue University, 1967; M.S., Massachusetts Institute of Technology, 1968; Ph.D., Texas A M University, 1981. Registered Professional Engineer, Texas.
Ramezani, Cyrus A. (1999) Finance	Professor and Area Chair	B.A., University of California, Santa Cruz, 1984; M.S., 1988; M.S., University of California, Berkeley, 1991; Ph.D., 1992.
Rastad, Mahdi (2012) Finance	Assistant Professor	Ph.D., University of Illinois Urbana Campus, 2009
Rawlings, Don P. (1979) Mathematics	Professor Emeritus	B.S., Arizona State University, 1974; M.A., University of California, San Diego, 1976; Ph.D., 1978.



Reaves, Scott (2003) Food Science and Nutrition	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1991; Ph.D., University of Arizona, 1995.
Reich, Jonathan (2001) Architecture	Professor	B.A., University of Washington, Seattle, 1979; B.A.E.D., 1979; M.Arch., University of California, Berkeley, 1983. AIA, Registered Architect, California and Washington.
Rein, Steven (1998) Statistics	Associate Professor	B.A., University of California, Los Angeles, 1987; M.A., University of California, Berkeley, 1989; Ph.D., 1993.
Reiners, Derek Seth (2011) Political Science	Assistant Professor	B.A., St. Olaf College, 1994; M.A., University of Wyoming, 1999; Ph.D., Indiana University, 2006.
Retallick, Keela Marie (2013) Animal Science	Assistant Professor	B.S., University of Wisconsin-Madison, 2007; M.S. University of Illinois: Urbana-Champaign, 2009; Ph.D., 2012
Retsek, Dylan Q. (2003) Mathematics	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1996; M.A., Washington University, 1997; Ph.D., 2001.
Reyes, Luis (2011) Physics	Assistant Professor	B.S., Universidad de los Andes, Bogota-Columbia, 2001; Ph.D. University of Maryland, College Park, 2007.
Ribeiro, Bruno (2012) Art and Design	Assistant Professor	B.S., Universidade do Estado do Rio de Janeiro, 2002; M.B.A, Fundação Getúlio Vargas, 2007; M.F.A., The Ohio State University, 2012
Rice, Margaret (Peggy) S. (1996) Chemistry and Biochemistry	Professor	B.S., University of California, Los Angeles, 1979; Ph.D., University of Oregon, 1990.
Richert, Benjamin P. (2003) Mathematics	Professor	B.S., Wheaton College, 1995; Ph.D., University of Illinois, Urbana-Champaign, 2000.
Ridgely, John R. (2001) Mechanical Engineering	Professor	B.S., University of California, Berkeley, 1986; M.S., 1988; Ph.D., 2001.
Riggs, William Warren (2013) City and Regional Planning	Assistant Professor	B.A., Ball State University, Indiana, 2001; M.U.P., University of Louisville, 2003; Ph.D., University of California, Berkeley, 2011. American Institute of Certified Planners. LEED AP.
Riley, Kate J. (2003) Mathematics	Professor	B.S., South Dakota State University, 1980; M.S., Montana State University, 1992; Ph.D., 2003.
Rinzler, Paul (1997) Music	Professor	B.A., University of California at Santa Barbara, 1977; M.A., 1980; D.A., University of Northern Colorado, 1988.
Ritchie, Gerry (2008) Food Science and Nutrition and Wine and Viticulture	Professor	B.S., University of Reading, UK, 1974; Ph.D., University of Western Australia, 1981; Graduate Diploma, University of Adelaide, Australia, 1995.
Ritter, Matthew K. (2003) Biological Sciences	Professor	B.S., University of California, Santa Barbara, 1996; Ph.D., University of California, San Diego, 2002.
Robbins, Marian E. (2004) Mathematics	Professor	B.A., Agnes Scott College, 1986; M.S., University of Virginia, 1989; Ph.D., 1992.
Robins, Lori (2008) Chemistry and Biochemistry	Associate Professor	B.S., Brandeis University, 2002; Ph.D., University of California, Davis, 2007.
Rodgers, Julie Spencer (2012) Psychology and Child Development	Assistant Professor	B.Sc., Carleton University, 1993; B.A., 1995; M.S., San Francisco State University, 1998; Ph.D., University of California, Santa Barbara, 2005.
Rong, Xiaoying (2005) Graphic Communication	Associate Professor	B.E., Beijing Institute of Printing, 1992; M.B.A., Beijing Institute of Technology, 1999; M.S., Western Michigan University, 2003; Ph.D., Western Michigan University, 2007.
Ross, Kevin James (2012) Statistics	Assistant Professor	B.S., University of North Carolina at Chapel Hill, 1997; M.S., 2005; Ph.D., 2006.
Rossman, Allan J. (2001) Statistics	Professor and Department Chair	B.A., Geneva College, 1984; M.S., Carnegie Mellon University, 1986; Ph.D., 1989.
Roy, Soma (2008) Statistics	Associate Professor	B.Sc., Delhi University, 2000; M.Sc., 2002; M.S., The Ohio State University, 2005; Ph.D., 2008.
Rubba, Johanna E. (1995) English	Professor	B.A., Rutgers University, 1975; M.A., Southern Illinois University, 1986; Ph.D., University of California, San Diego, 1993.
Rucas, Stacey L. (2005) Social Sciences	Associate Professor	B.A., University of Texas, Arlington, 1998; M.A., 2000; Ph.D., University of New Mexico, 2004.
Ruef, Michael (1999) School of Education	Professor	B.A., University of San Francisco, 1966; M.A., San Diego State University, 1992; Ph.D., University of Kansas, 1997.

Rummell, Kathryn (1997) English	Professor and Department Chair	B.A., Centre College, 1990; M.A., University of North Carolina at Chapel Hill, 1992; Ph.D., 1997.
Russell, Craig H. (1982) Music	Professor	B.M., University of New Mexico, 1973; M.M., 1976; Ph.D., University of North Carolina, 1981.
Ruttenberg, Benjamin I. (2013) Biological Sciences	Assistant Professor	B.A., Tufts University, 1994; M.S., Yale University, 1999; Ph.D., University of California, Santa Barbara, 2006.
Ryan, Kathleen A. (1981) Psychology and Child Development	Professor Emeritus	B.A., San Diego State University, 1975; M.A., Bowling Green State University, 1978; Ph.D., 1980.
Ryujin, Donald H. (1989) Psychology and Child Development	Professor	B.A., Stanford University, 1968; M.A., University of Michigan, 1972; Ph.D., 1983.
Saenz, Richard A. (1980) Physics	Professor Emeritus	A.B., University of California, Berkeley, 1972; M.S., Cornell University, 1975; Ph.D., 1977.
Saghri, John A. (2000) Electrical Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1973; M.S., Oregon State University, 1975; Ph.D., Rensselaer Polytechnic Institute, 1979.
Saha, Koushik (2010) Industrial Technology	Assistant Professor	Ph.D., Michigan State University, 2010
Saliklis, Edmond P. (2005) Architectural Engineering	Professor	B.S., University of Illinois, Chicago, 1984; M.S., Syracuse University, 1988; Ph.D., University of Wisconsin, Madison, 1992. Registered Civil Engineer, California.
Sanchez, Fernando Fabio (2011) Modern Languages and Literatures	Assistant Professor	B.A., Universidad La Salle, Mexico, 1995; M.A., University of Colorado, Boulder, 2000; Ph.D., 2006.
Saunders, Karl F. (2004) Physics	Associate Professor	B.S., Dublin City University, 1996; Ph.D., University of Oregon, 2001.
Savage, Richard (2003) Biomedical and General Engineering	Professor and Department Chair	B.S., Juniata College, 1975; Ph.D., Indiana University, 1979.
Schaffner, Andrew (1997) Statistics	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1992; M.S., University of Washington, 1994; Ph.D., 1997.
Schinc-Mikel, Amelie (2009) Mathematics	Assistant Professor	B.Sc., Concordia University, 1999; M.Sc., 2001; Ph.D., University of North Carolina at Charlotte, 2009.
Schlemer, Lizabeth T. (1993) Industrial and Manufacturing Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1981; M.S., University of Southern California, 1986; M.B.A., 1986; Ph.D., University of California, Santa Barbara, 2007.
Schnupp, Alvin J. (1988) Theatre and Dance	Professor	B.S., Millersville State College, 1974; M.A., Bowling Green State University, 1979; Ph.D. University of California, Los Angeles, 1985.
Schroeter, Christiane (2007) Agribusiness	Associate Professor	B.S., Justus-Liebig University, 1997; M.S., 2001; M.S., Kansas State University, 2000; Ph.D., Purdue University, 2005.
Schultz, Ned W. (1976) Psychology and Child Development	Professor Emeritus	B.S., Pennsylvania State University, 1973; M.A., 1975; Ph.D., Ohio State University, 1976.
Schuster, Peter J. (2003) Mechanical Engineering	Professor	B.A., Cornell University, 1991; M.S., Stanford University, 1992; Ph.D., Michigan Technology University, 2000.
Schwab, Keri (2013) Recreation, Parks, and Tourism Administration	Assistant Professor	B.A., James Madison University, 2000; M.A. and Ph.D., University of Utah, 2011.
Schwartz, Debora (1996) English	Associate Professor	A.B., Bryn Mawr College, 1982; M.A., Princeton University, 1986; Ph.D., 1994.
Schwartz, Peter V. (2000) Physics	Associate Professor	B.S., Massachusetts Institute of Technology, 1986; M.S., Princeton University, 1993; Ph.D., 1998.
Schwartz, Gregory (2013) BioResource and Agricultural Engineering	Assistant Professor	B.S., Cal Poly State University, San Luis Obispo, 1995; M.S., Clemson University, 1998; Ph.D., Clemson University, 2004.
Scott, Greg (2011) Chemistry and Biochemistry	Assistant Professor	B.S., Davidson College, 2004; Ph.D., University of Illinois, Urbana-Champaign, 2011.
Scriven, Tal E. (1980) Philosophy	Professor and Department Chair	B.A., University of South Florida, 1976; M.A., 1977; Ph.D., University of Southern California, 1980.

Selby, Michael J. (1991) Psychology and Child Development	Professor Emeritus	B.S., University of California, Santa Barbara, 1971; M.S., California Polytechnic State University, San Luis Obispo, 1981; Ph.D., Memphis State University, 1988. Licensed Psychologist, California.
Self, Brian P. (2006) Mechanical Engineering	Professor	B.S., Virginia Polytechnic Institute and State University, 1988; M.S., 1991; Ph.D., University of Utah, 1996.
Sena, James (1987) Management	Professor	B.S., Xavier University of Ohio, 1961; M.B.A., 1964; M.S., University of Dayton, 1968; D.B.A., University of Kentucky, 1972.
Seng, John S. (2003) Computer Science, Computer Engineering	Associate Professor	B.S., Northwestern University, 1997; M.S., University of California, San Diego, 1999; Ph.D., 2003.
Settle, Allen K. (1970) Political Science	Professor	B.A., University of California, Santa Barbara, 1966; M.A., 1967; Ph.D., 1970.
Shaban, Ali O. (1984) Electrical Engineering	Professor	B.S., University of Tripoli, 1974; M.S., University of Southern California, 1978; Ph.D., Oregon State University, 1985.
Shafran, Aric (2007) Economics	Associate Professor	B.S., Cornell University, 1999; M.A., University of Colorado, 2003; Ph.D., 2007.
Shani, Abraham (Rami) B. (1983) Management	Professor	B.A., University of Tel Aviv, 1972; M.A., 1978; Ph.D., Case Western Reserve University, 1981.
Shapiro, Jonathan (1998) Mathematics	Professor	B.A., University of California, Berkeley, 1988; Ph.D., 1995.
Sharpe, John P. (1995) Physics	Professor	B.Sc., Edinburgh University, 1985; Ph.D., 1989.
Shelton, Mark D. (1982) College of Agriculture, Food and Environmental Sciences	Associate Dean	B.S., University of Idaho, 1977; M.S., Purdue University, 1980; Ph.D., Utah State University, 1989. Registered Professional Entomologist.
Sherman, Morgan P. (2008) Mathematics	Associate Professor	B.A., Knox College, 1999; M.A., Columbia University, 2000; M.Phil., 2004; Ph.D., 2005.
Shollenberger, Kim A. (2002) Mechanical Engineering	Professor	B.S., Cornell University, 1989; M.S., University of California, Berkeley, 1991; Ph.D., 1994.
Siembieda, William J. (1997) City and Regional Planning	Professor	B.A., University of California, Berkeley, 1965; MCRP, University of California, Berkeley, 1967; MPA, California State University, San Diego, 1970; Ph.D., University of California, Los Angeles, 1990. American Institute of Certified Planners.
Sikora, David M. (2012) Management	Assistant Professor	B.S., Cornell University, 1981; Ph.D., Florida State University, 2012.
Silvestri, Michael G. (1978) Chemistry and Biochemistry	Professor	B.S., University of California, Santa Barbara, 1973; Ph.D., University of California, Santa Cruz, 1977.
Simonian, Lonny G. (2003) Construction Management	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1978; M.S., University of California, Berkeley, 1992. Registered Professional Engineer, Certified Project Management Professional.
Singh, Jagjit (Jay) (2003) Industrial Technology	Professor	B.S., Poona University, Pune, India, 1992; M.S., Michigan State University, 1998; Ph.D., 2002.
Sklar, Jeffrey C. (2005) Statistics	Associate Professor	B.A.S., University of California, Davis, 1995; M.A., University of California, Santa Barbara, 1998; Ph.D., 2003.
Slivovsky, Lynne A. (2003) Electrical Engineering, Computer Engineering	Professor	B.S., Purdue University, 1992; M.S., 1993; Ph.D., 2001.
Smidt, Robert K. (1978) Statistics	Professor Emeritus	B.S., Manhattan College, 1971; M.S., Rutgers University, 1973; Ph.D., University of Wyoming, 1976.
Smilkstein, Tina (2009) Computer Engineering, Electrical Engineering	Assistant Professor	B.S., Nanzan University, 1989; M.S., University of California, Berkeley, 2003; Ph.D., 2007.
Smith, Erling A. (2008) Architectural Engineering	Professor Emeritus	B.S., University of Leeds, 1969; Ph.D., University of Durham, 1975.
Smith, Hugh M. (2000) Computer Science, Computer Engineering	Associate Professor	B.S., Xavier University, 1985; M.S., Michigan State University, 1994; Ph.D., 1999.

Smith, Terry L. (1980) Natural Resources Management and Environmental Sciences	Professor Emeritus	B.S., University of Nebraska, Lincoln, 1972; M.S., 1975; Ph.D., Iowa State University, 1980.
Spiller, Robert (1989) Animal Science	Professor	B.S., California State Polytechnic College, 1969; M.S., 1971; Ph.D., Oregon State University, 1974.
Spiller, William T. (1991) Music	Professor and Department Chair	B.M., University of Washington, 1981; M.M., Indiana University, 1983; D.M.A., University of Southern California, 1991.
Staley, Clinton A. (1988) Computer Science	Professor	B.A., Principia College, 1980; M.S., University of California, Santa Barbara, 1982; Ph.D., 1987.
Stankus, Mark (1998) Mathematics	Professor	B.S., Rensselaer Polytechnic Institute, 1987; Ph.D., University of California, San Diego, 1993.
Stannard, Sandra (2001) Architecture	Professor	B.A., University of California, Berkeley, 1987; M.Arch., University of Washington, 1992. AIA, Registered Architect, California and Idaho.
Stanton, Diana L. (2000) Theatre and Dance	Associate Professor	B.A., University of California, Irvine, 1994; M.F.A., University of Colorado, Boulder, 1997.
Starnes, Heather Ann (2012) Kinesiology	Assistant Professor	B.S., California State University, Chico, 2003; M.A., 2006; Ph.D. Purdue University, 2012.
Starzyk, Gregory F. (2009) Construction Management	Assistant Professor	B.S.C.E., University of Illinois, Urbana-Champaign, 1982; M.P.M., Northwestern University, 2001; J.D., William Howard Taft University, Santa Ana, 2010. Associate Design-Build Certification (Assoc. DBIA), Certified Professional Constructor (CPC).
Stegner, Paul Dustin (2007) English	Associate Professor	B.A., University of San Francisco, 2000; M.A., The Pennsylvania State University, 2002; Ph.D., 2007.
Steinmaus, Scott J. (1998) Biological Sciences, Horticulture and Crop Science	Professor and Interim Department Head	B.S., University of California, Davis, 1984; Ph.D., 1996. Pest Control Advisor, California.
Strand, Christy (2007) Biological Sciences	Associate Professor	B.A., Concordia University 1992; Ph.D., Arizona State University, 2007.
Styles, Stuart W. (1984) BioResource and Agricultural Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1984; M.B.A., 1988; D.Engr., University of California, Davis, 2001. Registered Civil Engineer, California.
Sun, Cheng (1989) Electrical Engineering	Professor Emeritus	B.S., National Taiwan University, Taiwan, 1958; M.S., Cornell University, 1962; Ph.D., 1965.
Sungar, Nilgun (1989) Physics	Professor	B.S., Middle East Technical University, Turkey, 1979; Ph.D., University of Missouri, 1985.
Surfleet, Christopher Graham (2012) Natural Resources Management and Environmental Sciences	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1993; M.S. Oregon State University 1997; Ph.D. 2008. Certified Professional in Erosion and Sediment Control.
Swan, Benjamin G. (2010) Agricultural Education and Communication	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1997; M.S., 2001; Ph.D., The Ohio State University, 2005.
Sweatt, Lisa I. (2000) Psychology and Child Development	Associate Professor	B.S., University of California, Irvine, 1989; M.A., Ohio State University, 1992; Ph.D., Loyola University Chicago, 1999. Licensed Psychologist, California.
Sze, Lawrence (1998) Mathematics	Associate Professor	B.S., Louisiana State University, Baton Rouge, 1986; M.A., University of California, Los Angeles, 1989; Ph.D., Penn State University, 1998.
Szlavik, Robert (2006) Biomedical and General Engineering	Professor	B.Eng., McMaster University, 1991; M.Eng., 1994; Ph.D., 1999.
Taufik, (1999) Electrical Engineering	Professor	B.S., Northern Arizona University, 1993; M.S. University of Illinois at Chicago, 1995; Dr. Eng., Cleveland State University, 1999.
Taylor, Emily N. (2005) Biological Sciences	Associate Professor	B.A., University of California, Berkeley, 1998; Ph.D., Arizona State University, 2005.
Taylor, J. Kevin (1999) Kinesiology	Professor and Department Chair	B.A., Newcastle and Sunderland Polytechnic, Newcastle, England, 1986; M.S., Central Washington University, 1990; Ph.D., University of South Carolina, 1994.

Tejani, James (2009) History	Assistant Professor	B.A., University of California, San Diego, 1998; M.A., Columbia University, 2003; Ph.D., 2009.
Teufel, Brady (2006) Journalism	Associate Professor	B.A., University of California, Santa Cruz, 1997; M.A., University of Missouri, 2003.
Thatcher, Tracy (2005) Civil and Environmental Engineering	Associate Professor	B.S., University of California, Davis, 1984; M.S., University of California, Berkeley, 1991; Ph.D., 1996. Registered Professional Engineer, California.
Theodoropoulos, Christine Olympia (2012) College of Architecture and Environmental Design	Dean	B.S., Princeton University, 1979; M.Arch., Yale University, 1985. AIA, Licensed Architect and Registered Professional Civil Engineer, California.
Thompson, John Jay (1998) Modern Languages and Literatures	Professor and Department Chair	B.A., University of California, Santa Barbara, 1986; M.A., Yale University, 1987; M.Phil., 1989; Ph.D., 1993.
Thompson, Richard P. (1990) Natural Resources Management and Environmental Sciences	Professor and Interim Department Head	B.S., Oklahoma State University, 1974; M.S., 1978; Ph.D., Texas AM University, 1990. Registered Professional Forester, California and Oklahoma.
Thorncroft, Glen E. (1998) Mechanical Engineering	Professor	BSE, University of Central Florida, 1988; MSME, 1991; Ph.D., University of Florida, 1997.
Thulin, Andrew J. (1998) College of Agriculture, Food and Environmental Sciences, Animal Science	Dean, Professor	B.S., California Polytechnic State University, San Luis Obispo, 1977; M.S., Kansas State University, Manhattan, 1979; Ph.D., 1985.
Todorov, Todor D. (2003) Mathematics	Professor	B.S., University of Sofia, 1975; Ph.D., University of Sofia and Bulgarian Academy of Sciences, 1982.
Toker, Umut (2005) City and Regional Planning	Associate Professor	B.Arch., Middle East Technical University, Ankara, 1996; M.C.P., 1999; Ph.D., North Carolina State University, 2003.
Tolin, Jeffrey (2009) Accounting	Associate Professor	B.S., New York University, 1971; J.D., Brooklyn Law School, 1975; LL.M., New York University, 1981.
Tomanek, Lars (2005) Biological Sciences	Associate Professor	B.S., University of Konstanz, Germany, 1995; M.S., 1995; Ph.D., Oregon State University, 1999.
Tong, Phillip S. (1988) Dairy Science	Professor	B.S., University of California, Davis, 1977; M.S., Cornell University, 1982; Ph.D., 1986. Director of the Dairy Products Technology Center.
Torres-Bustamente, Cesar (2010) Landscape Architecture	Assistant Professor	B.Arch., Universidad de las Américas, Puebla, 2000; M.L.A., RMIT University, 2005; Ph.D., 2009.
Trice, Tom R. (2002) History	Associate Professor	B.A., Louisiana College, 1981; M.A., Louisiana State University, 1987; Ph.D., University of Illinois, 1998.
Trudell, Carmen Gayle (2005) Architecture	Assistant Professor	B.Arch., California Polytechnic State University, San Luis Obispo, 2001; M.S., Columbia University, 2006. Registered Architect California, New York
Tso, Jin (1988) Aerospace Engineering	Professor	B.S., National Taiwan University, 1971; M.S., 1973; Ph.D., Johns Hopkins University, 1984.
Turner, Clark S. (1999) Computer Science	Professor	B.S., Kings College, 1979; M.A., Pennsylvania State University, 1981; J.D., University of Maine, 1986; Ph.D., University of California, Irvine, 1999.
Twomey, Colleen Larkin (2011) Graphic Communication	Assistant Professor	B.S., Rochester Institute of Technology 1989; M.B.A., University of Delaware, 1997
Vakalis, Ignatios (2006) Computer Science	Professor and Department Chair	B.S., University of Patras, Greece, 1982; M.S., Western Michigan University, 1988; Ph.D., 1992.
Valencia-Laver, Debra L. (1991) College of Liberal Arts, Psychology and Child Development	Professor and Associate Dean	B.S., University of California, Irvine, 1983; M.S., The Claremont Graduate University, 1988; Ph.D., 1992.
Valle, Victor (1992) Ethnic Studies	Professor Emeritus	B.A., California State University, Long Beach, 1974; M.A., 1978; M.S.J., Northwestern University, 1981.
Van Draanen, Nanine A. (1996) Chemistry and Biochemistry	Professor and Department Chair	B.S., California Polytechnic State University, San Luis Obispo, 1985; Ph.D., University of California, Berkeley, 1992.
Vanasupa, Linda S. (1991) Materials Engineering	Professor	B.S., Michigan Technological University, 1985; M.S., Stanford University, 1987; Ph.D., 1991.



Vaughan, Karen Lynn (2011) Natural Resources Management and Environmental Sciences	Assistant Professor	B.S., University of Delaware, Newark 2001; M.S., University of Maryland, College Park, 2004; Ph.D. University of Idaho, Moscow, 2008
Velasquez, Gloria (1985) Modern Languages and Literatures	Professor	B.A., University of Northern Colorado, 1978; M.A., Stanford University, 1980; Ph.D., 1985.
Verma, Priya O. (2011) Natural Resources Management and Environmental Sciences	Assistant Professor	B.S., University of Massachusetts, Boston, 2000; M.A., University of California, Santa Barbara, 2004; Ph.D. 2011.
Vernon, J. Scott (1991) Agricultural Education and Communication	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1983; M.S., 1985; Ph.D., Texas AM University, 1991.
Vigil, Samuel A. (1982) Civil and Environmental Engineering	Professor Emeritus	B.S., University of California, Berkeley, 1969; M.S., Texas A M University, 1974; Ph.D., University of California, Davis, 1981. Registered Professional Engineer, California, Board Certified Environmental Engineer, LEED Accredited Professional.
Vilkitis, James R. (1980) Natural Resources Management and Environmental Sciences	Professor Emeritus	B.S., Michigan State University, 1965; M.S., University of Idaho, 1968; Ph.D., University of Massachusetts, 1970; additional graduate study 1973–74.
Villablanca, Francis X. (1999) Biological Sciences	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1987; Ph.D., University of California, Berkeley, 1993.
Villegas, Daniel J. (1987) Economics	Associate Professor	B.S., University of Southern California, Los Angeles, 1972; A.M., Stanford University, 1975; Ph.D., 1979.
Vix, Marlin Dale (1977) Agribusiness	Associate Professor Emeritus	B.S., San Jose State College, 1968; M.S., California Polytechnic State University, San Luis Obispo, 1977.
Vogl, Howard E. (2011) Graphic Communication	Assistant Professor	B.S., Roberts Wesleyan Collage, 2003. M.S., Rochester Institute of Technology, 2005.
Vorst, Keith L. (2005) Industrial Technology	Associate Professor	B.S., Purdue University, 1977; M.S., Michigan State University, 2002; Ph.D., 2005.
Vredevoe, Larisa K. (1999) Biological Sciences	Professor	B.S., University of California, Davis, 1992; Ph.D., 1998.
Wack, Paul (1997) City and Regional Planning	Professor Emeritus	B.A., San Fernando Valley State College, 1969; M.A., California State University, Northridge, 1974; MPA, University of Southern California, 1976. American Institute of Certified Planners.
Waitinas, Catherine (2006) English	Associate Professor	B.A., St. Bonaventure University, 1996; M.A., University of Illinois at Urbana-Champaign, 1999; Ph.D., 2006.
Waldorf, Daniel (1998) Industrial and Manufacturing Engineering	Professor	B.S., University of Illinois at Urbana-Champaign, 1989; M.S., 1991; Ph.D., 1996. Registered Professional Engineer, California.
Walker, John L. (2001) Statistics	Professor	B.S., University of Chicago, 1988; M.S., Cornell University, 1993; Ph.D., 1995.
Walsh, Daniel W. (1986) Biomedical and General Engineering, and Materials Engineering	Professor Emeritus	B.S., Rensselaer Polytechnic Institute, 1973; M.S., 1976; Ph.D., 1985.
Walter, Virginia R. (1974) Horticulture and Crop Science	Professor	B.S., Ohio State University, 1970; M.S., 1972.
Watabe-Belzel, Madoka (1993) Food Science and Nutrition	Professor Emeritus	B.S., Illinois State University, 1982; M.S., 1983; Ed.D., Pepperdine University, 1991. Registered Dietitian.
Watts, David J. (2007) Landscape Architecture	Associate Professor and Department Head	B.S.L.A., University of Wisconsin-Madison, 1980; M.S.L.A., 2006. Registered Landscape Architect, Wisconsin.
Weber, Paul A. (1999) Construction Management	Associate Professor	B.S., California Polytechnic State University, San Luis Obispo, 1981; B.Arch., 1983; M.B.A., 1992; Ph.D., Colorado State University, 2000. Registered Architect, California. Licensed Building Contractor (B), California.
Weisenthal, Howard (1984) Architecture	Professor Emeritus	B. Arch., University of Florida, 1972; M. Arch., 1974. Registered Architect, Florida.

Wendt, Dean E. (2002) College of Science and Mathematics, Biological Sciences	Associate Dean and Professor	B.S., California Polytechnic State University, San Luis Obispo, 1993; A.M., Harvard University, 1995; Ph.D., 1999.
Westphal, Russell (2008) Mechanical Engineering	Professor	B.S., Washington State University, 1978; M.S., Stanford University, 1979; Ph.D., 1983.
Wetzel, S. Jean (1996) Art and Design	Associate Professor	B.A., Rockford College, 1982; M.A., University of Kansas, 1985; M.Phil., 1986; Ph.D., 1991.
White, Crow (2013) Biological Sciences	Assistant Professor	B.A., University of Oregon, 1997; M.S., University of Montana, 2002; Ph.D., University of California, Santa Barbara, 2008.
White, Matthew E. (2001) Mathematics	Associate Professor	B.S., Cornell University, 1990; M.S., California Polytechnic State University, San Luis Obispo, 1994; Ph.D., University of California, Santa Barbara, 2000.
Widmann, James M. (2004) Mechanical Engineering	Professor	BSME, Michigan Technological University, 1987; MSME, Stanford University, 1988; Ph.D., Stanford University, 1995.
Wild, Rosemary (1999) Management	Interim Associate Dean, Professor	B.A., University of Arizona, 1980; M.A., 1981; M.S., 1985; Ph.D., 1989.
Williams, Jason A. (2008) Psychology and Child Development	Associate Professor	B.A., University of California, Riverside, 1989; Ph.D., University of California, Santa Cruz, 2001.
Williams, Jean M. (2000) Political Science	Professor and Department Chair	B.A., Pomona College, 1988; M.A., The Johns Hopkins University, 1996; Ph.D., 1998.
Winstead, Candace R. (2005) Biological Sciences	Associate Professor	B.A., Augustana College, 1991; Ph.D., Loyola University, 1999.
Wolf, Marianne McGarry (1994) Wine and Viticulture	Professor and Department Chair	B.A., The Johns Hopkins University, 1976; M.S., 1977; Ph.D., 1979.
Wong, Jeffrey C. (2002) Horticulture and Crop Science	Professor	B.S., Saint Mary's College of California, 1994; M.S., University of Illinois at Champaign, 1999; Ph.D., 2002. The J. G. Boswell Foundation of Pasadena Endowed Chair.
Wood, Zoe J. (2003) Computer Science	Assistant Professor	B.A., University of California, Santa Cruz, 1992; B.S., 1997; M.S., California Institute of Technology, 2000; Ph.D., 2003.
Woolley, Julia Katharine R. (2012) Communication Studies	Assistant Professor	B.A., Wellesley College, 2005; Ph.D., Pennsylvania State University, 2012.
Wu, Xi (2005) Mechanical Engineering	Associate Professor	M.S., Chong Qing University, 1991; Dr. Eng., Cleveland State University, 2005.
Yang, Tao H. (1987) Industrial and Manufacturing Engineering	Professor	B.S., Tunghai University, Taiwan, 1978; M.S., San Jose State University, 1982; Ph.D., Arizona State University, 1987.
Yeh, Grace I. (2007) Ethnic Studies	Associate Professor	B.A., Duke University, 1995; M.A., Georgetown University, 2000; M.A., University of California, Los Angeles, 2003; Ph.D., 2007.
Yeung, Po Sai Marie (2006) Biological Sciences	Assistant Professor	B.Sc., The Chinese University of Hong Kong, 1995; M.S., California Polytechnic State University, San Luis Obispo, 2001; Ph.D., Cornell University, 2004.
Yeung, Vincent (2013) Dairy Science	Assistant Professor	B.Sc. (Hon.), The Chinese University of Hong Kong, 1996; M.Sc., California Polytechnic State University, San Luis Obispo, 1999; Ph.D., Cornell University, 2003.
Yip, Christopher L. (1988) Architecture	Professor	B.A., University of California, Berkeley, 1971; M. Arch., 1977; Ph.D., 1985.
Yong, Yuen-Cjen (1978) Mechanical Engineering	Professor Emeritus	B.E., University of Malaya, 1969; M.E., University of California, Davis, 1977; Ph.D., 1984. Registered Professional Engineer, Great Britain and Malaysia.
York, Jonathan (2008) Industrial Technology	Associate Professor	B.A., Yale University, 1973; M.A., Michigan State University, 1976; Ph.D., 1979.
Yoshimura, Michael A. (1975) Biological Sciences	Professor Emeritus	B.A., Stanford University, 1970; M.S., University of Hawaii, 1972; Ph.D., University of Arizona, 1975.
Yoshinobu, Stan (2009) Mathematics	Professor	B.A., University of California, San Diego, 1995; M.A., University of California, Los Angeles, 1997; Ph.D., 2000.
Yu, Xiao-Hua (Helen) (2000) Electrical Engineering	Professor	B.S., TianJin University, People's Republic of China, 1988; M.S., Temple University, 1992; Ph.D., University of California, Irvine, 1998.

Zambrano, Eduardo (2007) Economics	Associate Professor	B.A., Universidad Católica Andrés Bello, Venezuela, 1993; M.A., Cornell University, 1998; Ph.D., Cornell University, 1999.
Zammit, Ronald E. (1986) Physics	Professor Emeritus	B.S., Louisiana State University, 1969; M.S., Purdue University, 1971; Ph.D., 1975.
Zatzick, Christopher Douglas (2012) Management	Associate Professor	Ph.D., University of California, Irvine, 2001
Zhang, Ning (2007) Political Science	Associate Professor	B.A., Peking University, Beijing, China, 1999; Ph.D., University of California, Santa Barbara, 2007.
Zhang, Shanju (2011) Chemistry and Biochemistry	Assistant Professor	B.S., Jilin University, People's Republic of China, 1993; Ph.D., 1998.
Zhang, Xiaozheng (Jane) (2003) Electrical Engineering	Professor and Associate Department Chair	Diplom, University of Erlangen-Nuremberg, Germany, 1997; Ph.D., Georgia Institute of Technology, 2002.
Zohns, Mark A. (1986) BioResource and Agricultural Engineering	Professor	B.S., California Polytechnic State University, San Luis Obispo, 1981; M.S., University of California, Davis, 1983; D.Eng., 1986. Registered Mechanical Engineer, California.
Zulfacar, Maliha (2002) Social Sciences	Professor	B.A., Western College, 1971; M.A., University of Cincinnati, 1973; M.S., 1973; Ph.D., Paderborn University, Germany, 1997.
Zweifel, K. Richard (1972) College of Architecture and Environmental Design	Professor and Associate Dean	B.S.L.A., University of Wisconsin, 1970; M.S.L.A., 1975. Registered Landscape Architect, California. Fellow, American Society of Landscape Architects.

# The CSU System

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Welcome to the California State University (CSU) – the largest comprehensive higher education system in the nation with 23 unique campuses serving more than 437,000 students with 44,000 employees statewide. Each year, the university awards nearly 100,000 bachelor's, master's and doctoral degrees. CSU graduates now total nearly 3 million strong, and are serving as leaders in the industries that drive California's economy, including business, agriculture, entertainment, engineering, teaching, hospitality and healthcare. Learn more at [www.calstate.edu](http://www.calstate.edu).

## More than 50-year tradition of excellence

Academic excellence has been achieved by the CSU through a distinguished faculty whose primary responsibility is superior teaching. While each campus is unique based on its curricular specialties, location and campus culture, every CSU is distinguished for the quality of its educational programs. All campuses are fully accredited, provide a high-quality broad liberal educational program and offer opportunities for students to engage in campus life through the Associated Students, Inc., clubs and service learning. Through extensive industry partnerships and robust campus auxiliaries, the CSU is expanding programs, internships and workforce training opportunities to ensure CSU students are ready with the critical thinking skills, industry knowledge and hands-on experience for employment and career advancement.

## Facts

- CSU faculty attract more than \$500 million annually in research and education grants, and contracts by federal, state and regional agencies.
- 1 in every 10 employees in California is a CSU alumnus.
- The CSU awards 45 percent of the bachelor's degrees earned in California.
- More than half of all the nurses in the state earn their degrees from the CSU.
- The CSU awards 95 percent of the hospitality/tourism degrees in the state.
- Nearly half of all of the state's engineers earn their degrees from the CSU.
- The CSU is the leading provider of teacher preparation programs in the state.
- The CSU offers 105 fully online degree programs through [www.calstateonline.net](http://www.calstateonline.net).
- The CSU offers 3,250 online courses to provide more educational options to students who may prefer an online format to a traditional classroom setting.
- The CSU's growing online concurrent enrollment program gives students the ability to enroll in courses offered by other campuses in the CSU system.
- The CSU serves more than 5,000 individuals annually through professional development certificate programs in educational health services, business and technology, leisure and hospitality, manufacturing, international trade, and many other industries.
- For every \$1 that the state invests in the CSU, the university generates \$5.43 for California's economy.

## Governance

The system is governed by the Board of Trustees, most of whom are appointed by the governor and serve with faculty and student representatives. The CSU Chancellor is the chief executive officer, reporting to the Board. The campus presidents serve as the campus-level chief executive officers. The Trustees, Chancellor and presidents develop systemwide educational policy. The presidents, in consultation with the Academic Senate and other campus stakeholder groups, render and implement local policy decisions.

## CSU Historical Milestones

The individual California State Colleges was established as a system with a Board of Trustees and a Chancellor in 1960 by the Donahoe Higher Education Act. In 1972, the system was designated as the California State University and Colleges, and in 1982 the system became the California State University (CSU). Today, the CSU is comprised of 23 campuses, including comprehensive and polytechnic universities and, since July 1995, the California Maritime Academy, a specialized campus.

The oldest campus—San José State University—was founded in 1857 and became the first institution of public higher education in California. The newest—CSU Channel Islands—opened in fall 2002, with freshmen arriving in fall 2003.

In 1963, the State Academic Senate was established to act as the official voice of CSU faculty in systemwide matters. Also, the California State College Student Presidents Association—which was later renamed the California State Students Association—was founded to represent each campus student association on issues affecting students.

Through its many decades of existence, the CSU has continued to adapt to address societal changes, student needs and workforce trends. While the CSU's core mission has always focused on providing high-quality, affordable bachelor's and master's degree programs, over time the university has added a wide range of services and programs to support student success – from adding health centers and special programs for veterans to building student residential facilities to provide a comprehensive educational experience.

To improve degree completion and accommodate students working full- or part-time, the educational paradigm expanded to give students the ability to complete upper-division and graduate requirements through part-time, late afternoon, and evening study. The university also expanded its programs to include a variety of teaching and school service credential programs, specially designed for working professionals.

The CSU marked another significant educational milestone when it broadened its degree offerings to include doctoral degrees. The CSU independently offers educational doctorate (Ed.D.), Doctor of Physical Therapy (DPT), and Doctor of Nursing Practice (DNP) degree programs. A limited number of other doctoral degrees are offered jointly with the University of California and private institutions in California.

In 2010, in an effort to accommodate community college transfer students, the university, in concert with the California Community Colleges, launched the Associate Degree for Transfer, which guarantees transfer students admission to the CSU with junior status.

Always adapting to changes in technology and societal trends to support student learning and degree completion, the CSU initiated another milestone in 2013, when it launched Cal State Online, a systemwide collection of services that support the delivery of fully

online programs from campuses. Now, full-time students also have access to fully online courses offered at other CSU campuses.

The CSU is dynamic and ever changing to ensure a quality higher education to the students of California. With 23 campuses, 437,000 students and 44,000 faculty and staff, the CSU plays a critical role in preparing outstanding candidates for the job market. The CSU is committed to continually developing innovative programs, services and opportunities that will give students the tools they need to meet their full potential.

## Trustees of the California State University

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The Honorable Edmund G. Brown, Jr.  
Governor of California

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*Appointments are for a term of eight years, except student, alumni, and faculty trustees, whose terms are for two years. Terms expire in the year in parentheses. Names are listed alphabetically.*

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- Cipriano Vargas (2014)

### Correspondence with Trustees should be sent to:

c/o Trustees Secretariat  
The California State University  
401 Golden Shore

Long Beach, CA 90802-4210

### Office of the Chancellor

The California State University  
401 Golden Shore  
Long Beach, California 90802-4210  
Phone: 562.951.4000

Name	Title
Dr. Timothy B. White	Chancellor - CSU System
Sally F. Roush	Interim Executive Vice Chancellor and Chief Financial Officer
Dr. Ephraim P. Smith	Executive Vice Chancellor and Chief Academic Officer
Mr. Framroze Virjee	Executive Vice Chancellor and General Counsel
Mr. Garrett P. Ashley	Vice Chancellor, University Relations and Advancement
Ms. Gail E. Brooks	Vice Chancellor, Human Resources
Mr. Larry Mandel	University Auditor

## Campuses—The California State University

### California State University, Bakersfield

9001 Stockdale Highway, Bakersfield, CA 93311-1022  
Dr. Horace Mitchell, President  
661.654.2782  
[www.csub.edu](http://www.csub.edu) (<http://www.csub.edu>)

### California State University, Channel Islands

One University Drive, Camarillo, CA 93012  
Dr. Richard Rush, President  
805.437.8400  
[www.csuci.edu](http://www.csuci.edu) (<http://www.csuci.edu>)

### California State University, Chico

400 West First Street, Chico, CA 95929  
Dr. Paul J. Zingg, President  
530.898.4636  
[www.csuchico.edu](http://www.csuchico.edu) (<http://www.csuchico.edu>)

### California State University, Dominguez Hills

1000 East Victoria Street, Carson, CA 90747  
Dr. Willie Hagan, President  
310.243.3696  
[www.csudh.edu](http://www.csudh.edu) (<http://www.csudh.edu>)

### California State University, East Bay

25800 Carlos Bee Boulevard, Hayward, CA 94542  
Dr. Leroy M. Morishita, President  
510.885.3000  
[www.csueastbay.edu](http://www.csueastbay.edu) (<http://www.csueastbay.edu>)

### California State University, Fresno

5241 North Maple Avenue, Fresno, CA 93740  
Dr. Joseph I. Castro, President  
559.278.4240  
[www.csufresno.edu](http://www.csufresno.edu) (<http://www.csufresno.edu>)

### California State University, Fullerton

800 N. State College Boulevard, Fullerton, CA 92831-3599  
Dr. Mildred Garcia, President



657.278.2011  
[www.fullerton.edu](http://www.fullerton.edu) (<http://www.fullerton.edu>)

**Humboldt State University**

Arcata, CA 95521-8299  
 Dr. Rollin C. Richmond, President  
 707.826.3011  
[www.humboldt.edu](http://www.humboldt.edu) (<http://www.humboldt.edu>)

**California State University, Long Beach**

1250 Bellflower Boulevard, Long Beach, CA 90840-0115  
 Dr. Donald J. Para, Interim President  
 562.985.4111  
[www.csulb.edu](http://www.csulb.edu) (<http://www.csulb.edu>)

**California State University, Los Angeles**

5151 State University Drive, Los Angeles, CA 90032  
 Dr. William A. Covino, President  
 323.343.3000  
[www.calstatela.edu](http://www.calstatela.edu) (<http://www.calstatela.edu>)

**California Maritime Academy**

200 Maritime Academy Drive, Vallejo, CA 94590  
 Rear Admiral Thomas A. Cropper, President  
 707.654.1000  
[www.csum.edu](http://www.csum.edu) (<http://www.csum.edu>)

**California State University, Monterey Bay**

100 Campus Center, Seaside, CA 93955-8001  
 Dr. Eduardo M. Ochoa, Interim President  
 831.582.3000  
[www.csumb.edu](http://www.csumb.edu) (<http://www.csumb.edu>)

**California State University, Northridge**

18111 Nordhoff Street, Northridge, CA 91330  
 Dr. Dianne F. Harrison, President  
 818.677.1200  
[www.csun.edu](http://www.csun.edu) (<http://www.csun.edu>)

**California State Polytechnic University, Pomona**

3801 West Temple Avenue, Pomona, CA 91768  
 Dr. J. Michael Ortiz, President  
 909.869.7659  
[www.csupomona.edu](http://www.csupomona.edu) (<http://www.csupomona.edu>)

**California State University, Sacramento**

6000 J Street, Sacramento, CA 95819  
 Dr. Alexander Gonzalez, President  
 916.278.6011  
[www.csus.edu](http://www.csus.edu) (<http://www.csus.edu>)

**California State University, San Bernardino**

5500 University Parkway, San Bernardino, CA 92407-2318  
 Dr. Tomás D. Morales, President  
 909.537.5000  
[www.csusb.edu](http://www.csusb.edu) (<http://www.csusb.edu>)

**San Diego State University**

5500 Campanile Drive, San Diego, CA 92182  
 Dr. Elliot Hirshman, President  
 619.594.5200  
[www.sdsu.edu](http://www.sdsu.edu) (<http://www.sdsu.edu>)

**San Francisco State University**

1600 Holloway Avenue, San Francisco, CA 94132  
 Dr. Leslie E. Wong, President  
 415.338.1111

[www.sfsu.edu](http://www.sfsu.edu) (<http://www.sfsu.edu>)

**San José State University**

One Washington Square, San Jose, CA 95192-0001  
 Dr. Mohammad H. Qayoumi, President  
 408.924.1000  
[www.sjsu.edu](http://www.sjsu.edu) (<http://www.sjsu.edu>)

**California Polytechnic State University, San Luis Obispo**

One Grand Avenue  
 San Luis Obispo, CA 93407  
 Dr. Jeffrey D. Armstrong, President  
 805.756.1111  
[www.calpoly.edu](http://www.calpoly.edu)

**California State University, San Marcos**

333 South Twin Oaks Valley Road  
 San Marcos, CA 92096-0001  
 Dr. Karen S. Haynes, President  
 760.750.4000  
[www.csusm.edu](http://www.csusm.edu) (<http://www.csusm.edu>)

**Sonoma State University**

1801 East Cotati Avenue, Rohnert Park, CA 94928  
 Dr. Ruben Armiñana, President  
 707.664.2880  
[www.sonoma.edu](http://www.sonoma.edu) (<http://www.sonoma.edu>)

**California State University, Stanislaus**

One University Circle, Turlock, CA 95382  
 Dr. Joseph F. Sheley, President  
 209.667.3122  
[www.csustan.edu](http://www.csustan.edu) (<http://www.csustan.edu>)

Higher Education Act (HEA)

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## Higher Education Act (HEA)

Under the Higher Education Act of 1965 (HEA) and its many amendments, Cal Poly is required to make certain disclosures and institutional information “readily available” to prospective and enrolled students, employees, the general public and the department of education on an annual basis (20 U.S.C. Section 1092(a)). For additional information, please contact the Dean of Students Office at 805.756.0327.

## Privacy Rights of Students in Education Records

[http://records.calpoly.edu/stu\\_info/ferpa\\_use.htm](http://records.calpoly.edu/stu_info/ferpa_use.htm)

The federal Family Educational Rights and Privacy Act (FERPA) of 1974 (20 U.S.C. 1232g) and regulations adopted thereunder (34 C.F.R. 99) set out requirements designed to protect students' privacy in their records maintained by the campus. The statute and regulations govern access to student records maintained by the campus and the release of such records. The law provides that the campus must give students access to most records directly related to the student, and must also provide opportunity for a hearing to challenge the records on the grounds that they are inaccurate, misleading or otherwise inappropriate. The right to a hearing under this law does not include any right to challenge the appropriateness of a grade determined by the instructor. The law generally requires the institution to receive a student's written consent before releasing personally identifiable data about the student. The institution has adopted a set of policies and procedures governing implementation of the statute and the regulations. Copies of these policies and procedures may be obtained at the Office of Academic Records or the Educational Equity Services Office. Among the types of information included in the campus statement of policies and procedures are:

1. the types of student records maintained and the information they contain;
2. the official responsible for maintaining each type of record;
3. the location of access lists indicating persons requesting or receiving information from the record;
4. policies for reviewing and expunging records;
5. student access rights to their records;
6. the procedures for challenging the content of student records;
7. the cost to be charged for reproducing copies of records; and
8. the right of the student to file a complaint with the Department of Education.

The Department of Education has established an office and review board to investigate complaints and adjudicate violations. The designated office is: Family Policy Compliance Office, U.S. Department of Education, 400 Maryland Avenue, SW, Washington, D.C. 20202-5920.

The campus is authorized under the Act to release "directory information" concerning students. "Directory information" may include the student's name, address, telephone listing, electronic mail address, photograph, date and place of birth, major field of study, participation in officially recognized activities and sports, weight and height of members of athletic teams, dates of attendance, grade level, enrollment status, degrees, honors, and awards received, and the most recent previous educational agency or institution attended by the student. The above-designated information is subject to release by the campus at any time unless the campus has received prior written objection from the student specifying what information the student requests not be released. Written objections should be sent to the University Registrar.

The campus is authorized to provide access to student records to campus officials and employees who have legitimate educational interests in such access. These persons have responsibilities in the campus' academic, administrative or service functions and have reason for accessing student records associated with their campus or other related academic responsibilities. Student records may also be disclosed to other persons or organizations under certain conditions (e.g., as part of accreditation or program evaluation; in response to a court order or subpoena; in connection with financial aid; or to other institutions to which the student is transferring).

## Completion/Graduation Rates

[http://ir.calpoly.edu/content/publications\\_reports/ret\\_grad/index](http://ir.calpoly.edu/content/publications_reports/ret_grad/index)

In 2012, the graduation rate for Cal Poly freshmen who entered the University in the Fall of 2006 was 73.4%. For more detailed information, please contact Institutional Planning and Analysis at 805.756.2204.

## Equity in Athletics Disclosure Act (EADA)

[http://ir.calpoly.edu/content/publications\\_reports/ret\\_grad/index](http://ir.calpoly.edu/content/publications_reports/ret_grad/index)

The Equity in Athletics Disclosure Act requires co-educational institutions of postsecondary education that participate in a Title IV, federal student financial assistance program, and have an intercollegiate athletic program, to prepare an annual report to the Department of Education on athletic participation, staffing, and revenues and expenses, by men's and women's teams.

In compliance with this requirement, information contained in the current report for Cal Poly San Luis Obispo is available on the US Department of Education's web site at <http://ope.ed.gov/athletics> (select "Get data for one institution"). Alternatively, a link is also available to this and other publications through Cal Poly's Institutional Planning & Analysis web site (see link at top of this section). A paper copy of the report is available upon request.

## Campus Security Report (Clery Act)

[www.Police.calpoly.edu](http://www.Police.calpoly.edu)

Crime statistics for Cal Poly are provided for all prospective and current students, faculty and staff on the website, along with critical updates and prevention advisories. These statistics are reported monthly to the Federal and State Departments of Justice as well as annually to the Office of the Chancellor of the CSU. Crime statistics are published to inform the campus community and to meet mandated reporting requirements. A printed copy of the Campus Security Report is available by request at the University Police Department.

## Institutional and Financial Assistance Information

**Student Financial Assistance.** Director, Financial Aid, Admin. 212; 805.756.2927

1. A description of the federal, state, institutional, local, and private student financial assistance programs available to students who enroll at Cal Poly;
2. For each aid program, a description of procedures and forms by which students apply for assistance, student eligibility requirements, criteria for selecting recipients from the group of eligible applicants, and criteria for determining the amount of a student's award;
3. A description of the rights and responsibilities of students receiving financial assistance, including federal Title IV student assistance programs, and criteria for continued student eligibility under each program;
4. The satisfactory academic progress standards that students must maintain for the purpose of receiving financial assistance and criteria by which a student who has failed to maintain satisfactory progress may reestablish eligibility for financial assistance;
5. The method by which financial assistance disbursements will be made to students and the frequency of those disbursements;

6. The way the school provides for Pell-eligible students to obtain or purchase required books and supplies by the seventh day of a payment period and how the student may opt out;
7. The terms of any loan received as part of the student's financial aid package, a sample loan repayment schedule, and the necessity for repaying loans;
8. The general conditions and terms applicable to any employment provided as part of the student's financial aid package;
9. The terms and conditions of the loans students receive under the Direct Loan and Perkins Loan Programs;
10. The exit counseling information the school provides and collects for student borrowers; and
11. Contact information for ombuds offices available for disputes concerning federal, institutional and private loans.

**Return of Federal Title IV student assistance funds.** Director, Financial Aid, Admin. 212; 805.756.2927.

**Cost of Attending Cal Poly.** Director, Financial Aid, Admin. 212; 805.756.2927: fees and tuition (where applicable); the estimated costs of books and supplies; estimates of typical student room, board, and transportation costs; and, if requested, additional costs for specific programs.

**Refund Policies.** Assistant Director, Student Financial Services, Admin. 211; 805.756.1428: return of unearned tuition and fees or other refundable portions of institutional charges.

**Facilities and Services available to Students with Disabilities.** Director, Disability Resource Center, Student Services Bldg. 124; 805.756.1395.

**Reporting Criminal Actions or Other Emergencies.** University Police, Building 74; 805.756.2281.

**Annual Fire Safety Report.** Facility Services, Bldg. 80; 805.756.6662.

**Prevention of Drug and Alcohol Abuse and Rehabilitation Programs.** Office of the Vice President for Student Affairs, Admin. 209; 805.756.1521.

**Grievance Procedures for Students.** The Dean of Students Office, Bldg 124, Rm 125; 805.756.0327.

**Teacher Certification Examinations, pass rates, teacher preparation programs.** School of Education, Bldg 2, Rm 120; 805.756.2126.

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## Campus Smoking Policy

Please view the revised smoking policy for the Cal Poly campus implemented January 2, 2004 at <http://policy.calpoly.edu/cap/100/cap170.htm>.

## Career Placement

The Career Services office 805.756.2501 may furnish, upon request, information about the employment of students who graduate from the academic programs. This information includes data concerning the median starting salary and the percentage of previously enrolled students who obtained employment or continued into graduate or professional schools.

## Military Selective Service Act

The federal Military Selective Service Act (the "Act") requires most males residing in the United States to present themselves for

registration with the Selective Service System within thirty days of their eighteenth birthday. Most males between the ages of 18 and 25 must be registered. Males born after December 31, 1959 may be required to submit a statement of compliance with the Act and regulations in order to receive any grant, loan, or work assistance under specified provisions of existing federal law. In California, students subject to the Act who fail to register are also ineligible to receive any need-based student grants funded by the state or a public postsecondary institution. Selective Service registration forms are available at any U.S. Post Office, and many high schools have a staff member or teacher appointed as a Selective Service Registrar. Applicants for financial aid can also request that information provided on the Free Application for Federal Student Aid (FAFSA) be used to register them with the Selective Service. Information on the Selective Service System is available and the registration process may be initiated online at <http://www.sss.gov>.

## Determination of Residency for Nonresident Tuition Purposes

University requirements for establishing residency for tuition purpose are independent from those of other types of residency, such as for tax purposes, or other state or institutional residency. These regulations were promulgated not to determine whether a student is a resident or nonresident of California, but rather to determine whether a student should pay tuition on an in-state or out-of-state basis. A resident for tuition purposes is someone who meets the requirements set forth in the Uniform Student Residency Requirements. These laws governing residency for tuition purposes at the California State University (CSU) are California Education Code sections 68000-68085, 68120-68134, and 89705-89707.5, and California Code of Regulations, Title 5, Subchapter 5, Article 4, sections 41900-41916.

This material can be viewed on the Internet by accessing the CSU's website at [www.calstate.edu/GC/resources.shtml](http://www.calstate.edu/GC/resources.shtml) (<http://www.calstate.edu/GC/resources.shtml>).

Each campus's Admissions Office is responsible for determining the residency status of all new and returning students based on the Application for Admission, Residency Questionnaire, Reclassification Request Form, and, as necessary, other evidence furnished by the student. A student who fails to submit adequate information to establish eligibility for resident classification will be classified as a nonresident.

Generally, establishing California residency for tuition purposes requires a combination of physical presence and intent to remain indefinitely. An adult who, at least one full year prior to the residency determination date for the term in which enrollment is contemplated, can demonstrate physical presence in the state combined with evidence of intent to remain in California indefinitely, may establish California residency for tuition purposes. A minor normally derives residency from the parent(s) they reside with or most recently reside with.

Evidence demonstrating intent may vary from case to case but will include, and is not limited to, the absence of residential ties to any other state, California voter registration and voting in California elections, maintaining California registration and driver's license, maintaining active California bank accounts, filing California income tax returns and listing a California address on federal tax returns, owning residential property or occupying or renting an apartment where permanent belongings are kept, maintaining active memberships

in California professional or social organizations, and maintaining a permanent military address and home of record in California.

Nonresident students seeking reclassification are required to complete a supplemental questionnaire that includes questions concerning their financial dependence on parents or others who do not meet University requirements for classification as residents for tuition purposes. Financial independence is required, along with physical presence and intent, to be eligible for reclassification.

Non-citizens establish residency in the same manner as citizens, unless precluded by the Immigration and Nationality Act from establishing domicile in the United States.

Exceptions to the general residency requirements are contained in California Education Code sections 68070-68085 and California Code of Regulations, Title 5, Subchapter 5, Article 4, sections 41906-41906.6, and include, but are not limited to, members of the military and their dependents, certain credentialed employees of school districts and most students who have attended high school in California and graduated or attained the equivalent. Whether an exception applies to a particular student cannot be determined before the submission of an application for admission and, as necessary, additional supporting documentation. Because neither campus nor Chancellor's Office staff may give advice on the application of these laws, applicants are strongly urged to review the material for themselves and consult with a legal advisor.

## Residency determination dates

Term	Date
Fall	September 20
Winter	January 5
Spring	April 1
Summer	July 1

Students classified as non-residents may appeal a final campus decision within 120 days of notification by the campus. A campus residency classification appeal must be in writing and submitted to:

The California State University, Office of General Counsel,  
401 Golden Shore, 4<sup>th</sup> Floor, Long Beach, CA 90802-4210

The Office of General Counsel can either decide the appeal or send the matter back to the campus for further review.

Students incorrectly classified as residents or incorrectly granted an exception from nonresident tuition are subject to reclassification as nonresidents and payment of nonresident tuition in arrears. If incorrect classification results from false or concealed facts, the student is also subject to discipline pursuant to Section 41301 of Title 5 of the California Code of Regulations.

Resident students who become nonresidents or who no longer meet the criteria for an exception must immediately notify the Admissions Office.

Changes may have been made in the rate of nonresident tuition and in the statutes and regulations governing residency for tuition purposes in California between the time this information is published and the relevant residency determination date. Students are urged to review the statutes and regulations stated above.

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## Use of Social Security Number

Applicants are required to include their correct social security numbers in designated places on applications for admission pursuant to the authority contained in Section 41201, Title 5, *California Code of Regulations*, and Section 6109 of the Internal Revenue Code (26 U.S.C. 6109). The University uses the social security number to identify students and their records including identification for purposes of financial aid eligibility and disbursement and the repayment of financial aid and other debts payable to the institution. Also, the Internal Revenue Service requires the University to file information returns that include the student's social security number and other information such as the amount paid for qualified tuition, related expenses, and interest on educational loans. This information is used by the IRS to help determine whether a student, or a person claiming a student as a dependent, may take a credit or deduction to reduce federal income taxes.

## Student Conduct

Inappropriate conduct by students or by applicants for admission is subject to discipline as provided in Sections 41301 through 41304 of Title 5, *California Code of Regulations*. These sections are:

### 41301. Standards for Student Conduct.

#### 1. Campus Community Values

The University is committed to maintaining a safe and healthy living and learning environment for students, faculty, and staff. Each member of the campus community should choose behaviors that contribute toward this end. Students are expected to be good citizens and to engage in responsible behaviors that reflect well upon their university, to be civil to one another and to others in the campus community, and contribute positively to student and university life.

#### 2. Grounds for Student Discipline

Student behavior that is not consistent with the Student Conduct Code is addressed through an educational process that is designed to promote safety and good citizenship and, when necessary, impose appropriate consequences. The following are the grounds upon which student discipline can be based:

- a. Dishonesty, including:
  - i Cheating, plagiarism, or other forms of academic dishonesty that are intended to gain unfair academic advantage.
  - ii Furnishing false information to a University official, faculty member, or campus office.
  - iii Forgery, alteration, or misuse of a University document, key, or identification instrument.
  - iv Misrepresenting one's self to be an authorized agent of the University or one of its auxiliaries.
- b. Unauthorized entry into, presence in, use of, or misuse of University property.
- c. Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.
- d. Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.
- e. Willful, material and substantial obstruction of the free flow of pedestrian or other traffic, on or leading to campus property or an off-campus University related activity.



- f. Disorderly, lewd, indecent, or obscene behavior at a University related activity, or directed toward a member of the University community.
- g. Conduct that threatens or endangers the health or safety of any person within or related to the University community, including physical abuse, threats, intimidation, harassment, or sexual misconduct.
- h. Hazing, or conspiracy to haze. Hazing is defined as any method of initiation or pre-initiation into a student organization or student body, whether or not the organization or body is officially recognized by an educational institution, which is likely to cause serious bodily injury to any former, current, or prospective student of any school, community college, college, university or other educational institution in this state (Penal Code 245.6), and in addition, any act likely to cause physical harm, personal degradation or disgrace resulting in physical or mental harm, to any former, current, or prospective student of any school, community college, university, or other educational institution. The term "hazing" does not include customary athletic events or school sanction events.  
  
Neither the express or implied consent of a victim of hazing, nor the lack of active participation in a particular hazing incident is a defense. Apathy or acquiescence in the presence of hazing is not a neutral act, and is also a violation of this section.
- i. Use, possession, manufacture, or distribution of illegal drugs or drug-related paraphernalia, (except as expressly permitted by law and University regulations) or the misuse of legal pharmaceutical drugs.
- j. Use, possession, manufacture, or distribution of alcoholic beverages (except as expressly permitted by law and University regulations), or public intoxication while on campus or at a University related activity.
- k. Theft of property or services from the University community, or misappropriation of University resources.
- l. Unauthorized destruction, or damage to University property or other property in the University community.
- m. Possession or misuse of firearms or guns, replicas, ammunition, explosives, fireworks, knives, other weapons, or dangerous chemicals (without the prior authorization of the campus president) on campus or at a University related activity.
- n. Unauthorized recording, dissemination, or publication of academic presentations (including handwritten notes) for a commercial purpose.
- o. Misuse of computer facilities or resources, including:
  - i. Unauthorized entry into a file, for any purpose.
  - ii. Unauthorized transfer of a file.
  - iii. Use of another's identification or password.
  - iv. Use of computing facilities, campus network, or other resources to interfere with the work of another member of the University community.
  - v. Use of computing facilities and resources to send obscene or intimidating and abusive messages.
  - vi. Use of computing facilities and resources to interfere with normal University operations.

vii Use of computing facilities and resources in violation of copyright laws.

viii Violation of a campus computer use policy.

- p. Violation of any published University policy, rule, regulation or presidential order.
- q. Failure to comply with directions of, or interference with, any University official or any public safety officer while acting in the performance of his/her duties.
- r. Any act chargeable as a violation of a federal, state, or local law that poses a substantial threat to the safety or well-being of members of the University community, to property within the University community or poses a significant threat of disruption or interference with University operations.
- s. Violation of the Student Conduct Procedures, including:
  - i. Falsification, distortion, or misrepresentation of information related to a student discipline matter.
  - ii. Disruption or interference with the orderly progress of a student discipline proceeding.
  - iii. Initiation of a student discipline proceeding in bad faith.
  - iv. Attempting to discourage another from participating in the student discipline matter.
  - v. Attempting to influence the impartiality of any participant in a student discipline matter.
  - vi. Verbal or physical harassment or intimidation of any participant in a student discipline matter.
  - vii. Failure to comply with the sanction(s) imposed under a student discipline proceeding.
- t. Encouraging, permitting, or assisting another to do any act that could subject him or her to discipline.

### 3. **Procedures for Enforcing this Code**

The Chancellor shall adopt procedures to ensure students are afforded appropriate notice and an opportunity to be heard before the University imposes any sanction for a violation of the Student Conduct Code.

### 4. **Application of this Code**

Sanctions for the conduct listed above can be imposed on applicants, enrolled students, students between academic terms, graduates awaiting degrees, and students who withdraw from school while a disciplinary matter is pending. Conduct that threatens the safety or security of the campus community, or substantially disrupts the functions or operation of the University is within the jurisdiction of this Article regardless of whether it occurs on or off campus. Nothing in this Code may conflict with Education Code section 66301 that prohibits disciplinary action against students based on behavior protected by the First Amendment.

### **41302. Disposition of Fees: Campus Emergency; Interim**

**Suspension.** The President of the campus may place on probation, suspend, or expel a student for one or more of the causes enumerated in Section 41301. No fees or tuition paid by or for such student for the semester, quarter, or summer session in which he or she is suspended or expelled shall be refunded. If the student is readmitted before the close of the semester, quarter, or summer session in which he or she is suspended, no additional tuition or fees shall be required of the student on account of the suspension.



During periods of campus emergency, as determined by the President of the individual campus, the President may, after consultation with the Chancellor, place into immediate effect any emergency regulations, procedures, and other measures deemed necessary or appropriate to meet the emergency, safe-guard persons and property, and maintain educational activities.

The President may immediately impose an interim suspension in all cases which there is reasonable cause to believe that such an immediate suspension is required in order to protect lives or property and to insure the maintenance of order. A student so placed on interim shall be given prompt notice of charges and the opportunity for a hearing within 10 days of the imposition of interim suspension.

During the period of interim suspension, the student shall not, without prior written permission of the President or designated representative, enter any campus of the California State University other than to attend the hearing. Violation of any condition of interim suspension shall be grounds for expulsion.

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## Civil and Criminal Penalties for Violation of Federal Copyrights Law

Anyone who is found to be liable for copyright infringement may be ordered to pay either actual damages or "statutory" damages between \$750 and \$30,000 per work infringed. In the case of a "willful" infringement, a court may award up to \$150,000 per work infringed. Courts also have discretion to award costs and attorneys' fees to the prevailing party. (See 17 U.S.C. §§504 & 505.) Willful copyright infringement can also result in criminal penalties, including imprisonment of up to five years and fines of up to \$250,000 per offense. (See 17 U.S.C. §506 & 18 U.S.C. §2319.)

## Student Complaint Procedure

The California State University takes very seriously complaints and concerns regarding the institution. If you have a complaint regarding the CSU, you may present your complaint as follows:

1. If your complaint concerns CSU's compliance with academic program quality and accrediting standards, you may present your complaint to the Western Association of Schools and Colleges (WASC) at <http://www.wascsenior.org/comments>. WASC is the agency that accredits the CSU's academic progress.
2. If your complaint concerns an alleged violation by CSU of a state law, including laws prohibiting fraud and false advertising, you may present your claim to the campus president or designee at (Betsy Kinsey, Chief of Staff, [ekinsley@calpoly.edu](mailto:ekinsley@calpoly.edu)). The president or designee will provide guidance on the appropriate campus process for addressing your particular issue.

If you believe that your complaint warrants further attention after you have exhausted all the steps outlined by the president or designee, or by WASC, you may file an appeal with the Associate Vice Chancellor, Academic Affairs at the CSU Chancellor's Office. This procedure should not be construed to limit any right that you may have to take civil or criminal legal action to resolve your complaint.

## Immigration Requirements for Licensure

The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (P.L. 104-193), also known as the Welfare Reform Act, includes provisions to eliminate eligibility for federal and state public benefits for certain categories of lawful immigrants as well as benefits for all illegal immigrants. Students who will require a professional or

commercial license provided by a local, state, or federal government agency in order to engage in an occupation for which the CSU may be training them must meet the immigration requirements of the Personal Responsibility and Work Opportunity Reconciliation Act to achieve licensure. Information concerning these requirements is available from the Office of the Registrar, Admin. 222; 805.756.2531.

## Average Support Cost per Full-time Equivalent Student and Sources of Funds

The total support cost per full-time equivalent student (FTES) includes the expenditures for current operations, including payments made to students in the form of financial aid, and all fully reimbursed programs contained in state appropriations. The average support cost is determined by dividing the total cost by the number of FTES. The total CSU 2013/14 budget amounts were \$2,330,500,000 from state General Fund (GF) appropriations (not including capital outlay funding) and before adding \$16.3 million CalPERS retirement adjustment, \$1,539,029,000 from tuition fee revenue and after tuition fee discounts (forgone revenue), and \$408,305,000 from other fee revenues for a total of \$4,277,834,000. The number of 2013/14 FTES is 336,510 resident target and 14,358 non-resident students for a total of 350,838 FTES. The GF appropriation is applicable to resident students only whereas fee revenues are collected from resident and nonresident students. FTES is determined by dividing the total academic student load by 15 units per term (the figure used here to define a full-time student's academic load).

The 2013/14 average support cost per FTES based on GF appropriation and net tuition fee revenue only is \$11,312 and when including all sources as indicated below is \$12,476, which includes all fee revenue in the CSU Operating Fund (e.g. tuition fees, application fees, and other campus mandatory fees). Of this amount, the average net tuition and other fee revenue per FTES is \$5,551.

### 2013/14

	Amount	Average Cost Per FTES	%
State Appropriation (GF)*	2,330,500,000	6,925	55.5
NetTuition Fee Revenue**	1,539,029,000	4,387	35.2
Other Fees Revenue**	408,305,000	1,164	9.3
Total Support Cost	4,277,834,000	12,476	100.0

\* Represents state GF appropriation in the Budget Act of 2013/14; GF is divisible by resident students only (336,510 FTES).

\*\* Represents CSU Operating Fund, Tuition Fee and other fees revenue amounts (net of tuition fee discounts) submitted in campus August 2013/14 final budgets. Revenues are divisible by resident and nonresident students (350,838 FTES).

The average CSU 2013/14 academic year, resident, undergraduate student basic tuition fee and other mandatory fees required to apply to, enroll in, or attend the university is \$6,695 (\$5,472 tuition fee plus \$1,223 average campus-based fees). However, the costs paid by

individual students will vary depending on campus, program, and whether a student is part-time, full-time, resident, or nonresident.

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