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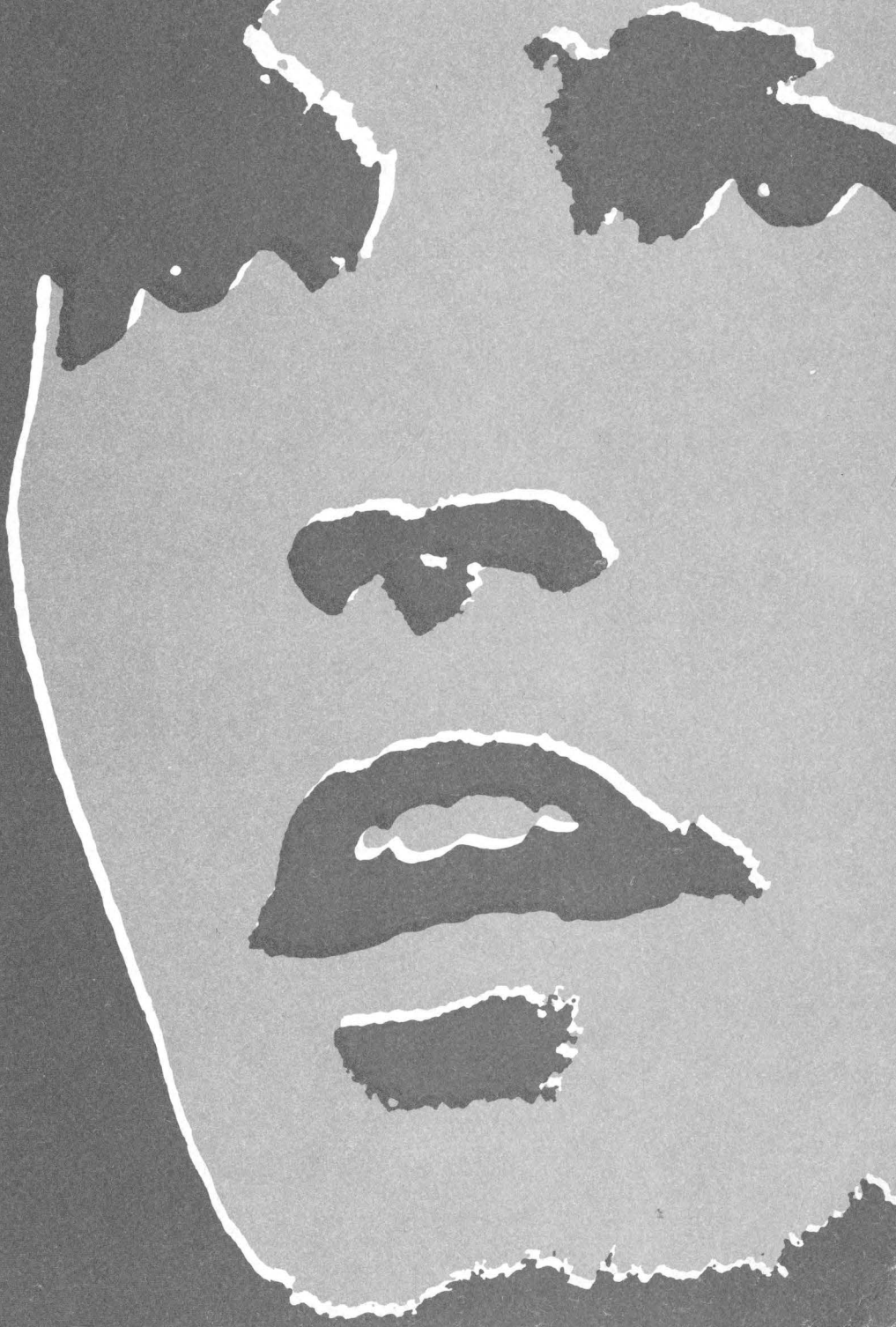
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University of Rhode Island 1976-77 Graduate School Bulletin

Jessie





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## The University



The University of Rhode Island, a land-grant institution founded in 1892, is located on 1200 acres in the village of Kingston, 30 miles south of Providence and six miles from the ocean. In 1971 it became one of the first four sea grant colleges in the United States. The full-time faculty numbers about 780, and there are about 2500 graduate and 8500 undergraduate students enrolled. Approximately 1,000 graduate students are in full-time residence.

The University is made up of eight colleges and three schools: the Colleges of Arts and Sciences, Business Administration, Engineering, Home Economics, Nursing, Pharmacy, and Resource Development, University College, the Graduate School, the Graduate Library School and the Graduate School of Oceanography.

The Division of University Extension in Providence enrolls about 5000 students. The Master of Arts in English, the Master of Business Administration, and the Master of Public Administration degrees may be earned in the Division of University Extension as well as on the main campus.

The 2300-acre W. Alton Jones Campus, where environmental education, research and conference facilities are located, is 20 miles from Kingston in West Greenwich.

The Graduate School of Oceanography is located on the 165-acre Narragansett Bay Campus, six miles from Kingston on the west shore of Narragansett Bay within easy reach of both bay and open ocean. Major buildings include the Charles J. Fish Laboratory, the Claiborne Pell Marine Science Library, the Francis H. Horn Research Laboratory, a research aquarium, and a number of smaller laboratory and research facilities. The campus also includes the state of Rhode Island's nuclear reactor and federal laboratories devoted to the marine sciences. A marine experiment station is located on the salt-marsh at Jerusalem, Rhode Island.

The University of Rhode Island prohibits discrimination on the basis of race, sex, religion, age, color, creed, national origin or handicap in the recruitment and admission of students, the recruitment and hiring of faculty and staff and the operation of its activities or programs, as specified by federal and state law. Inquiries concerning compliance with anti-discrimination laws should be addressed to the Affirmative Action Officer, University of Rhode Island.

### ACCREDITATION

The accrediting agencies which have approved the quality of the course offerings of the University of Rhode Island include the American Association of Universities, the American Assembly of Collegiate Schools of Business, the

American Chemical Society, the American Council on Pharmaceutical Education, the Engineers Council for Professional Development, the National League for Nursing, the New England Association of Colleges and Secondary Schools, and the State University of New York,

The University is also an approved member institution of the American Association of University Women, the Council of Graduate Schools in the United States, the National Association of Schools of Music, the National Association of Summer Sessions, and the National University Extension Association. The Doctor of Philosophy programs in clinical and school psychology are accredited by the American Psychological Association.

### GRADUATE STUDY

Graduate study at the University was inaugurated in 1907 with the Master of Science degrees in chemistry and in engineering. The Master of Arts degree was first awarded in 1951 and in 1960 the University awarded its first Doctor of Philosophy degree. Graduate work for professional degrees was initiated in 1962 when the degree of Master of Public Administration was first awarded. Today, the master's degree is offered in over 60 areas of study and the doctorate in 24 areas.

The Dean of the Graduate School has primary responsibility for administering the policies and procedures relating to advanced study at the University of Rhode Island. Graduate School policy is made by the Graduate Faculty, acting through its delegate body, the Graduate Council which includes student members. Only the Dean or the Graduate Council may grant exceptions to the regulations for graduate study, which are explained in detail in the *Graduate School Manual*.

### GRADUATE DEGREE PROGRAMS

The University offers the programs of study listed below. Work in a combination of special areas is usually possible.

#### *Master of Arts*

- Economics
- Education
  - Educational Research
  - Elementary Education
  - Guidance and Counseling
  - Reading Education
  - Science Education
  - Secondary Education
  - Youth and Adult Education
- English



- French
- Geography
- History
- Philosophy
- Political Science
  - International Relations
- Sociology
- Spanish
- Speech Pathology and Audiology

#### *Master of Science*

- Accounting
- Animal Pathology
- Animal Science
- Biochemistry
- Biophysics
- Botany
- Business Education
- Chemical Engineering
- Chemistry
- Child Development and Family Relations
- Civil and Environmental Engineering
- Computer Science
- Electrical Engineering
- Environmental Health Sciences
- Experimental Statistics
- Food and Nutritional Science
- Food and Resource Chemistry
- Geology
- Home Economics Education
- Industrial Engineering
- Mathematics
- Mechanical Engineering and Applied
  - Mechanics
- Medicinal Chemistry
- Microbiology
- Nuclear Engineering
- Nursing



Ocean Engineering  
 Oceanography  
 Pharmacognosy  
 Pharmacology and Toxicology  
 Pharmacy  
 Pharmacy Administration  
 Physical Education (men and women)  
 Physics  
 Plant and Soil Science  
 Plant Pathology-Entomology  
 Psychology (school)  
 Resource Economics  
 Speech Pathology and Audiology  
 Textiles, Clothing and Related Art  
 Zoology

*Doctor of Philosophy*

Biological Sciences  
 Animal Pathology  
 Biochemistry  
 Biophysics  
 Botany  
 Food and Resource Chemistry  
 Microbiology  
 Plant Pathology-Entomology  
 Zoology  
 Chemical Engineering  
 Chemistry  
 Civil and Environmental Engineering  
 Electrical Engineering  
 Biomedical Engineering  
 English  
 Mathematics  
 Mechanical Engineering and Applied  
 Mechanics  
 Ocean Engineering  
 Oceanography  
 Pharmaceutical Sciences

Medicinal Chemistry  
 Pharmacognosy  
 Pharmacology and Toxicology  
 Pharmacy  
 Physics  
 Psychology

*Professional Degrees*

Master of Business Administration (M.B.A.)  
 Master of Community Planning (M.C.P.)  
 Master of Library Science (M.L.S.)  
 Master of Marine Affairs (M.M.A.)  
 Master of Public Administration (M.P.A.)

In addition, three graduate certificate programs are available to supplement specific master's degrees. The following graduate certificates, which are not degrees, are awarded by the Dean of the Graduate School to attest to a specific, supplemental competence: Commercial Fisheries (see Marine Affairs, p. 33), International Development Studies (see International Studies, p. 32), North Atlantic Regional Studies (see International Studies, p. 32).

**RESEARCH**

Active research programs are carried on throughout the University and are supported by foundations, commercial firms, the United States government and the University. Specialized research is carried on in the several areas described below.

The Coordinator of Research signs, on behalf of the University, applications for research grants, maintains files of funding agencies, keeps a current facilities inventory, and in general acts as a liaison officer for the President,

the Vice President for Academic Affairs, the academic deans, the Research Committee and the faculty in matters pertaining to the general research policy.

#### Agricultural Experiment Station

The station, within the College of Resource Development, was established in 1888 and is concerned with basic and applied investigation in natural and human resources. This research aims to conserve and manage resources, improve the quality of environments, abate pollution and recycle waste materials, enhance rural environments, develop more rewarding home life, and support resource-using industry and business in the region. Research is conducted in food and resource chemistry, resource economics, plant and soil science, plant pathology-entomology, forest and wildlife management, animal science, and animal pathology. A strong orientation to estuarine and marine problems, and an interdisciplinary approach to resource research are station characteristics.

#### Bureau of Government Research

The bureau was organized in 1960 to provide service to municipalities and to the state. The bureau maintains a municipal consulting service which assists Rhode Island communities in dealing with problems of governmental organization and administration. It has a publications program including a research series, an information series, and a bi-monthly newsletter, and operates a program of conferences and awards. The bureau assists in the administration of the graduate program in public administration, including the arrangement and supervision of internships in governmental agencies. It also maintains a public administration library and an information service for local government units.

#### Division of Engineering Research and Development

The division was established in 1942 to coordinate the research activities of the College of Engineering. It disseminates the results of basic or fundamental investigations; conducts fundamental and applied research projects; provides opportunities for graduate students and highly qualified undergraduates to participate in research studies; and offers opportunities for members of the engineering faculty, through research, to keep abreast of advances in the profession. Facilities are available for research in the fields of chemical, civil, electrical, industrial, mechanical, materials, nuclear, environmental and ocean engineering.

#### Laboratories for Scientific Criminal Investigation

These laboratories in the Department of Pharmacology and Toxicology of the College of Pharmacy provide instruction, research, and service in the field of scientific criminal investigation. The laboratory staff works closely with the Rhode Island Attorney General's Office and also provides technical consultation for various law enforcement agencies, and special instruction and research in criminalistics, in which faculty members of various departments participate. The program sponsors a special course for police and law enforcement agencies.

#### Marine Research Programs

A number of marine research programs are carried on at the University and are coordinated under the Provost for Marine Affairs. These include basic and applied research in the several areas of physical, chemical, geological and biological oceanography within the Graduate School of Oceanography; as well as areas within the Colleges of Arts and Sciences, Engineering, Pharmacy and Resource Development.

The *Sea Grant College Program*, started in 1968 with funds from the Sea Grant College and Program Act of 1968, encompasses specialized marine research, education and public service projects in many departments of the University. Both the *URI Marine Advisory Service*, which provides marine extension services in the state, and the *New England Marine Resources Information Program*, which does the same in New England, are based at the University and are part of the Sea Grant Program.

With support from the U.S. Agency for International Development, the *International Center for Marine Resource Development* encourages and coordinates international programs of the University.

The *Coastal Resources Center*, established in 1971 to assist the Rhode Island Coastal Resources Management Council in preparation of coastal and marine management plans for the state and its political subdivisions, is based at the University.

#### Research Center in Business and Economics

The research activities of the College of Business Administration are centered in this organization established in 1965. The center initiates, conducts, and services research activities of the faculty in the field of accounting, business education and office administration, business law, economics, finance, insurance, management science, marketing management, organizational management and industrial



relations, and production and operations management. The center publishes *The New England Journal of Business & Economics*, whose main focus is upon the business and economics issues which directly or indirectly concern New England.

#### Rhode Island Water Resources Center

This is the state center for research and training in all phases of water resources. Similar centers in each of the 50 states and Guam, Puerto Rico, the Virgin Islands and the District of Columbia were established by law in 1964 and work cooperatively with the federal government in an effort "to assist in assuring the nation at all times of a supply of water sufficient in quantity and quality to meet the requirements of its expanding population." Principal investigators of projects need not be employed at the University.

#### The University Libraries

The University's library collection of over 600,000 volumes is housed in the newly expanded and remodeled University Library and

its Rodman Hall annex, the Division of University Extension Library in Providence, and the Claiborne Pell Marine Science Library on the Narragansett Bay Campus.

The University Library, which holds the bulk of the collection, is a four-story, air-conditioned building where open stacks provide direct access to books, periodicals, documents, maps, microforms and audiovisual materials. The Special Collections Department collects and maintains rare books, manuscripts, the University archives and a variety of special interest materials. Service hours at the other libraries vary, but the University Library provides full reference, bibliographic and circulation services during most of the 90 hours per week it is open. Coin operated copiers are available for reproducing pages from books and journals, and for producing copy from microform. A computer-based bibliographic system makes most books available to users one week after their receipt.

The Pell Library contains a wide collection of books and periodicals on the marine sciences and reports of major oceanographic expeditions, making it one of the most complete marine science libraries on the east coast. It has been designated the National Sea Grant Depository.





The building also houses a remote computer console linked with the Academic Computer Center.

#### RESEARCH RESOURCES

The Academic Computer Center has an IBM system/370 model 155 with 1563K of high speed storage, disk storage units, magnetic tape, card, and printer input/output devices, and an off-line plotter. The system's hardware and software accommodate both remote batch and interactive terminal usage as well as normal batch processing. Intermediate-speed remote batch terminals are installed within the Graduate School of Oceanography and the Department of Civil Engineering. The Department of Electrical Engineering has two PDP-9 computers with a graphics display console linked to the Computer Center's system. A Nova 1200 computer with a 16 channel A to D converter and Versatec printer-plotter located in the Department of Ocean Engineering has a magnetic tape input/output system compatible with the 370 system. The Department of Chemical Engineering has an applied dynamics 32 PB analog computer. The staff members of the Department of Computer Science and Experimental Statistics provide consultation in numerical methods, statistical analysis and computational techniques.

Other equipment includes a major laboratory for research on photo-electronic imaging devices, optical properties of materials and micro-electronics, a materials research laboratory including ultra-high pressure and high pressure temperature equipment that permits study of solid state under pressure of up to 80 kilobars and temperatures up to 2000°C, a mechanical properties testing facility, a field station for radio-propagation research,

reverberant and anechoic rooms for airborne acoustics work, a low speed wind tunnel for fluid mechanics studies, instrumentation including atomic absorption, emission, infra-red, mass, nuclear magnetic resonance (H-1, C-13), Raman, X-ray diffraction/fluorescence and ultraviolet spectrometers, gas and liquid chromatographs, gas chromatograph-mass spectrograph, electron microscopes, scanning electron microscopes, metallographs, nuclear counting equipment and multichannel analyzers.

Equipment available for marine research includes chambers for leak testing equipment prior to deep-sea use, triaxial test chambers for soil and sediment testing, X-ray radiographs, a rotating basin for studying basic problems on oceanographic hydrodynamics, a large buoy to monitor pollution parameters and telemeter data to the Nova 1200 computer, an instrumented habitat located in Narragansett Bay to monitor ocean data, Deep Ocean Sediment Probe (DOSP) for in situ sediment measurements, an underwater acoustics test facility and a marine experimental aquarium, and a marine ecosystem research laboratory.

The University's research vessel, ENDEAVOR, operated by the Graduate School of Oceanography, is a 177-foot ship capable of working in all parts of the world's oceans. It can carry a scientific party of 14 men and women and provides one of the largest laboratory areas of any United States research vessel. Two 45-foot motor cruisers, GAIL ANN and CROWNEST VI, are part of the permanent fleet and a 40-foot dragger, BILLIE II, is chartered on a year-round basis for work in Narragansett Bay and Rhode Island Sound.

Students at the University have a research reactor and associated facilities available to them at the Rhode Island Nuclear Science Center, located on the Narragansett Bay Cam-

pus. Constructed and operated by the State of Rhode Island, this critical reactor is extensively used for research by many departments of the University. The reactor, designed for 5MW, is now operating at 2MW. Hot laboratories, counting equipment and multi-channel analyzers are also available. In addition, a sub-critical reactor is located in the nuclear laboratory in the Department of Chemical Engineering.

## GRADUATE LIFE

Students find unique advantages at a University located in a small village in the heart of the northeastern Megalopolis. Cultural variety and compact size are combined in the state of Rhode Island, and other cultural centers are easily accessible. Boston is 80 miles to the north and New York City 160 miles southwest. Direct bus service to these cities, as well as to Providence, Newport and Cape Cod, is available from the campus. There is also a local bus service. The Kingston station of Amtrak is two miles away.

### Services

The recreational and cultural facilities of the campus are open to graduate students, including use of the Memorial Union building. Facilities there include meeting rooms, lounges, bowling lanes, billiards, table tennis, the University Bookstore, cafeteria, and snack bar. Services include an information center, barber shop, bank, travel agency, Western Union office, record and art print libraries, and student pub serving wine and beer.

Every effort is made to provide graduate students with opportunities for consultation and advice on matters of concern to them in their academic, extracurricular and personal lives. Descriptions of available services and facilities, including those associated with religious life, may be found in the *Undergraduate Bulletin*. Of particular interest to graduate students are the following: Career Planning and Placement, 70 Lower College Road; Counseling Center, Roosevelt Hall; Health Service, Potter Building; International Student Affairs, Taft Hall; Religious Counselors, Memorial Union and Catholic Center; Student Aid Office, Davis Hall.

### Services for the Disadvantaged or Handicapped

The Dean of the Graduate School, the Director of Career Planning and Placement, the Director of Counseling, and the Director of the (undergraduate) Special Program for Talent Development cooperate to provide information and guidance for economically and socially dis-

advantaged individuals seeking opportunities for graduate study at the University. Inquiries may be directed to any of these offices.

Special counseling for physically, psychologically, or vocationally handicapped individuals is available from the Counseling Center.

### Graduate Student Association

This organization is interested in both the academic and social aspects of graduate life. Officers and representatives of the association are elected annually from the entire graduate student body and the association is represented on the Graduate Council. The association publishes a newsletter, *The Grad Side*, and the *Graduate Student Handbook*, a student's perspective of the campus and community.

There are also organizations for spouses of graduate students and for students from foreign countries.

### Housing

A new housing complex and several older buildings provide 140 units of unfurnished apartments for graduate students. There is usually a waiting list for these and interested students should write to the University Housing Office for additional information and applications. The Housing Office also maintains a list of off-campus rooms, apartments, and houses which may be rented by graduate students. For these the use of a car is desirable. For further information on housing, including current costs, interested students should contact the Director of Residential Life, Roger Williams Complex.

### Dining Services

Dining services are available for graduate students and their guests at any of the University dining halls. The Ram's Den in the Memorial Union provides additional services. At present, resident students have a choice of a 15-meal per week (Monday through Friday) contract at \$357.50, or a 20-meal per week (Monday through Sunday) plan at \$420. Weekly and monthly rates for commuters as well as guest rates and other information may be obtained from the Dining Services Office, Lippitt Hall.

### Army ROTC

A two-year program has been designed to fill the needs of graduate students who have not taken Army ROTC during their undergraduate years. The United States Army offers the opportunity to earn commissions as second lieutenants after two years of on-campus ROTC

training. The student attends a six-week basic summer camp and completes the advanced ROTC course while attending graduate school.

### Academic and Social Codes

Each student is a member of the University community with all the rights, privileges and responsibilities that go with such membership. The rights and privileges include full use of the educational opportunities and facilities offered on the campus. The responsibilities include those of making proper use of these facilities in order to progress educationally, of respecting the rights of others, and of knowing and obeying the rules and regulations developed by the University community for the good of the total membership.

The University expects that all course papers, theses and dissertations will be prepared and all examinations taken in conformance with accepted standards of academic integrity. This includes the proper citation and attribution of all material which is not the original product of the writer. It is the graduate student's responsibility to determine the appropriate style used in his or her discipline for presentation of material derived from other sources and to adhere to it scrupulously in all written presentations. Where no special disciplinary style exists, that given in Kate L. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations*, published by the University of Chicago Press, should be used.

### University Ombudsman

The ombudsman investigates complaints from students, faculty and administrative personnel that they have been unfairly dealt with in the normal channels of administrative process. An opportunity is thus provided for a personal appeal to an impartial official with broad perspective who has ready access at all levels to those involved in a grievance. The ombudsman is always available to receive complaints, inquire into the matters involved and mediate or otherwise resolve the problem. However, the ombudsman does not become involved with the normal operations of established procedures as outlined in the *Graduate Student Manual*, except where they are not functioning as intended.

The ombudsman, Prof. Jean Houston, and her student assistant have an office in the Memorial Union.

### CONFIDENTIALITY OF STUDENT RECORDS

Procedures for the release and disclosure of student records maintained by the University

are in large measure governed by state and federal laws. Where the law is silent, the University is guided by the principle that the privacy of an individual is of great weight and that as much information in a student's files as possible should be disclosed to the student upon request. A current or former student has the right to inspect or review official records, files and data directly related to him or her. This right does not extend to applicants, those denied admission to the University or those who were offered admission but did not enroll.

Some records not available to students are: letters of recommendation obtained or prepared before January 1, 1975; letters of recommendation which the student has waived his or her right to inspect; employment records of students as University employees; clinical, medical, counseling or psychiatric records; parents' financial aid records; and campus law enforcement records.

A student may challenge the factual and objective elements of the content of student records, but not the qualitative and subjective elements of grading. If the student objects to certain items included in his or her personal records, a grievance procedure has been established. Ultimately, a Hearing Board on Student Confidential Records could render a decision.

Third parties do not have access to personally identifiable records or information pertaining to students without the written consent of students who specify the records to be released. Federal law requires that parents be considered third parties.

Detailed guidelines for the release and disclosure of information from student records are available from the Office of Student Relations and Research in the Memorial Union. They comply with the legal requirements of the Family Educational Rights and Privacy Act of 1974.

### NOTICE OF CHANGE

Rules, regulations, dates, tuition, fees; the availability and titles of programs and areas of specialization, their administrative location, and courses set forth in this catalog are subject to change without notice. Where a change in program requirements is made while a graduate student is currently enrolled, the student may elect to complete the program under the requirements in effect at the time of matriculation, or to shift entirely to the new requirements, but may not choose parts of each set. As a result of the ongoing reviews of all graduate programs, certain offerings may be deleted or restructured between editions of the *Graduate School Bulletin*.

## Degree Requirements



Each advanced degree awarded by the University requires as a minimum the successful completion of a specified number of approved credits of graduate study at the University and the passing of prescribed examinations. Credit hours for a master's or doctoral degree may include formal course work, independent study, research, preparation of a thesis or dissertation, and such other scholarly activities as are approved by the candidate's program committee and the Dean of the Graduate School.

*It is the student's responsibility to know the calendar, regulations and pertinent procedures of the Graduate School and to meet its standards and requirements. These are set forth in this bulletin, the Graduate Student Manual, the Statement on Thesis Preparation, and other publications, all of which are available to graduate students at the Graduate School Office.*

These documents govern both master's and doctoral degree programs. The manual gives detailed information on responsibilities of major professors and program committees, examination procedures, preparation of theses and dissertations, academic standards, and the Graduate Student Academic Appeals System.

The requirements immediately following are general requirements for all graduate students. Specific requirements for individual programs are itemized in the section on Graduate Programs.

### PROGRAM OF STUDIES

All degree candidates are required to prepare a program of studies with the guidance of their major professors (for master's degree programs) or of their program committees (for doctoral programs) in accordance with the guidelines in the *Graduate Student Manual*. After the program has been approved by the major professor for master's degree candidates or program committee for doctoral candidates as specified in the manual, the program of studies is to be submitted for approval to the Dean of the Graduate School.

The purpose of the program of studies is to ensure that the student, at an early stage in his graduate study, organizes a coherent, individualized plan for his course work and research activities. It is expected that the successful completion of the student's program of studies along with collateral readings, research, etc., will enable him to demonstrate that he has achieved the high level of competence required of graduate students in their respective fields.



### COURSE NUMBERING SYSTEM

All regular graduate courses are now numbered at the 500 and 600 levels. 900-level courses are special types of graduate courses for which no graduate credit is given. Courses numbered at the 400 level are for advanced undergraduates, but may, with approval and to a limited extent, be accepted toward meeting degree requirements at the master's level. For doctoral candidates who have completed the master's degree in the same field or one closely related, all program work must be at the 500 or 600 level. Candidates for the doctorate may receive up to 30 credits toward the minimum required for recent graduate work taken at other institutions if appropriate for the program and discipline.

### SCHOLASTIC STANDING

Graduate work is evaluated by letter grades. All grades earned will remain on the student's record and, unless the courses were approved for no program credit prior to registration, will be included in calculating the student's scholastic average. Only grades of A and B carry graduate credit for courses below the 500 level. In 500- and 600-level graduate courses only grades of A, B and C will be credited toward the degree.

A grade of C or lower in courses numbered below the 500 level is considered a failing grade. In such cases of failure the course must either be repeated or else replaced by another course approved by the candidate's program committee and the Dean of the Graduate School. If a student receives more than one C in courses below the 500 level, his graduate status is subject to review by the Dean of the Graduate School.

Grades of D and F are failing grades in 500- and 600-level courses and require immediate review of the student's status. Courses failed at this level must be repeated or else replaced by another course approved by the candidate's program committee and the Dean of the Graduate School.

The grades S (satisfactory) and U (unsatisfactory) will be used for courses of study involving research undertaken for the thesis or dissertation and for certain courses and seminars so designated. The letter I (incomplete) is used for excused unfinished work. Incomplete grades assigned to graduate students in May 1971 or thereafter may be removed within one calendar year by completion of the required work. If the grade of I (incomplete) is not removed within one calendar year, it will remain on the transcript but may not be used for program credit. Grades of S, U and I are not included in the academic average.

For graduation an average of B (3.0 on a 4.0 scale) in all work is required, except for courses meeting entrance deficiencies or approved for no program credit prior to registration in the course. At any time when the student's record indicates unsatisfactory performance his status is subject to review. A student who fails to maintain satisfactory scholarship or to make acceptable progress in his program will be terminated as a graduate student.

### MASTER'S DEGREE REQUIREMENTS

There are no major or minor area requirements for the master's degree. However, no degree can be awarded for the accumulation of credits without a planned program of study. Courses for the degree are expected to be concentrated in the candidate's field of interest and related areas to



produce a well-developed and coherent program which will meet his special objectives.

Requirements for the master's degree must be completed within a period of four calendar years, or seven calendar years with special permission of the department and the Dean of the Graduate School if the study is done on a part-time basis. The master's degree may be earned either through full- or part-time study or by a combination of the two. Candidates must take at least 80 percent of the credits required for the degree at the University of Rhode Island.

Some departments offer both a thesis and a non-thesis option while others offer only one plan. Please refer to the chapter on Graduate Programs for specific information on each program. The general requirements for these options are as follows.

#### Thesis Option

The minimum requirements for a master's degree are: (1) The successful completion of 30 credits, including 6 thesis research credits. (2) At the discretion of the department, the passing of written comprehensive examinations toward the end of the course work. (3) The submission of an acceptable thesis and the passing of an oral examination in defense of the thesis. Four copies of the thesis prepared in accordance with Graduate School requirements must be submitted to the Graduate School Office. A statement on preparation of theses is available from that office.

#### Non-Thesis Option

Depending upon departmental requirements, some master's degrees may be earned without a thesis. The minimum requirements for a non-thesis master's degree program are: (1) The

successful completion of a minimum of 30 credits. (2) Registration in advanced seminars, practicums, internships, or other experiences useful to the student's future professional career. (3) Registration in one course which requires a substantial paper involving significant independent study. (4) The passing of a written comprehensive examination toward the end of the course work. Some departments may also require a final oral examination.

#### Language

Although a language is not normally required for the master's degree, a student's major professor or thesis committee may require proficiency in a foreign language where appropriate for the subject chosen.

### PROFESSIONAL DEGREE REQUIREMENTS

Students should refer to the specific program requirements for professional degrees and consult with the appropriate dean or director.

### DOCTOR OF PHILOSOPHY DEGREE REQUIREMENTS

The Doctor of Philosophy degree must be completed within seven years of the date when the student is first enrolled as a candidate.

The requirements for the doctor's degree are: (1) The completion of a minimum of 72 credit hours of graduate study beyond the baccalaureate degree, of which a minimum of 42 credit hours must be taken at the University of Rhode Island. (2) Satisfying the residence requirement that the student must maintain full-

time residence for at least two semesters, exclusive of summer sessions, while acquiring the last 42 credits for the degree. Residence is interpreted as full-time attendance on campus or in the Division of University Extension during a regularly scheduled semester. Study carried on elsewhere under a University adjunct professor or in a laboratory having University of Rhode Island affiliation may also qualify as residence. With the exception of graduate assistants, research assistants, and other employees of the University, no candidate for the doctorate may count, except by action of the Graduate Council, part-time study toward satisfying this residence requirement. (3) If required by his department, proficiency in one or more foreign languages and/or in an approved research tool. (4) The passing of a qualifying examination. (5) The passing of a comprehensive examination. (6) The completion of a satisfactory dissertation. (7) The passing of a final oral examination in defense of the dissertation. The department in which the student studies for the doctor's degree may or may not require a master's degree preliminary to, or as a part of, the regular course of study.

#### Qualifying Examination

This examination is intended to assess a student's potential to perform satisfactorily at the doctoral level, and is not a review of courses taken. A student without a master's degree who is accepted as a doctoral candidate is expected to take a qualifying examination, usually after 24-30 credits of course-work have been completed. A student who holds a master's degree in the same or a closely related field is normally not required to take the examination. If an examination is to be required, it will be stipulated in the letter of admission.

#### Comprehensive Examination

Each doctoral candidate shall take comprehensive examinations at or near, but not later than 12 months after, completion of the formal courses stipulated in the program of study. The examination is designed to assess the student's intellectual capacity and adequacy of training for scholarly research.

The comprehensive examination consists of two parts: written, requiring a minimum of eight hours; and oral, requiring not more than two hours. The student, with the approval of his program committee, applies to the Graduate School to take the examination. The oral examination committee includes the student's committee and two additional members of the Graduate Faculty appointed by the Dean of the Graduate School. One of the additional members

represents a field of study allied to that of the student's concentration. The candidate's major professor arranges for and chairs the examination. Unanimous approval by the examining committee is required for passing the comprehensive examination.

A candidate whose performance fails to receive unanimous approval of either examining committee may, upon the committee's recommendation, be permitted one reexamination in the part or parts failed, to be taken only after an interval of at least ten weeks.

#### Final Oral Examination

This examination is a defense of the dissertation and is open to all members of the faculty and, generally, to all students. The examination, usually two hours long, is conducted by an examining committee comprised of the candidate's program committee and two additional graduate faculty members appointed by the Dean of the Graduate School. One of the appointed members will be designated by the Dean to chair the examination.

Unanimous approval of the examining committee is required for passing. If the candidate does not perform satisfactorily, the committee may recommend one reexamination under stated conditions.

#### Research Tool

Each department, in cooperation with the Graduate School, is authorized to formulate and to amend its own requirements and methods of testing for competency in research tools such as computer science, foreign language(s) or statistics. The department may, in turn, delegate this responsibility to the program committee for each individual doctoral candidate.

### THESES AND DISSERTATIONS

For the oral defense, a sufficient number of completed copies of the thesis or dissertation, in a form acceptable to each member of the examining committee and the Dean of the Graduate School, is required. After all changes and corrections have been made, four copies prepared in accordance with Graduate School and Library requirements must be submitted to the Graduate School Office. Four copies of an abstract, not to exceed 600 words, are also required.

Students are advised to consult the *Statement on Thesis Preparation and Instructions for Thesis Defense* available in the Graduate School Office and the most recent edition of Kate L. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations* published by the University of Chicago Press.

## Admission and Registration

### ADMISSION

Persons holding the baccalaureate degree and wishing to take graduate-level courses at the University may do so through admission to the Graduate School as degree candidates, or may be accepted for postbaccalaureate work as non-degree students. Admission to the Graduate School is based upon academic qualifications and potential without regard to age, race, religion, sex or national origin.

Application forms may be obtained from the Dean of the Graduate School, University of Rhode Island, Kingston, Rhode Island 02881. Zip code should be included in the applicant's return address. Inquiries concerning particular degree programs or courses of instruction should be addressed to the appropriate department chairman.

Applications and credentials are to be submitted to the Dean of the Graduate School who, after obtaining the recommendation of the department concerned, notifies the applicant of either full or conditional admission, or rejection. Final decision rests with the Dean of the Graduate School.

Where admission to a doctoral program is possible for those holding the bachelor's degree and meeting other requirements, the Graduate School reserves the right to offer admission only to the master's program while postponing a decision on admission to the doctoral program until at least a substantial portion of the master's work has been completed.

All applications must be accompanied by a \$12 non-refundable application fee. Simultaneous application to more than one department requires duplicate applications and credentials and separate application fees.

General deadlines for receipt of applications and all supporting documents are April 15 for September or Summer Session admission, and November 15 for January admission. As is indicated in the Graduate Programs section of this bulletin, certain programs admit students only for September and/or have earlier deadlines. There is no assurance that applications completed after these dates will be processed in time for enrollment in the desired semester. Admission is offered for a specific entrance date only, and must be reconsidered if a postponement is subsequently requested.

### Foreign Applicants

Applicants from foreign countries must complete the Test of English as a Foreign Language (TOEFL) with minimum scores of 500 for students applying for science programs and 550 for non-science programs. All inquiries from foreign students concerning applications, fees,







of study. The request for transfer credit must have the approval of the student's major professor and the Dean of the Graduate School. If transfer credit is desired for work taken elsewhere after a graduate student is enrolled at this University, prior approval must be obtained from the Dean of the Graduate School.

#### Degree Candidates

Applicants must forward to the Dean of the Graduate School two completed application forms, two official copies of transcripts of all previous college work sent directly by the issuing institutions, three letters of recommendation and scores in the appropriate nationally administered tests. Tests required for specific programs may be found in the Graduate Programs section of this bulletin.

For acceptance on full status in the Graduate School, in addition to satisfactory test scores and references, applicants should have maintained an undergraduate average of approximately B (3.0 on a 4.0 scale). Applicants with undergraduate averages below this level, but not less than 2.0, may be admitted to conditional status upon the submission of high test scores. Such persons will be admitted to full graduate standing upon the completion of the equivalent of one semester of full-time work with a grade average of B or better. No student may remain on conditional status for more than two consecutive semesters.

In certain cases, applicants who have been denied admission may be advised to take several courses in non-degree status (see below) to provide a basis for a later reconsideration of their applications. In such cases, these courses are usually regarded as entrance deficiencies and are not accepted for advanced standing within minimum-credit programs of study.

housing, etc., should be sent to the Director for International Student Affairs, Taft Hall.

#### Transfer Credit

Transfer credit may be requested for graduate work taken at other accredited institutions of higher learning. Such credits may not exceed 20 percent of the total credits required for the master's degree program or 30 credits in a doctoral program. The transfer work must have been taken at the graduate level (equivalent to the 500 level or higher in the University of Rhode Island course numbering system) and graded as B or higher, must have been completed not more than five years prior to the date of request for transfer into a master's program (ten years for the doctoral program), and must have a clear and unquestioned relevance to the student's program

### Non-Degree Students

Non-degree students are those who desire registration with credits in courses during a regular academic year and who are not seeking an advanced degree. Non-degree students do not have the privileges regularly enjoyed by degree candidates. For example, their enrollment in courses is subject to the accommodation of degree candidates wishing to take those courses. No more than a total of 12 credit hours of work taken at the University of Rhode Island in non-degree status may be applied toward degree requirements if the student is later admitted to a degree program, and then only upon recommendation of the student's program committee and with the approval of the Dean of the Graduate School. Advanced standing for work taken at another institution, or obtained by examination or equivalency, must also be included within this limit.

Applicants seeking acceptance in non-degree status must file the regular application for admission and submit the required transcripts. They need not, however, submit letters of recommendation or scores on nationally administered tests until such time as they may wish to apply for admission to a degree program.

### REGISTRATION

The responsibility for being properly registered rests with the student. Each student must register and complete his registration within the time period announced by the University. The chairman of the student's major department will assign an adviser to assist the new graduate student in planning his program.

Registration for each semester consists of three separate procedures: registering for course selections, payment of fees, and obtaining a class program.

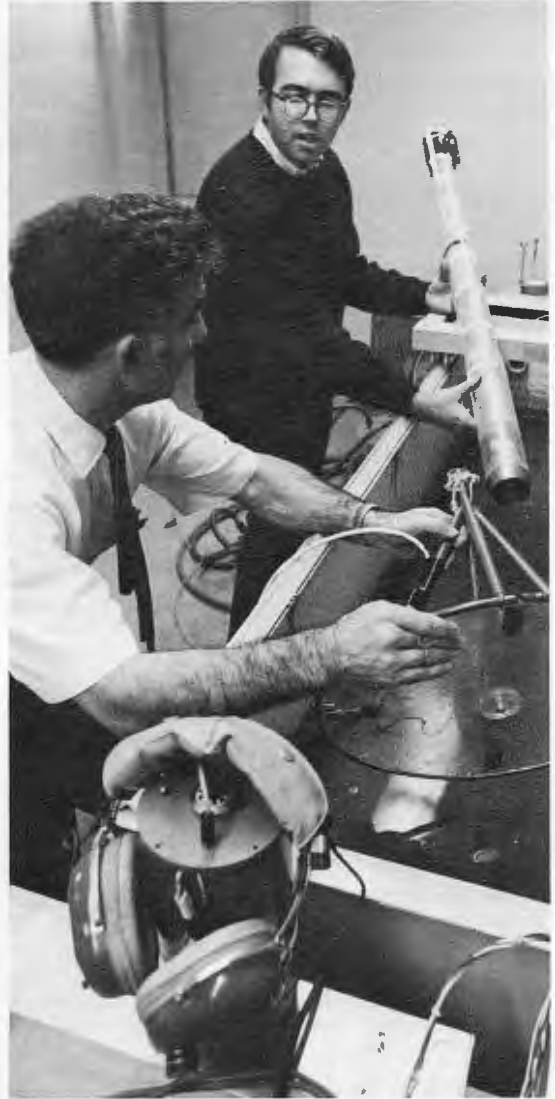
#### Registering for Course Selections

Students must obtain registration materials at the announced time and place. Currently enrolled students register in November for the spring semester and in April for the fall semester. Completed registration materials are submitted to the Registrar during the registration period, according to the announced instructions.

New and transfer students will be instructed concerning registration procedures.

#### Payment of Fees

Arrangements must be made with the Bursar for complete payment of tuition and/or fees by the due date. Class programs will be issued only



for those students who have registered for course selections, and satisfied payment requirements with the Bursar.

#### Class Programs

Students may not attend classes without class programs. These are issued prior to the first day of classes according to instructions from the Office of the Registrar.

#### Drop and Add

Students are permitted to add courses and to drop courses without a fee penalty (see page 18) during the first two weeks of classes. The final day to drop courses without a failing grade is midsemester.

### Change of Address

It is the responsibility of the student to complete a change of address form in the Office of the Registrar whenever a change is made in his local, campus, or mailing address.

### Summer Session

Although many graduate-level courses are offered during the Summer Session, the University does not guarantee that any particular course will be offered. The availability of individual faculty members to supervise research or to participate in comprehensive examinations and examinations in defense of theses or dissertations during the Summer Session varies from year to year. During the Summer Session, special arrangements must be made with both the Graduate School and the department for scheduling comprehensive examinations and thesis or dissertation defenses. Graduate students must make prior, individual arrangements for taking directed studies or special problems courses.

### Time Limit and Continuous Registration

A graduate student is expected to complete his course work and research within the four-year time limit prescribed for the master's degree and the seven-year time limit for the doctorate. A student who has completed his course work and residence requirement is required to register and pay for Continuous Registration (CR) until his thesis or dissertation and all examination requirements are completed. A student must also be registered for either course work or CR during the semester in which he expects to complete all degree requirements. Upon application to the Dean of the Graduate School, the time limit for a degree program may be extended for such legitimate reasons as military service or serious illness. This request requires the endorsement of the student's major professor or department chairman.

See the *Graduate Student Manual 1976*, Section IV B, for regulations regarding interruptions of study, notification requirements, and circumstances under which graduate students will be assumed to have withdrawn from the University.

A student who does not register for a semester or obtain approval for an interruption of studies or leave of absence will be considered as voluntarily withdrawn.

### Full-time and Part-time Students

The normal full-time registration is 12 credit hours of study during a regular semester. Minimum full-time registration is nine credit

hours during a regular semester and six credit hours during a summer term. Full-time registration is required of all students holding fellowships, scholarships, and traineeships administered by the University. Students who do not meet the minimum full-time registration requirement are considered part-time students.

### Off-campus Activity

Students who wish to register for credits to be counted toward a degree, and who will be earning these credits through off-campus activities such as research or independent study at a national laboratory, are required to obtain prior approval of the Dean of the Graduate School and to have these activities listed as part of their programs of study.

### Intellectual Opportunity Plan (Pass/Fail Option)

To allow graduate students to venture into new areas of knowledge without fear that their scholastic average will suffer, the Graduate Council has approved the Intellectual Opportunity Plan. To be eligible for this option, the student's major professor or adviser must certify that the course or courses are outside the student's major field of study, are not entrance deficiencies, and are not specific requirements of, but are relevant to, the student's program. A maximum of four credit hours may be taken by the master's degree candidate and a maximum of eight credit hours, including any taken as a master's candidate, by the Ph.D. candidate.

### Credit by Examination or Equivalent

In master's programs only, a maximum of six credits may be allowed for competency based on experience outside the traditional academic setting and demonstrated by examination or equivalent. This maximum of six credits must fit within an overall maximum of 12 credits including program credit allowed for advanced standing and transfer credit, if any. See the *Graduate Student Manual 1976*, Section 7.30 for details of this procedure.

### Audit

Courses may be audited with the approval of individual course instructors and by presenting an auditor's card secured from the Registrar. An auditor receives no course grade; consequently, an audited course does not count as part of the student's course load for registration purposes, and cannot count as work taken toward completion of residence requirements. A student must be enrolled in at least one other course to be permitted to audit a course.

## Fees and Financial Aid

*Charges and fees set forth in this bulletin are subject to change without notice.*

Tuition and fees vary according to whether or not the student is a legal resident of the state of Rhode Island and according to full-time or part-time enrollment. All charges are payable by the semester on receipt of the bill.

The Dean of the Graduate School classifies each student admitted to the University as a resident or nonresident student on the basis of all relevant information available to him. A Rhode Island resident must file with the Bursar a certificate of residence signed by the clerk of the Rhode Island city or town where he claims legal residence. A student may appeal the decision to the Board of Residence Review.

### New England Regional Student Program

Under the provisions of the New England Regional Student Program for graduate students, administered by the New England Board of Higher Education, the University charges the Rhode Island resident tuition rate to residents of another New England state who are matriculated graduate students in certain programs. The specific program must be one which is *not available* at the student's home-state university. Normally, these programs are listed in the New England Regional Student Program graduate level booklet. In cases where an apparently similar program of study is available at both institutions involved, a resident of another New England state must obtain certification from the dean of the Graduate School of his home-state university that the program of study is not available there. This certification will normally take the form of a statement by the chairman of the relevant department endorsed by the graduate dean. Inquiries and requests for further information may be directed to the Dean of the Graduate School at the University of Rhode Island or to the New England Board of Higher Education, 40 Grove Street, Wellesley, Massachusetts 02181.

### Rhode Island Inter-institutional Exchange

Any full-time student matriculated at one of the public institutions of higher education in Rhode Island may enroll for a maximum of seven (7) credit hours of his/her full-time schedule per semester for study at one of the other public institutions at no additional expense. Each institution will determine and maintain the integrity of the degree to be awarded. Students will be subject to the course selection process applicable at the receiving institution. Summer session and continuing education registrants are not covered under this program. Students interested in this arrangement should contact the Registrar's Office.



### Schedule of Fees

This schedule of fees is effective for the 1976-77 academic year. The University reserves the right to revise its schedule of tuition and fees without notice.

#### Full-time, One Academic Year

Students registered for nine (9) or more credits are considered full-time and are charged the following fees:

##### Tuition

Rhode Island residents	\$770.00
Out-of-state residents	1300.00
Registration fee	10.00
Graduate student assessment	51.00
Health Services fee*	80.00
Medical Insurance fee*	34.00

#### Part-time, One Semester

Students registered for eight (8) credits or less are charged the fees below. Residents maintaining continuous registration and registered for no credit are required to pay a fee of \$45 per semester; non-residents pay \$75 per semester.

##### Tuition, per credit hour

Rhode Island residents	\$45.00
Out-of-state residents	75.00
Registration fee	5.00
Graduate student assessment, 5-8 credits	5.00
4 credits or less	1.00

#### Division of University Extension

See the Division's degree programs bulletin.

#### Summer Session

See the Summer Session bulletin.

#### Application Fee

Twelve dollars (\$12) must accompany each application for admission. See page 13 for application procedure.

#### Additional Fees

Students may be asked to make key deposits and to cover laboratory and other incidental expenses for specific courses.

Master's degree candidates must pay a thesis-binding fee of \$4 and doctoral candidates must pay a dissertation-binding and microfilming fee

of \$30. These fees are due before the candidate submits his dissertation for approval by the Graduate School. All degree candidates must pay a diploma fee of \$10.

#### Late Fees

A late registration fee of \$15 for the first day and \$5 for each succeeding day (not including Sundays or holidays) is charged unless excused by the Registrar.

Each course dropped after the conclusion of the "drop and add" period (see page 15) incurs a \$5 charge unless the student withdraws from the University.

#### Remission of Fees

Remission of tuition and the registration fee is granted to holders of tuition scholarships, graduate assistantships and most fellowships. This policy does not include graduate research assistants and associates whose stipends are normally larger than those of graduate assistants. The health services and medical insurance fees and the graduate student assessment are excluded from this remission policy.

#### Refunds

Refunds of payments made or credits against amounts due to the University shall be made to students who officially withdraw according to the following scale: first two weeks, 80%; third week, 60%; fourth week, 40%; fifth week, 20%; after five weeks, no refund. The attendance period in which withdrawal occurs is counted from the first day of registration and includes weekends and holidays.

### FINANCIAL AID

There are several forms of financial assistance available to graduate students. To be eligible for any form of assistance, the student must first be admitted to the Graduate School. Detailed information (stipends, allowances, tenure, etc.) on the fellowships, scholarships, and assistantships described below is available from the Graduate School Office and is included in the *Graduate Student Manual*. Fellowships, and scholarships are awarded by the Dean of the Graduate School to students selected from nominees submitted by department chairmen. Students are advised to request nomination for these awards by the chairman of the department in which they plan to study or are currently enrolled at the University.

\*All full-time graduate students entering the University in September 1975 or thereafter are required to participate in the University Health Services plan and accompanying Medical Insurance plan. Individuals who present evidence to the Bursar of participation in an approved comprehensive health plan will be exempted from this requirement.

## Fellowships

Fellowships are awarded to graduate students in recognition of achievement and promise as scholars. They are intended to enable students to pursue graduate studies and research without rendering any service to the University. A fellow's stipend is not considered compensation, but a gift. Graduate fellows are required to be full-time students and may not engage in additional remunerative work without the specific approval of the Dean of the Graduate School.

*Special Fellowships* are supported by various industrial firms, private foundations and individuals, and are usually restricted to students in particular areas of study and research. The stipends and supplemental allowances of these fellowships are not uniform.

A limited number of *University of Rhode Island Graduate Fellowships* is awarded each year. URI Fellows receive a stipend of \$3,000 for the academic year and have tuition remitted by the University.

*Public Health Service Predoctoral and Special Fellowships* are provided to enhance the competence and increase the number of professional persons in the medical sciences and other health-related fields. These fellowships are awarded by the National Institutes of Health and by the Bureau of State Services Divisions of Nursing, Air Pollution, and Water Supply and Pollution Control. Applications for these fellowships are made directly to Career Development Review Branch, Division of Research Grants, National Institutes of Health, Public Health Service, Bethesda, Maryland 20014.

## Graduate Assistantships and Graduate Research Assistantships

Assistantships are awarded to full-time graduate students to provide them with teaching and research training. Assistants may be required to provide service for up to 20 hours per week. Appointments are initiated by department chairmen. To be eligible for such an appointment, the student must first be admitted to the Graduate School. His application for the assistantship should be submitted to the department chairman by February 15. Appointments are announced about April 1.

*Graduate Assistants* assist, under supervision, with instructional and/or research activities of a department. Not more than ten hours per week will be in classroom contact. Graduate assistant stipends for the 1976-77 academic year range from \$3100 to \$3500, depending upon qualifications and experience. In addition, tuition and the enrollment fee are remitted for the academic year of the appointment. Additional

remuneration is given for any work done during the summer, although such work cannot be guaranteed.

*Graduate Research Assistants* are assigned to individual research projects sponsored either by the University or by an outside agency. On supported research contracts and grants, the graduate research assistants are judged to be employed on a half-time basis (based on a 40-hour week). For this they normally receive a stipend ranging from \$3880 to \$4810 for nine months without remission of tuition or fees. Additional remuneration is given for any work done during the summer months.

*Graduate School Affirmative Action Assistantships.* A limited number of graduate assistantships, assigned to the Graduate School, are awarded to members of HEW-designated minorities and to women in programs having a substantial predominance of male students. In all other respects, these assistantships are identical to the graduate assistantships described above.

## Other Assistance

*Tuition scholarships*, which provide for the remission of tuition and enrollment fees, are awarded by the Dean of the Graduate School from University funds. These scholarships are awarded to qualified students demonstrating need of financial assistance. Application forms are available in the Graduate School Office.

*Loans* for qualified students are available. For information contact the Student Aid Office in Davis Hall, which administers them.

*Veterans' benefits* information may be obtained from the Graduate School Office or from the Veterans Liaison Officer on campus. All students receiving veterans' benefits are required to report to the veterans' representative in the Graduate School Office upon withdrawing from or dropping any course, or upon withdrawal from the University. Failure to do so will result in the termination of veterans' benefits.

## Graduate Programs

This section must be read in conjunction with the preceding sections on Degree Requirements and on Admission and Registration. The specific admission and program requirements listed below are included within the general requirements set forth in the preceding sections, and do not reduce those general requirements. For example, scores on the Verbal and Quantitative Aptitude Tests of the Graduate Record Examination (GRE) are required of all applicants unless another nationally-administered test such as Graduate Management Admission Test (GMAT) or the Miller Analogies Test (MAT) is specified below. Scores on the GRE Advanced (subject matter) Tests are required only where specified below.

Please note that the specific program requirements given on the following pages are minimum requirements. For example, additional course credits may be required for individual candidates whose academic background is insufficient.

*The availability of programs of study and areas of specialization set forth in this section, as well as their administrative location, requirements and titles, are subject to change without notice.*

Each graduate program at the University of Rhode Island is designed primarily as a learning experience for the student. The University experience is designed to provide the successful student with a range of knowledge and skills which can be utilized in a variety of ways after graduation provided that they are combined with appropriate motivation and initiative. Options available to students vary from the traditional liberal education to programs which are heavily professionally oriented. Successful completion of any course of study at the University, however, does not guarantee that the student will find either a specific kind or level of employment.

Students who are interested in the career opportunities related to particular programs of study are encouraged to discuss their interests with the appropriate department chairman or director of graduate studies as listed in this bulletin, with the deans of the Graduate School, and/or with the staff of the Office of Career Planning and Placement. Students who are uncertain about their career choice are invited to inquire about the services offered by the Counseling Center.

**Accounting**

M.S.

## GRADUATE FACULTY

Associate Professor Martin, *chairman*. Professor Sanderson; Associate Professors Brandon, Matoney, Vangermeersch, Wood; Assistant Professors Bracken, Looney, Schwarzbach, Swanson.

## MASTER OF SCIENCE

*Admission requirements:* undergraduate grade point average of approximately B or above and a score at the fiftieth percentile or above on the GMAT examination. Applicants for whom English is not the native language will be expected to demonstrate proficiency in written and oral communications (TOEFL score of 575 or above), or they may be required to correct deficiencies by taking selected courses for no program credit.

*Program requirements:* from 30 to 60 credits depending upon undergraduate program. A thesis is optional but the candidate is required to take GBA 671 if he elects the non-thesis option. A written comprehensive examination is required and an oral examination is optional at the discretion of the department.

## MASTER OF BUSINESS ADMINISTRATION

See Business Administration program, page 22.

All 500- and 600-level courses offered by departments in the College of Business Administration are open to matriculated graduate students only.

**Animal Pathology**M.S., Ph.D. (*Biological Sciences*)

## GRADUATE FACULTY

Professor Yates, *chairman*. Professor Chang; Associate Professor Wolke; Visiting Assistant Professor Brown; Adjunct Professors Dardiri, Liu.

## SPECIALIZATIONS

Characterization of avian adeno and adeno-associated viral infections in cells, embryos, and in avian and mammalian hosts; recovery of viruses from inland estuaries, streams and ponds; ichthyopathology; diseases of invertebrates.

## MASTER OF SCIENCE

*Admission requirements:* GRE and an undergraduate major in biological science with a concentration in animal science, microbiology, botany or zoology; mathematics through introductory calculus; one year of organic chemistry and physics. Courses in statistics, histology and physiology are strongly recommended.

*Program requirements:* thesis and BCP 581, 582; APA 501, 502, 534, 536; MIC 432, 533.

DOCTOR OF PHILOSOPHY  
(BIOLOGICAL SCIENCES)

*Admission requirements:* same as for master's degree.

*Program requirements:* courses listed under M.S. degree and APA 538; BCP 521; MIC 552, 541.

**Animal Science**

M.S.

## GRADUATE FACULTY

Professor Millar, *chairman*. Professors Meade, L.T. Smith; Associate Professors Durfee, Gould, Henderson, Hinkson, Kupa; Assistant Professors Golet, Gray, Nippo.

## SPECIALIZATIONS

*Aquaculture:* nutrition, physiology, genetics, aquaculture systems. *Wildlife management:* game bird propagation, habitat management. *Small animals:* physiology.

Research in aquaculture is a cooperative effort supported by the National Sea Grant Program and the R.I. Agricultural Experiment Station.

## MASTER OF SCIENCE

*Admission requirements:* GRE. A bachelor's degree in agriculture or biological science is preferred.

*Program requirements:* thesis.

**Biochemistry and Biophysics**M.S., Ph.D. (*Biological Sciences*)

## GRADUATE FACULTY

Professor Fisher, *chairman*. Professors Constantinides, Dain, Hartman, Purvis, Tremblay; Associate Professor Bell; Adjunct Professors Douglas, Hammond.



## SPECIALIZATIONS

Mitochondrial metabolism and transport, comparative biochemistry of the cytochromes, biochemical aspects of endocrinology, neurochemistry, chemical embryogenesis of the nervous system and mechanisms of action of nervous tissue, glycolipid synthetic enzymes, regulation of protein synthesis, pyrimidine metabolism, control of blood coagulation, control of enzyme activity, electron microscopy, mammalian cell culture and tumor viruses, structure and functions of nucleic acid and ribosomes, structure of viruses, infra-red and Raman spectroscopy.

## MASTER OF SCIENCE

*Admission requirements:* GRE (including advanced test) and a bachelor's degree in some field of science or engineering including 2 semesters each in organic chemistry with laboratory, biological sciences, and calculus, and 1 semester in physics. Students may be accepted with deficiencies which must be made up without program credit.

*Program requirements:* Thesis and BCP 435, 521, 541, 581, 582 and 3 credits in a 600-level course from any department exclusive of seminar, special topics or research.

DOCTOR OF PHILOSOPHY  
(BIOLOGICAL SCIENCES)

*Admission requirements:* Same as for master's degree; M.S. degree not required to enroll in Ph.D. program.

*Program requirements:* Same as listed under master's degree; plus BCP 595, 596 and at least 6 credits of BCP at the 600 level, exclusive of BCP 699.

**Botany**

*M.S., Ph.D. (Biological Sciences)*

## GRADUATE FACULTY

Professor Goos, *chairman*. Professors Albert, Beckman, Caroselli, Hauke, Lepper, Palmatier, Smayda, Wood; Associate Professors Halvorson, Hargraves, Harlin, Mottinger, Swift; Adjunct Professor Simmons.

## SPECIALIZATIONS

Aquatic botany (marine and freshwater); genetics and cytogenetics, mycology, plant development, plant ecology, plant pathology, plant physiology, plant taxonomy.

## MASTER OF SCIENCE

*Admission requirements:* GRE including ad-

vanced test and undergraduate major in the sciences. Candidates lacking undergraduate courses in organic chemistry, physics, mathematics through introductory calculus, and fundamental courses in biological sciences may be required to make up deficiencies without graduate credit.

*Program requirements:* thesis and BOT 581, 582.

DOCTOR OF PHILOSOPHY  
(BIOLOGICAL SCIENCES)

*Admission requirements:* same as for master's degree, and master's degree normally required.

*Program requirements:* one foreign language or proficiency in a research tool. Comprehensive examination will require competency in major areas of botany.

**Business Administration**

*M.B.A.*

## GRADUATE FACULTY

Professor Weeks, *dean*, College of Business Administration; Professor Johnson, *associate dean and director of M.B.A. program*.

*Accounting:* Associate Professor Martin, *chairman*. Professor Sanderson; Associate Professors Brandon, Matoney, Vangermeersch, Wood; Assistant Professors Bracken, Looney, Schwarzbach, Swanson.

*Business Law:* Professor Geffner; Assistant Professor Sisco.

*Finance and Insurance:* Professor Poulsen, *chairman*. Professors Brainard, Pitterman; Associate Professors Booth, Fitzgerald; Assistant Professors Dash, Lord.

*Management Science:* Professor Rogers, *chairman*. Professor Jarrett; Associate Professors Armstrong, Budnick, McLeavey, Shen, Sternbach; Assistant Professors Ageloff, Sanghvi, Zartler.

*Marketing Management:* Professor Alton, *chairman*. Associate Professors Bowman, Della Bitta, Hill, Loudon, Nason.

*Organizational Management & Industrial Relations:* Associate Professor Overton, *chairman*. Professors Coates, deLodzia, Schmidt; Associate Professor Desfosses; Assistant Professors Allen, Callahan, Comerford.

The Master of Business Administration program is offered on the Kingston campus for full-time and part-time students and in the evening at the Division of University Extension for part-time students. Full-time work is preferred and encouraged. Candidates may begin the

program in June, September or January of each year. Applications to the Dean of the Graduate School should specify the M.B.A. program and indicate on which campus study is to be undertaken.

#### SPECIALIZATIONS

Accounting, finance, insurance, management science, marketing management, organizational management and industrial relations, health care administration.

#### MASTER OF BUSINESS ADMINISTRATION

*Admission requirements:* undergraduate grade point average of approximately B or above and a score at the 50th percentile or above on the Graduate Management Admissions Test (GMAT). Applicants for whom English is not the native language will be expected to demonstrate proficiency in written and oral communications (TOEFL score of 575 or above), or they may be required to correct deficiencies by taking selected courses for no program credit.

*Program requirements:* the non-thesis program (36 credit hours) can be completed in one calendar year by students who satisfy all foundation requirements. Students with no foundation work completed will take two calendar years (60 credit hours) to finish the program. ACC 611; ECN 690; FIN 641, 645; GBA 671; MGS 682; MMG 651; OMR 626, 681; plus nine credit hours of elective courses in the College of Business Administration or outside of the College of Business Administration, provided the student obtains prior permission from the M.B.A. director.

All 500- and 600-level courses offered by departments in the College of Business Administration are open to matriculated graduate students only.

### **Business Education**

#### M.S.

#### GRADUATE FACULTY

Associate Professor Langford, *chairman*. Associate Professors Smith, Sink; Assistant Professors Clark, Allred.

#### SPECIALIZATIONS

Administration and supervision of business education, use of audiovisual equipment and materials in business education, consumer education, innovations in teaching business education, survey of office and distributive occupations, cooperative education programs, business communications.

#### MASTER OF SCIENCE

*Admission requirements:* undergraduate grade point average of approximately B or above and a score at the 50th percentile or above on the MAT examination for full admission.

*Program requirements:* undergraduate credit hours in accounting, finance, economics, marketing, management, production, statistics and business law. Candidates lacking undergraduate courses in business education may be required to make up deficiencies. Thirty credit hours without a thesis, including BED 524, 525, 526; six credits selected from BED 520, 522, 528; three credits in economics numbered above 400; three credits selected from EDC 572 and BED 428; six credits in academic business subjects selected from accounting, business law, computer science, economics, finance, insurance, management science and marketing management courses; plus three credits of graduate-level free electives numbered above 500.

All 500- and 600-level courses offered by departments in the College of Business Administration are open to matriculated graduate students only.

### **Chemical Engineering**

#### M.S., Ph.D.

#### GRADUATE FACULTY

Professor Treybal, *chairman*. Professors Gielisse, Mairs, Mohrnhelm, Shilling, Thompson, Votta; Associate Professors Barnett, Knickle, Rockett, Rose; Adjunct Assistant Professors Sahagian, Spano.

#### SPECIALIZATIONS

*Biochemical Engineering:* Fermentation processes, food engineering.

*Materials:* Ceramics, corrosion, electron microscopy, metal finishing, metal oxidation, metallurgy, materials engineering, X-ray metallography.

*Transfer Processes:* Adsorption, desalination, distillation, ion exchange, liquid extraction, membrane processes; dispersion processes, fluid dynamics, heat transfer, mass transfer, phase equilibria.

*Energy Engineering:* Nuclear technology, fuel technology, thermodynamics, pollution control, water resources.

#### MASTER OF SCIENCE

*Admission requirements:* GRE including advanced test in area of specialization. Bachelor's degree in chemical engineering; candidates from

other engineering fields or from mathematics, biology, chemistry, or physics may be accepted into the program with possible addition of prerequisite courses.

*Program requirements:* thesis option: CHE 501, 502. Non-thesis option for part-time students, with permission of the department: master's examination and comprehensive report with oral examination; CHE 501, 502.

#### DOCTOR OF PHILOSOPHY

*Admission requirements:* GRE including advanced test and M.S. degree in engineering (may be waived for University of Rhode Island graduate students who pass qualifying examination with superior performance).

*Program requirements:* a candidate's program will be determined in consultation with his committee and be based on his background and career goals. There is no general language requirement but a student's committee may require a foreign language or research tool which may be necessary for the candidate's program. In addition to an acceptable dissertation, a candidate must submit the manuscript of a paper, based on his research, suitable for transmission to a technical journal; CHE 501, 502.

### Chemistry

M.S., Ph.D.

#### GRADUATE FACULTY

Professor Cruickshank, *chairman*. Professors Abell, C. Brown, Goodman, MacKenzie, Rosie, Vittimberga; Associate Professors Cheer, Fasching, Gonzalez, Kirschenbaum, Nelson, Petersen, Rosen; Assistant Professors P. Brown, Freeman, Force.

#### SPECIALIZATIONS

*Theoretical aspects* include quantum mechanics, molecular orbital calculations, spectral interpretations, reaction mechanisms and kinetics (organic and inorganic), computer simulation, and hyperreactive intermediates. *Analytical and structural studies* employ spectral methods, mass spectrometry, light scattering, surface chemistry, photochemistry, organometallic compounds, X-ray crystallography, electrochemistry, neutron activation analysis, and gas chromatography. *Applications to contemporary problems* include studies in ancient organic residues, drug-receptor interactions, nucleosides, chelatable polymers, heterocycles, air and ocean analyses, alkali metal superoxides, and liquid crystals.

#### MASTER OF SCIENCE

*Admission requirements:* GRE, including advanced test. Minimum TOEFL score of 560. Preference is given to candidates with undergraduate majors in chemistry or chemical engineering with mathematics through calculus.

*Program requirements:* placement examination to determine specific program requirements; for thesis option (30 credit hours): 12 credit hours of graduate core courses in at least three of the four areas of chemistry, CHM 641 or 642 and thesis; for non-thesis option (36 credit hours): 18 credit hours of graduate core courses, CHM 641 or 642 and CHM 551, 552.

#### DOCTOR OF PHILOSOPHY

*Admission requirements:* same as for master's degree.

*Program requirements:* successful completion of qualifying examination; 18 credit hours of graduate core courses, CHM 641, 642; reading proficiency in one foreign language (French, German or Russian) or a research tool (computer science).

### Child Development and Family Relations

M.S.

#### GRADUATE FACULTY

Professor Fitzelle, *chairman*. Associate Professors Cohen, Greene, Rae, Spence; Assistant Professors Cooper, Schroeder; Adjunct Professor M.S. Smart; Emeritus Professor R. C. Smart.

#### SPECIALIZATIONS

Social and personality development in children, family life education, early childhood development.

#### MASTER OF SCIENCE

*Admission requirements:* fall admission only; GRE and 18 undergraduate credit hours distributed among at least three of the following areas; child development and family relations, psychology, sociology, biology, education.

*Program requirements:* 24 course hours plus 6 credits toward thesis (30 credit hours) or 24 course hours plus 6 related action thesis credits (30 credit hours).

### Civil and Environmental Engineering

M.S., Ph.D.

## GRADUATE FACULTY

Associate Professor McEwen, *chairman*. Professors Campbell, Nacci, Poon, Silva; Associate Professors Fang, Kelly, Lavelle, Moulthrop, Sussman; Assistant Professor Marcus.

## SPECIALIZATIONS

*Environmental Engineering*: water supply and treatment facilities, municipal and industrial waste treatment, flocculation and coagulation of wastes, pollution of marine sediments, air pollution, solid waste management, modeling of environmental systems.

*Soil Mechanics*: properties of ocean sediments, hydrostatic anchors, soil stabilization, thermal properties of soils, deep ocean sampling, ground water, hydrology, modeling of aquifers.

*Structural Engineering*: matrix and finite element analysis, computer and numerical methods, photoelastic stress analysis, curved highway bridges, marine structures, structural stability, thin-walled structures.

## MASTER OF SCIENCE

*Admission requirements*: GRE and bachelor's degree in civil or environmental engineering. Candidates in other engineering fields or in mathematics, biology, chemistry or physics may be accepted with the possible addition of prerequisite courses.

*Program requirements*: thesis or non-thesis option. 30 credit hours plus CVE 601, 602; a minimum of two courses taken outside the department. Non-thesis option requires comprehensive report.

## DOCTOR OF PHILOSOPHY

*Admission requirements*: GRE and master's degree in civil or environmental engineering or in a related field.

*Program requirements*: 30 course credits beyond the master's degree; one language; a three-course and a two-course minor from outside the department which may include work at the master's level.

## Community Planning and Area Development

M.C.P.

## GRADUATE FACULTY

Associate Professor Kupa, *director*. Professors Hammerschlag, Jeffrey; Associate Professors Brooks, Feast, Feld, Foster, Kumekawa; Assistant Professors Johnson,

Mahayni; Adjunct Professors Barber, Hoffman, Thomas.

## SPECIALIZATIONS

A focus on preparation of professional planners based on disciplinary skills, special techniques and integrative methodology leading to competence in general community planning. Concentrated studies in regional, environmental and inner-city planning are options open to students and central to their preparation. Special concentrations in urban design, land-use, coastal planning and natural resources planning are available.

## MASTER OF COMMUNITY PLANNING

*Admission requirements*: GRE; undergraduate background in the social sciences, architecture, landscape architecture, natural resources, engineering or geography preferred. Students are normally not admitted for January matriculation and only a limited number of part-time students can be admitted. Applications should be completed by March 15.

*Program requirements*: CPL 503, 504, 505, 508, 510, 601, 603, 606 or 608; EST 408; thesis or non-thesis option; summer internship or equivalent professional experience. The two-year program of 60 credit-hours is distributed one-half in core courses and about one-half in elected concentration and thesis. Students normally take 15-credits per semester to complete studies within two years. Not all CPL courses are necessarily offered in each academic year.

## Computer Science

M. S.

## GRADUATE FACULTY

Professor Hemmerle, *chairman*. Professor Carney, Merenda, L. Smith; Associate Professors Bass, Carrano, Hanumara, Lawing; Assistant Professors Heltshe, Tetreault, Weiderman.

## SPECIALIZATIONS

Operating systems, statistical computations, simulation, numerical analysis, artificial intelligence, programming languages, theory of programming, information retrieval, performance evaluation, theory of computation, computer-aided education, computer organization.

## MASTER OF SCIENCE

*Admission requirements*: bachelor's degree in-

cluding the equivalent of MTH 141, 142, Introductory and Intermediate Calculus with Analytic Geometry; MTH 243 Calculus and Analytic Geometry of Several Variables; MTH 215 Introduction to Algebraic Structures; CSC 201, 202, Introduction to Computing I and II; and CSC 311 Machine and Assembly Language Programming. GRE including advanced test in computer science, mathematics, or undergraduate major field is required for admission.

*Thesis option program requirements:* a minimum of 24 credits (exclusive of thesis) is required. At least 12 of these credits must be in CSC courses at the 500-level (exclusive of CSC 591, 592 unless approved by the major professor and department chairperson). Every candidate must complete CSC 411 and at least one course from each of the following four groups: 1) CSC 412, 413; 2) CSC 500, 551; 3) CSC 502, 515; 4) CSC 525, 535. A thesis is required.

*Non-thesis option program requirements:*

1) Substantial computational experience obtained through employment (normally two years).

2) 33 credit hours of course work with at least 15 credit hours at the 500-level or above, as follows: a) At least 24 credit hours selected from: CSC 412, 413, 500, 502, 512, 515, 525, 535, 551; EST 409, 412. b) Up to 6 credit hours of electives (or CSC 491/492, CSC 591/592 provided that these are conducted as seminar or lecture courses rather than project courses). c) A 3-credit-hour seminar (CSC 591). A written library research paper and an oral presentation of same is required. d) CSC 411 or equivalent is required, but may not be counted towards program credit.

3) Written comprehensive examination covering eight of the courses selected from 2a) above.

## Economics

M.A.

### GRADUATE FACULTY

Professor Sabatino, *chairman*. Professors Dirlam, Haller, Hellman, Norton, Rayack, Schurman; Associate Professor Starkey; Assistant Professors Barnett, Ramsay, Suzawa.

### SPECIALIZATIONS

Economic development, economic theory, industrial organization, international economics, money and banking, public finance, econometrics, mathematical economics. Combinations with business administration, public administration, community planning, computer science and statistics are available.

## MASTER OF ARTS

*Admission requirements:* GRE and, normally, some undergraduate training in economics. Some training in mathematics and statistics is also desirable.

*Program requirements:* thesis or non-thesis option, 30 credit hours, including, for Track I, ECN 512, 527, 528, 575, 576, and 515 or 516 or thesis. This track is strongly advised for students desiring to pursue further studies in the mainstream of contemporary thought or to prepare themselves for professional work in business, government and teaching at the university level. For Track II, ECN 512, 527, 528 and 515 or 516 or thesis. This track is available to students who prefer a wider range of courses and more freedom of choice. Track III is a terminal program in applied economics combined with some training in an area of vocational interest such as business administration, public administration, computer science or community planning. The programs in this track will be designed separately for each individual student.

## Education

M.A.

### GRADUATE FACULTY

Professor MacMillan, *chairman and coordinator of graduate studies*.

*Adult Education:* Associate Professors Bromley, McCreight; Instructor Jones.

*Educational Research:* Associate Professors Long, Pezzullo, Purnell, Soderberg; Assistant Professors Schaffran, Sullivan.

*Elementary Education:* Professor Nally; Associate Professors W. F. Kelly, Nagel; Assistant Professors Sullivan, Whitcomb.

*Guidance and Counseling:* Associate Professors Gunning, Maynard, Pascale.

*Reading:* Professor McGuire; Associate Professor Bumpus; Assistant Professor Baker.

*Science Education:* Associate Professors Croasdale, Kellogg.

*Secondary Education:* Professors Casey, Russo; Associate Professors Calabro, Heisler, Long; Assistant Professors Allen, Brittingham, Howard, Nelson, Willis.

Enrollment of foreign students is limited; a minimum TOEFL score of 600 is required.

The Master of Arts degree is offered in the following areas of study. Applicants should specify the area of specialization on the application form.

### ADULT EDUCATION

*Admission requirements:* MAT, teaching cer-

tificate or sound background in general education and/or social sciences, interview with program faculty.

*Program requirements:* thesis or non-thesis option. EDC 505, 529; 580 or 581; 582, 583 or 584; 585; and a minimum of 18 credit hours of education or other electives including six hours of thesis or non-thesis seminar. All courses are offered in late afternoon and/or evening.

#### EDUCATIONAL RESEARCH

*Admission requirements:* MAT or GRE, teaching certificate, strong background in mathematics or statistics.

*Program requirements:* thesis; EDC 503, 514 or 574, 529, 570 or 571; PSY 410, 434, 510, 520; computer science elective.

#### ELEMENTARY EDUCATION

*Admission requirements:* MAT and teaching certificate, one year teaching experience desirable.

*Program requirements:* thesis or non-thesis option. EDC 529, 570 and 572 or 577; 21 to 24 hours of coursework including 3 hours of foundations, 3 hours of methods, 3 hours of free elective, 6 hours of thesis or non-thesis seminar and 6 hours taken outside of Education Department.

#### GUIDANCE AND COUNSELING

*Admission requirements:* MAT, teaching experience at elementary or secondary school desirable for counseling at these levels, personal interview. Applications for summer, fall, and spring admissions reviewed by March 15 and October 15, respectively. Agency and Higher Education Counseling also available.

*Program requirements:* thesis or non-thesis option. EDC 450, 529, 551, 552, 553, 554, 555, 556. Six additional hours as planned with adviser.

#### READING

*Admission requirements:* MAT and teaching certificate, teaching experience under contract.

*Program requirements:* thesis or non-thesis option. EDC 503, 529; PSY 434; 24 credit hours of courses approved for the preparation of reading specialists including a thesis or six credit hours of clinic or practicum experience, and one or more electives.

#### SCIENCE EDUCATION

*Admission requirements:* MAT and teaching certificate, undergraduate major in science, interview with faculty.

*Program requirements:* EDC 529; 12-18 credit hours of education electives including six hours of thesis or non-thesis seminar and a minimum of 12 hours of science courses.

#### SECONDARY EDUCATION

*Admission requirements:* MAT or GRE and teaching certificate, one-year teaching experience desirable, undergraduate major in academic area of secondary education, interview with appropriate faculty.

*Program requirements:* thesis or non-thesis option. EDC 503, 529; 571, 572 or 574; additional 6-12 credit hours of education courses including six hours for thesis or non-thesis seminar and a minimum of 12 credit hours in academic area. For areas specializing in secondary education see Departmental Bulletin.

### Electrical Engineering

*M.S., Ph.D.*

#### GRADUATE FACULTY

Professor Polk, *chairman*. Professors Etzold, Haas, Lengyel, Lindgren, Mitra, Poularikas, Sadasiv, Spence, Tufts; Associate Professors Birk, Daly, Jackson, Jaron, Kelley, Mardix; Assistant Professors Krikorian, Ohley; Adjunct Professors Biberman, Cooper, Hall, Karlson, Middleton, Most, Zirkind; Visiting Professor Seely.

#### SPECIALIZATIONS

*Biomedical Engineering:* instrumentation, pattern recognition, X-ray holography, biological effects of electromagnetic radiation, cardiovascular modeling, control of cardiovascular assist devices, medical diagnostic techniques, health science application of computers—in cooperation with Rhode Island Hospital. *Acoustics and Underwater Acoustics:* information processing in acoustic channels, speech recognition, architectural acoustics, "noise pollution" studies. *Solid State Electronics and Photoelectronic Imaging Devices:* optical properties of non-metallic solids, solar cell development, heterojunction structures, development of photocathodes and photodetector arrays, performance analysis of displays and of imaging devices for infrared to X-ray spectrum. *Communication and Digital Systems:* computer graphics, multi-processing, data compression, digital filtering, pattern recognition. *System Dynamics and Control:* digital control of industrial robots, time varying and distributed parameter systems, electro-optical systems. *Electromagnetic Wave Propagation, Optics and Plasma Dynamics:* tropospheric and ionospheric propagation, atmospheric electricity, ELF noise and geomagnetic micropulsations; optical waveguides; optical computing and information processing; applications of holography.

**MASTER OF SCIENCE**

*Admission requirements:* GRE and B.S. in electrical engineering, engineering science, physics, mathematics, or computer science. Preparation in related fields such as aeronautical, civil, chemical and mechanical engineering or in the life sciences may be acceptable.

*Program requirements:* thesis or non-thesis option. Individual programs are designed in accordance with the students' backgrounds and interests. Thesis or non-thesis option: minimum of 18 credit hours in electrical engineering; 12 credit hours either in electrical engineering or in other areas of science and engineering. Programs of study require departmental approval.

**DOCTOR OF PHILOSOPHY**

*Admission requirements:* GRE and M.S. degree or equivalent in electrical engineering, engineering science, physics, mathematics or computer science.

*Program requirements:* for the comprehensive examination, background in several of the following areas is required—linear and nonlinear systems, communication and control systems, design of digital systems, electromagnetic theory and solid state physics. Most students find it essential to become thoroughly familiar with the application of digital computer techniques. Attendance at the departmental seminar (ELE 601/602) is required of all students in graduate residence. Dissertation research makes use of major, modern laboratories in the listed areas of specialization.

**English**

*M.A., Ph.D.*

**GRADUATE FACULTY**

Professor Miller, *chairman*; Associate Professor McCabe, *director of graduate studies*. Professors Goldman, Gullason, Hoffmann, Neuse, Pertrie, Potter, Robinson, Seigel, Smith, Sorlien, Steeves, White; Associate Professors Barker, Cane, Kunz, Marshall, Mathews, Murphy, Reaves, Towers, Tutt; Assistant Professors Arakelian, Campbell, Collins, Dvorak, Hills, Jacobs, Leo, Malina, Mensel.

**SPECIALIZATIONS**

*For the M.A. and for the Ph.D., all fields of English and American literature.*

**MASTER OF ARTS**

*Admission requirements:* GRE and a minimum

of 21 credits in English with a B average in all English courses.

*Program requirements:* 24 credits plus thesis (6 credits); OR 30 credits (including two 600-level seminars) plus comprehensive examination in three fields.

**DOCTOR OF PHILOSOPHY**

*Admission requirements:* GRE with advanced test (Literature in English) and M.A. in English or equivalent.

*Program requirements:* Reading knowledge of one foreign language, unless waived by doctoral committee in consultation with director of graduate studies. 24 credits (including four 600-level seminars) plus 18 credits of dissertation research. Written comprehensive examination in four areas (various options available: historical periods, genres, major figures, cross-disciplinary studies). Oral comprehensive examination in area of specialization. At least one course must be taken in each historical period in which a student does not write a comprehensive examination (courses taken for the M.A. may fulfill this requirement).

**Environmental Health Sciences**

*M.S.*

**GRADUATE FACULTY**

Professor Worthen, *program director*.

This interdisciplinary 36-credit program involves graduate faculty from the Colleges of Arts and Sciences, Engineering, Pharmacy, and Resource Development. Representative faculty from each of these colleges comprise a Steering Committee that supervises the program and advises the students.

**SPECIALIZATIONS**

Curriculum designed to prepare people for working in public health laboratories. In addition to a core curriculum, students are able to specialize in such areas as microbiology, environmental engineering or food chemistry.

**MASTER OF SCIENCE**

*Admission requirements:* GRE, bachelor's degree in biology, chemistry, engineering or allied field.

*Program requirements:* CVE 570, 571, 572 (2 of these 3 courses); EHS 562 (Interdisciplinary Seminar); EHS 563X (Public Health Administration); Biostatistics or a suitable substitute; FRC 432, 521, and MIC 412 or equivalent courses. Students are also required to take a course which

involves an assigned project including a comprehensive written report.

## Experimental Statistics

M.S.

### GRADUATE FACULTY

Professor Hemmerle, *chairman*. Professors Carney, Merenda, Smith; Associate Professors Bass, Carrano, Hanumara, Lawing; Assistant Professors Heltshe, Tetreault, Weiderman.

### SPECIALIZATIONS

Experimental design, multivariate methods, statistical computations, sequential methods, non-parametric methods, sampling methods, industrial statistics, genetics, psychometrics, ecological statistics, biostatistics.

### MASTER OF SCIENCE

*Admission requirements:* bachelor's degree including the equivalent of MTH 141, 142, Introductory and Intermediate Calculus with Analytic Geometry; MTH 243, Calculus and Analytic Geometry of Several Variables; MTH 215, Introduction to Algebraic Structures; CSC 201, Introduction to Computing; MTH 451, Introduction to Probability and Statistics or EST 409, Statistical Methods in Research I. GRE including advanced test in mathematics or undergraduate major field are required for admission.

*Program requirements:* a minimum of 24 credits (exclusive of thesis) is required. MTH 451, EST 409, and EST 412 are required; however, a maximum of six credits in these courses may be applied as program credit. All candidates must complete twelve credits at the 500-level; nine of these credits must be selected from EST 500, 511, 520, 541, 550. A thesis is required.

## Food and Nutritional Science

(Program Under Reorganization)

M.S.

### GRADUATE FACULTY

Professor Dymysza, *chairman*. Professor Constantinides; Associate Professor Bergan; Assistant Professor Caldwell; Adjunct Professor Silverman.

Individualized interdisciplinary programs of study are available in cooperation with other programs in allied fields. These graduate

programs are enriched by departmental participation in the Agricultural Experiment Station, the Sea Grant Program, the AID-supported International Center for Marine Resource Development, the Food Science Committee, the University gerontology program, and community and state nutrition programs. Work beyond the M.S. degree may be developed in conjunction with Ph.D. programs in biological sciences.

### SPECIALIZATIONS

Human nutrition and dietetics, nutritional status evaluation, nutritional biochemistry and metabolism, hyper-nutrition, life-cycle requirements. Nutritional value of new food sources, nutrition education, international and domestic public nutrition improvement programs. Marine food preservation, food enzymology, utilization of fish and marine species, food safety.

### MASTER OF SCIENCE

*Admission requirements:* GRE and a bachelor's degree with adequate preparation for the proposed area of study.

*Program requirements:* thesis, two semesters of seminar (FNS 511, 512) and graduate courses approved by department.

## Food and Resource Chemistry

M.S., Ph.D. (Biological Sciences)

### GRADUATE FACULTY

Professor Felbeck, *chairman*. Professors Chichester, Cosgrove, Olney, Rand, Salomon, Simpson; Associate Professors Bergan, Lee; Adjunct Associate Professor Zarogian; Adjunct Assistant Professor Coduri; Instructor Rice.

There is a close relationship in graduate study with the Departments of Biochemistry, Biophysics, Chemistry, Food and Nutritional Science, Animal Science, and Plant and Soil Science, and the Graduate School of Oceanography.

### SPECIALIZATIONS

Food biochemistry, soil biochemistry, pesticide chemistry, soil chemistry, plant biochemistry, chemistry of agricultural and marine products, organic geochemistry.

### MASTER OF SCIENCE

*Admission requirements:* GRE and a bachelor's degree in agricultural science, a biological science, or chemistry, at least one year



of organic chemistry.

Program requirements: thesis and advanced courses in biochemistry and chemistry.

DOCTOR OF PHILOSOPHY  
(BIOLOGICAL SCIENCES)

Admission requirements: same as for master's degree, and M.S. degree with thesis requirement.

Program requirements: dissertation and advanced courses in biochemistry and chemistry.

**French**

M.A.

GRADUATE FACULTY

Professor Dornberg, *chairman*. Department of Languages; Assistant Professor Kuhn, *section head*. Professors Porter, Rothschild, Waters; Associate Professors J. Hyland, Rogers; Assistant Professors Chartier, Morello, Toloudis.

SPECIALIZATIONS

French studies which include French literature, black-French studies, linguistics.

MASTER OF ARTS

Admission requirements: GRE or MAT; 24 semester hours, or equivalent, of French, of which a minimum of nine must be literature.

Program requirements: thesis, eight 500-level courses and comprehensive examination; or, for non-thesis program, ten 500-level courses and comprehensive examination. FRN 471 and/or 472 and/or 473 may be substituted for 500-level courses in either the thesis or the non-thesis program.

**Geography**

M.A.

GRADUATE FACULTY

Professor Alexander, *chairman*. Professor Michel; Associate Professors Havens, West; Assistant Professor Krausse.

SPECIALIZATIONS

Marine geography, political and economic geography, comparative urban processes and land utilization, meteorology and climatology, North America and the North Atlantic region, quantitative and cartographic methods.

MASTER OF ARTS

Admission requirements: GRE. The advanced

examination in geography is not required, but candidates should have, or be prepared to make up without graduate credit, the equivalent of 12 credits of introductory work in physical geography (or earth science), cultural, economic, and political geography. Another 15 credits in related social or natural sciences are desirable as are introductory courses in cartography and computer science.

Program requirements: thesis and, normally, GEG 421, 502, 591 or 592.

An interdisciplinary program involving 18 additional credits in geography, history, and political science leads to a Graduate Certificate in North Atlantic Regional Studies awarded by the Dean of the Graduate School as an adjunct to the M.A. in geography. For details, see International Studies, p. 32.

**Geology**

M.S.

GRADUATE FACULTY

Professor Cain, *chairman*. Associate Professors Fisher, Hermes, Tynan; Assistant Professors Boothroyd, Frohlich.

SPECIALIZATIONS

Coastal geology (geomorphology, sedimentology); glacial geology; igneous and metamorphic petrology-geochemistry; analytical geochemistry; applied geophysics; resources and environmental studies; geohydrology; palynology. Individual programs may include courses and/or research in conjunction with the Graduate School of Oceanography. Interdisciplinary studies are encouraged.

MASTER OF SCIENCE

Admission requirements: GRE and bachelor's degree in science or engineering. By the end of the first year, students lacking an undergraduate major in geology will be required to demonstrate, through course work and/or a qualifying examination, satisfactory knowledge of geology and related fields.

Program requirements: thesis, departmental seminar, defense of thesis.

**History**

M.A.

GRADUATE FACULTY

Professor Briggs, *chairman*. Professors Findlay, Gutchen, Klein, Metz, Weisbord;

Associate Professors Bryan, Cohen, Kim, Strom; Assistant Professors Brown, Costigliola, Daniel, Honhart, Quinney, Roughton, Schach, Silvestri, Thurston.

#### SPECIALIZATIONS

American history; diplomatic history; East Asian, African, black, Latin American and women's history; imperialism; history of science; modern English history; modern European history; state and local history. Degree programs are offered in American history, European history before 1789, European history since 1789, and in Third World Area Studies.

In addition to the courses listed in this catalog, the History Department offers many courses at the 300-level which deal with subject matter that may be of value to graduate students not only in history, but in other disciplines as well. In such cases, the graduate student may register for HIS 502 (if the 300-level course deals with European history), HIS 536 (for American history), or HIS 588 (Third World history). The student will audit the lectures of the 300-level course and, in addition, will meet in tutorial sessions with the lecturer in order to pursue the topic at greater depth. These 500-level tutorial courses may be repeated for different 300-level courses in each area but no more than three of these tutorials will normally be permitted in a graduate program. Arrangements must be made with the instructor at the beginning of the semester. For a listing of the 300-level courses, see the *Undergraduate Bulletin*.

#### MASTER OF ARTS

Admission requirements: GRE (advanced test desirable) and bachelor's degree with at least 24 credits in history. Majors in related fields may be admitted with permission of the department.

Program requirements: thesis option (30 credit hours) to include four courses at 500-level, at least one of which must be a colloquium and one must be a seminar; non-thesis option (30 credit hours) to include five courses at the 500-level, at least one of which must be a colloquium and two must be seminars. Both options require a four-hour written examination and an oral examination. Two courses in a related field are allowed.

### Home Economics Education

M.S.

#### GRADUATE FACULTY

Professor P.S. Kelly, *director*. Associate Professors MacKenzie, May; Assistant Professor Kalymun.

The M.S. in Home Economics Education is interdepartmental within the College of Home

Economics. The graduate student's program is planned on an individual basis considering the student's needs and interests, past educational and professional experiences, and future goals. Considering these goals and the type of employment the student wishes to pursue, a program will be developed through the study of home economics methods and curriculum, concentrating on one or more subject matter areas. Additional courses may be selected from related areas in education, psychology, economics, business and resource development.

The Home Economics Education program also offers courses to meet the Rhode Island certification requirements for a permanent teaching certificate. Thirty-six credits or an M.S. are required within six years of receiving one's Provisional Secondary Certificate in Home Economics.

#### SPECIALIZATIONS

Innovative practices in methods and teaching techniques; curriculum development with specialization in middle school, secondary, adult, recurrent, consumer and nutrition education; teacher education and supervision.

#### MASTER OF SCIENCE

Admission requirements: B.S. or B.A. in home economics with certification for teaching; experience or interest in teaching home economics; GRE with Advanced Test in Education.

Program requirements: for thesis option (30 credits), research methods course, basic knowledge of statistics, four-hour written comprehensive examination, two-hour oral defense of thesis; for non-thesis option (36 credits), action research project, research methods course, four-hour written comprehensive examination, oral presentation of action research project.

### Industrial Engineering

M.S.

#### GRADUATE FACULTY

Professor James, *chairman*. Professors Nichols, Rubinsky; Associate Professors Branson, Lawing, Shao.

#### SPECIALIZATIONS

Production systems, materials processing-metrology, operations research, applied statistics, quality control and reliability, inventory control, stochastic processes, industrial-ocean engineering, health systems, occupational safety and health.

### MASTER OF SCIENCE

*Admission requirements:* GRE with advanced test and B.S. degree in industrial engineering. An applicant with a B.S. degree in another field of engineering, or in mathematics, physics, chemistry, or computer science will be considered; generally such applicants will be required to complete some deficiency courses.

*Program requirements:* thesis or non-thesis option. One course each in operations research and computer science, two courses in probability-statistics, or equivalent.

### SPECIAL FINANCIAL AID

Research assistantships, part-time professional employment in local industries and hospitals.

## International Studies

International studies are represented by international orientations in many graduate programs as well as by the specialized programs described below. The International Studies Committee is charged with the overall task of developing policy, coordinating programs, and monitoring the University's work in this area. It includes representatives of the Graduate School, the Graduate Student Association, the International Student Affairs Office, the Graduate School of Oceanography, the College of Business Administration, the College of Engineering, the College of Resource Development, the Master of Marine Affairs Program and the Departments of Economics, Education, Geography, History, Languages, and Political Science in the College of Arts and Sciences.

Inquiries concerning international orientations available through various combinations of electives within existing degree programs may be addressed to the department in which the student plans to enroll or to Prof. Lewis J. Hutton, *chairman*, International Studies Committee, c/o Department of Languages, Independence Hall. Further information may also be obtained from Prof. Frank G. Wiener, *adviser* for International Studies, or Theodore Suddard, *director* for International Student Affairs.

### SPECIALIZATIONS

*Master of Arts in Political Science with International Relations Specialization.* The Department of Political Science offers over 20 courses in international relations and area studies enabling students to fashion programs suitable to their special interests. To insure an interdisciplinary approach, the department encourages students to take up to 12 credits of relevant

course offerings in economics, history, geography, or sociology. For requirements, see Political Science.

*Graduate Certificate Program in International Development Studies.* A five-course, 15-credit program leading to a Graduate Certificate awarded by the Dean of the Graduate School is offered in each spring semester by the Departments of Economics, Geography, Political Science, and Resource Economics. The Department of Sociology and Anthropology also participates in certain aspects of this program. Sponsored by the University's International Studies Committee and supported by the University's International Center for Marine Resource Development, this graduate certificate program is designed to provide a supplemental, interdisciplinary concentration on the problems and processes of modernization and international development.

*Admission requirements:* GRE and master's degree or equivalent in one of the participating disciplines or concurrent enrollment in a participating master's program.

*Program requirements:* interdisciplinary core seminar (REN 595—Problems of Modernization in Developing Countries); two specialized seminars selected from PSC 510, ECN 566, REN 430; 3 credits of directed study selected from PSC 556, ECN 515, 516, REN 491, 492, or GEG 591, 592; and 3 credits of approved elective. When the graduate certificate is pursued concurrently with a master's degree, the certificate credit requirements must be taken in addition to all requirements for the master's degree. Completion of the master's degree program is required to receive the certificate.

Requests for further information and for application forms should be directed to the Dean of the Graduate School. Initial inquiries should indicate in which of the above disciplines and from which institution the applicant holds the master's degree, or whether he is interested in pursuing the master's degree at this University concurrently with the graduate certificate program, and where his particular research interests lie. Such information will assist the administering committee in selecting an adviser for the student and in designing a program adapted to his needs. Assistantships or scholarships are not available for participants in the graduate certificate program as such, but may be held by students who are concurrently enrolled in one of the participating master's programs.

*Graduate Certificate in North Atlantic Regional Studies.* Designed to take advantage of the University's location in a northeastern state with a strong tradition of involvement in maritime and naval affairs, and with strong com-

mercial and cultural ties with Western Europe, this program is an adjunct to the M.A. degree in geography or in political science. It is open both to University of Rhode Island degree candidates in these departments and to those who have already received an equivalent master's degree from other institutions. When the graduate certificate is pursued concurrently with a master's degree, the certificate credit requirements must be taken in addition to all requirements for the master's degree. Successful completion of both sets of requirements results in the award of the Graduate Certificate by the Dean of the Graduate School.

The program requires two core courses plus four electives. The core courses are GEG 545 and a directed study or research course in geography or political science in which the student prepares and defends a substantial paper under the direction of a faculty committee. The four electives may be chosen from GEG 441, 443, 543, 571; HIS 411, 418; PSC 301, 431, 464, 472, 513. Assistantships or scholarships are not available for participants in the Graduate Certificate Program as such, but may be held by students who are concurrently enrolled in the M.A. programs in geography or political science.

Additional information is available from the chairman of the Department of Geography.

## Library Science

### M.L.S.

Professor Potter, *acting dean*, Graduate Library School. Professor Bergen; Associate Professors Chin, Salvatore, Schneider; Assistant Professors Bohnert, Tryon.

### SPECIALIZATIONS

Readers' services, technical services, information science, bibliography and service in public, school, college and university, and special libraries.

### MASTER OF LIBRARY SCIENCE

*Admission requirements:* MAT or GRE and the bachelor's degree. All materials required for application should be received by the Graduate School by November 15 for spring semester admission, February 15 for summer admission, and April 15 for fall admission. Notification of acceptance or rejection is mailed approximately six weeks after receipt by the Graduate School.

*Program requirements:* 36 credit hours, 27 or more in library science; LSC 500, 502, 503, 504, and 505, and one course selected from LSC 520, 521, 522 or 523.

## Marine Affairs

### M.M.A.

### GRADUATE FACULTY

Professors Alexander (geography), *director*; Knauss (oceanography), *provost for marine affairs*. Professors Marshall (oceanography), Rorholm (resource economics), Sheets (ocean engineering); Associate Professor Fisher (geology); Assistant Professor Cameron (marine affairs).

This 30-credit program is for those persons interested in problems of evaluation, use and control of the marine environment. Normally the work is completed in nine months of intensive, full-time resident study with considerable independent responsibility on work projects and substantial written work. It is administered by a committee from the Departments of Geography, Geology, Ocean Engineering, Political Science, Resource Economics, and the graduate school of Oceanography.

### SPECIALIZATIONS

Regimes for the deep seas, decision inputs for coastal zone regulation, jurisdictional requirements for pollution controls, criteria for deciding among competing uses for the continental shelf, applications of cost-benefit analysis to systems models for coastal decisions, implications of treating ocean basins as distinct regions, regulation of the high seas fisheries, impact of ocean engineering advances on the definition of continental shelf, and legal problems of international scientific expeditions.

Students with an interest in Commercial Fisheries can participate in a 45-credit combined M.M.A. and graduate certificate program (see below for details).

### MASTER OF MARINE AFFAIRS

*Admission requirements:* GRE, prior graduate degree or equivalent experience in marine areas. For international students, minimum TOEFL score of 575. Applicants are admitted for September only.

*Program requirements:* non-thesis program MAF 651, 652, GEG 571, OCE 500, OCG 401 or appropriate oceanography substitute, PSC 464, REN 514.

*Special Financial Aid:* Marine affairs fellowships up to \$4000 are available.

### GRADUATE CERTIFICATE PROGRAM IN COMMERCIAL FISHERIES

As an adjunct to the Master of Marine Affairs program, an additional 15-credit program,

leading to a graduate certificate awarded by the Dean of the Graduate School is offered in Commercial Fisheries. The joint, 45-credit program is designed to combine the evaluative, use and control aspects of the M.M.A. curriculum with the technology and performance of the marine commercial fisheries.

*Admission requirements:* GRE, appropriate background or undergraduate preparation, and concurrent enrollment in the M.M.A. program.

*Program requirements:* FMT 518, 591, 592, plus 15 credits selected from the following electives, of which 9 credits are applied towards the M.M.A. program and 6 towards the graduate certificate: APG 411, FMT 416, 452, 521, OCG 568, REN 543.

*Financial aid:* assistantships, fellowships and scholarships are not available to participants in the graduate certificate program as such, but may be held by students concurrently enrolled in the M.M.A. program.

## Mathematics

*M.S., Ph.D.*

### GRADUATE FACULTY

Professor Ladas, *chairman*. Professors Driver, Roxin, Shisha, Suryanarayan; Associate Professors Beauregard, Datta, Finizio, Fraleigh, Grove, Levine, Lewis, Liu, Papadakis, Schwartzman, Sine, Verma; Assistant Professors Barron, Caldwell, Montgomery, Pakula.

### SPECIALIZATIONS

Ordinary, functional, and stochastic differential equations, partial differential equations, abstract differential equations, functional analysis, approximation theory, probability, fluid mechanics, control theory and differential games.

### MASTER OF SCIENCE

*Admission requirements:* GRE, including advanced test in mathematics and bachelor's degree in mathematics. Candidates from other fields may be accepted into the program with possible addition of prerequisite courses.

*Program requirements:* 30 credit hours (or 24 plus thesis), including at least 18 credits in mathematics of which at least 12 must be at the 500 level or higher, and written comprehensive examination. Recommended courses include MTH 513, 515, 525, 535, 536, and 562.

### DOCTOR OF PHILOSOPHY

*Admission requirements:* GRE, including advanced test in mathematics.

*Program requirements:* MTH 513, 515, 525,

535, 536, and 562, plus specialized courses and electives. Two languages chosen from French, German, Russian; or one of these and computer science as a research tool. The M.S. comprehensive examination serves as the written portion of the department's Ph.D. qualifying examination. This is followed by an oral qualifying examination.

## Mechanical Engineering And Applied Mechanics

*M.S., Ph.D.*

### GRADUATE FACULTY

Professor Nash, *chairman*. Professors Bradbury, G. Brown, Conta, Dowdell, Ferrante, Schenck, Test, White, Wilson; Associate Professors Bachelder, DeLuise, Goff, Hagist, Hatch, Kim, Lessmann, Palm, Parker.

### SPECIALIZATIONS

Interdisciplinary studies, energy conservation, boundary layer theory, ecological systems modeling, flow noise, direct energy conversion, low pollution power-plants, socio-technological problems, analysis of nonlinear systems, global problems, design, hydrodynamics, gas-dynamics, magnetofluid-mechanics, two-phase flow, turbulence, fluidics, flow instrumentation, heat transfer, thermodynamics, elasticity, plasticity, materials, vibration, fatigue failure and fracture mechanics, reliability of engineering systems, biomechanics, kinematics, dynamics, stability, systems analysis, controls, computer simulation, scuba safety, thermal pollution, thermal stress analysis, solar energy, wind-generated power.

### MASTER OF SCIENCE

*Admission requirements:* GRE with advanced test; B.S. degree in mechanical engineering, applied mechanics, or aerospace engineering, or in a related field such as engineering science, civil engineering, applied physics, applied mathematics.

*Program requirements:* thesis, two advanced-level courses in mathematics (or one in mathematics and one in computer science) or equivalent, one course outside area of specialization; MCE 501, 502, graduate seminar, required of all on-campus students. Almost all specializations require use of digital computer techniques.

### DOCTOR OF PHILOSOPHY

*Admission requirements:* master's degree and GRE with advanced test.

*Program requirements:* dissertation, two advanced-level courses beyond M.S. in mathematics or computer science, one course outside area of specialization; research tool or associated studies in two areas; completion of a minimum of 30 course credits beyond master's exclusive of seminar; MCE 501, 502, graduate seminar, required of all on-campus students. Almost all specializations require use of digital computer techniques.

## **Medicinal Chemistry**

*M.S., Ph.D. (Pharmaceutical Sciences)*

### GRADUATE FACULTY

Professor C. Smith, *chairman*. Associate Professors Abushanab, Turcotte; Adjunct Professor Modest; Emeritus Professor Bond.

### SPECIALIZATIONS

Design and synthesis of potential medicinal agents, including antihypertensives, steroids, antimetabolites, antitumor agents, complex lipids, and molluscicides; development of methods of drug analysis; drug instabilities.

### MASTER OF SCIENCE

*Admission requirements:* GRE, including advanced test in chemistry, and bachelor's degree in pharmacy, chemistry, or allied sciences.

*Program requirements:* thesis; physical chemistry and CHM 425, 521; MCH 443, 444, or equivalent; MCH 621, 622; placement examination to determine specific program requirement; one modern foreign language recommended.

### DOCTOR OF PHILOSOPHY (PHARMACEUTICAL SCIENCES)

*Admission requirements:* GRE, including advanced test in chemistry, and master's degree in pharmacy, chemistry, or allied sciences or bachelor's degree in one of these with evidence of superior ability.

*Program requirements:* thesis, reading knowledge of scientific German; CHM 522; MCH 621, 622; primary emphasis in organic and medicinal chemistry or pharmaceutical analysis, and secondary emphasis in related areas, e.g., physical chemistry, biochemistry, pharmacology, physical pharmacy, or pharmacognosy; placement examination to determine specific program requirements.

## **Microbiology**

*M.S., Ph.D. (Biological Sciences)*

### GRADUATE FACULTY

Professor N.P. Wood, *chairman*. Professors Cohen, Fisher, Houston, Sieburth, Traxler; Assistant Professors Laux, Hufnagel, Shivvers; Adjunct Professors Cabelli, Chapple, McCormick; Adjunct Associate Professors Prager, Levin; Emeritus Professor Carpenter.

### SPECIALIZATIONS

Diagnostic and pathogenic bacteriology, water-borne pathogens; plasmids; immunology, tumors and the immune response, cytophilic antibody; microbial genetics, transcriptional and translational control; microbial ecology, thermal pollution, bioassay and removal of pollutants, cell interaction and contact inhibition, marine ecosystem and mini-population development, soil conversion, marine algal nutrition, hydrocarbon and nitroaromatics degradation, halogenated compound cooxidation; industrial microbiology, protozoology, microtubule development, electron microscopy of cell structures and virus infected cells; microbial physiology, polyamine metabolism, redox controlled reactions; molecular biology, ribosome structure; food and sanitary microbiology, shellfish pollution.

### MASTER OF SCIENCE

*Admission requirements:* GRE and two semesters each of introductory courses in biology (zoology, botany), inorganic and organic chemistry, mathematics, and physics; a semester each of microbiology, genetics, quantitative analysis, and biochemistry.

*Program requirements:* thesis; BCP 581; MIC 401, 599, 695, and 696; major portion of courses in microbiology, including two from areas other than bacteriology (virology, mycology, phycology, cell biology, protozoology); written comprehensive examination.

### DOCTOR OF PHILOSOPHY (BIOLOGICAL SCIENCES)

*Admission requirements:* same as for master's degree and two semesters of calculus, BCP 435, statistics and proficiency in one foreign language. Master's degree normally required; outstanding candidates may be accepted without an M.S. degree.

*Program requirements:* Same as for master's degree plus BCP 521, 582; MIC 533, 552, 695, 696, and dissertation. Of the credits earned beyond the master's degree, 18 should be in course work.

Prior to the last semester, the candidate must pass written and oral comprehensive examination in the major areas of microbiology.

## Nuclear Engineering

M.S.

### GRADUATE FACULTY

Assistant Professor Knickle, *program coordinator*. Professor Mairs; Associate Professor Rose; Adjunct Associate Professor DiMeglio; Adjunct Assistant Professor Doyle.

The program in nuclear engineering is administered by the Department of Chemical Engineering.

### SPECIALIZATIONS

*Reactor design and evaluation:* computational methods of reactor design, fluid dynamics, heat transfer, metallurgy. *Nuclear technology:* mass transfer, ion exchange, spectrometry, gauging. *Power plant siting and economics.*

### MASTER OF SCIENCE

*Admission requirements:* GRE with advanced test in area of specialization. Bachelor's degree in engineering, chemistry, physics, or mathematics.

*Program requirements:* thesis and at least 12 credits in nuclear engineering with other subjects chosen from chemistry, mathematics, physics, and other branches of engineering; CHE 501, 502.

## Nursing

M.S.

### GRADUATE FACULTY

Professor Tate, *dean*. Professor Cumings; Associate Professors Hirsch, Kang; Assistant Professors Castro, Schwartz-Barcott

### SPECIALIZATIONS

General nursing with teaching or administration.

### MASTER OF SCIENCE

*Admission requirements:* MAT and a bachelor's degree from an NLN-accredited program with an upper division major in nursing.

*Program requirements:* 36 credit hours without thesis, including 21 credits in nursing which includes practicum, 3 credits in biological science, 6 credits in behavioral science, 6 elective credits related to functional area.

## Ocean Engineering

M.S., Ph.D.

### GRADUATE FACULTY

Professor Sheets, *chairman*. Professors Haas, Kowalski, Middleton, Nacci, White; Associate Professors LeBlanc, Rose; Assistant Professors Heidersbach, Spaulding, Stepanishen; Adjunct Professors DiNapoli, Moffett, Sherman.

### SPECIALIZATIONS

Desalination of sea water, nuclear energy applications, corrosion, physical properties of marine sediments, acoustic properties of sediments, finite amplitude acoustics, *in situ* sediment measurements, sediment transport, coring techniques, bottom profiling and penetration; coastal and underwater structures, estuarine pollution, pollution abatement, waste disposal, turbidity measurements, mathematical modeling of estuaries; underwater acoustics, acoustic radiation and scattering, sonar arrays and systems, applications of information theory to underwater communications and data acquisition, turbulent boundary layer flow noise, underwater construction, guidance and control of underwater vehicles, digital processing of wave, current, and thermistor data; dynamics of towed body shapes, design of undersea pressure vessels, inelastic behavior of buoyant materials, wave motion and current studies, drag reduction with polymer additives, buoy dynamics, scuba safety and work effectiveness, underwater tooling, hydrodynamics of floating and submerged bodies.

### MASTER OF SCIENCE

*Admission requirements:* GRE and B.S. degree in engineering, physics, applied mathematics or other technical disciplines. Students with a non-engineering background may be required to make up deficiencies by taking undergraduate courses in thermodynamics, fluid flow, strength of materials, electrical engineering, or applied mathematics.

*Program requirements:* thesis and three courses selected from OCE 512, 521, 534, 560, 561, 565, 571, 587, 610, 653; one course selected from OCG 501, 521, 540, 561; and at least 12 course credits of electives.

## DOCTOR OF PHILOSOPHY

*Admission requirements:* GRE and M.S. degree and master's thesis in engineering, physics or equivalent; ocean engineering and oceanography core courses as in master of science program. Requirements must have been taken previously or will have to be made up for no program credit.

*Program requirements:* dissertation; one advanced applied mathematics course; completion of 30 course credits beyond master's.

## SPECIAL FINANCIAL AID

Link Foundation fellowship for M.S. candidate; a limited number of graduate and research assistantships are available for highly qualified students.

**Oceanography**

*M.S., Ph.D.*

## GRADUATE FACULTY

Professor Knauss, provost, Marine Affairs, and dean, Graduate School of Oceanography; Associate Professor Napora, assistant dean for students. Professors Dietz, Duce, Jeffries, Kennett, Kester, McMaster, Marshall, Pratt, Rossby, Sails, Schilling, Sieburth, Smayda, Stern, Watkins, Winn; Associate Professors, Hargraves, Heath, Lambert, Moore, Nixon, Pilson, Quinn, Sastry, Sigurdsson, Swift; Assistant Professors Bender, Watts; Adjunct Professors deBoer, Eisler, Holt, Imbrie, Krause, Phelps, Schneider, Shonting, Sturges, Tenore; Lecturer Oviatt.

## SPECIALIZATIONS

Biological, chemical, geological, and physical oceanography.

## MASTER OF SCIENCE

*Admission requirements:* GRE (verbal, quantitative and advanced sections) and bachelor's degree (B average) in some field of the natural sciences or engineering. Applicants are admitted for September only. Due to the limited number of students that can be accepted as degree candidates, no application will be considered showing an undergraduate average of less than B unless there is post-baccalaureate work indicating outstanding ability. Applications should be completed by February 15.

*Program requirements:* thesis, OCG 501, 521, 540, 561, 695; participation in a regular ocean research cruise.

## DOCTOR OF PHILOSOPHY

*Admission requirements:* GRE (verbal, quantitative and advanced sections); master's degree is not required, but bachelor's degree (B average) in some field of natural sciences or engineering. Applicants are admitted for September only. Due to the limited number of students that can be accepted as degree candidates, no application will be considered showing an undergraduate average of less than B unless there is post-baccalaureate working indicating outstanding ability. Applications should be completed by February 15.

*Program requirements:* B grade in core courses, OCG 501, 521, 540, 561; six additional course credits in oceanography at the 600 level (excluding problems and research courses and OCG 695); participation in regular ocean research cruise. Although there is no general language requirement, the individual student's major professor may require him to demonstrate ability in one or more foreign languages.

## SPECIAL FINANCIAL AID

There is a limited number of research assistantships for master's and doctoral candidates.

## GENERAL INFORMATION

It is anticipated that approximately 25 students will be admitted to the program for the 1977-78 academic year.

**Pharmacognosy**

*M.S., Ph.D. (Pharmaceutical Sciences)*

## GRADUATE FACULTY

Professor Worthen, chairman. Professor Younken; Associate Professor Shimizu; Adjunct Professor Nakanishi.

## SPECIALIZATIONS

Biosynthesis of drug plant constituents, natural product chemistry including the isolation and structural elucidation of materials of potential medicinal interest, screening of natural products for physiologically-active agents including materials from both land and marine sources.

## MASTER OF SCIENCE

*Admission requirements:* GRE, bachelor's degree in pharmacy, chemistry or biology.

*Program requirements:* thesis; PCG 445, 446, 447, or equivalent; PCG 548, PCL 441, 442, or equivalent; BOT 445, MCH 549.



DOCTOR OF PHILOSOPHY  
(PHARMACEUTICAL SCIENCES)

*Admission requirements:* GRE and master's degree in pharmacy, chemistry or biology, or bachelor's degree in one of these with evidence of superior ability.

*Program requirements:* PCG 551, 552, 633, 634. A candidate entering the Ph.D. program with a bachelor's degree must also meet the M.S. program requirements.

**Pharmacology and Toxicology**  
*M.S., Ph.D. (Pharmaceutical Sciences)*

GRADUATE FACULTY

Professor DeFeo, *chairman*. Professors Lal, DeFanti; Associate Professor Fuller; Assistant Professors Carroll, Swonger; Adjunct Professors Cardinale, Carlson, Karkalas, Pogacar, Smith, Miller, Lundgren.

SPECIALIZATIONS

Behavioral, biochemical, cardiovascular, environmental, and marine pharmacology; toxicology; forensic toxicology.

MASTER OF SCIENCE

*Admission requirements:* GRE and bachelor's degree in pharmacy, science or psychology.

*Program requirements:* thesis; mathematics through calculus; physical chemistry; one course in statistics; principles of pharmacology; PCL 441, 442, 521, 522. Other courses and research training will be included to complete the program, in accordance with the student's interest and background.

DOCTOR OF PHILOSOPHY  
(PHARMACEUTICAL SCIENCES)

*Admission requirements:* GRE and bachelor's or master's degree in pharmacy, science or psychology.

*Program requirements:* M.S. degree must be earned prior to Ph.D. if admission is granted without it. Additional courses and special training included according to the requirements of each student's program. Independent research topics will be selected in accordance with the student's interests.

**Pharmacy**  
*M.S., Ph.D. (Pharmaceutical Sciences)*

GRADUATE FACULTY

Professor Rhodes, *chairman*. Professors Os-

borne, Paruta; Assistant Professors, Greene, Lausier; Assistant Professors (Clinical) Kellenberger, Marr, Mattea, Millette, Moleski, Snodgrass; Clinical Professor Jeffrey; Clinical Associate Professor Gallina; Clinical Assistant Professors Pinkus.

SPECIALIZATIONS

Master of Science: pharmaceuticals, with emphasis in physical pharmacy, biopharmaceutics, pharmacokinetics, formulation and manufacturing pharmacy, and clinical pharmacy. Doctor of Philosophy: essential pharmaceuticals, as listed above.

MASTER OF SCIENCE

*Admission requirements:* GRE and bachelor's degree in pharmacy or equivalent.

*Program requirements:* thesis, PHC 521, 522, one modern foreign language strongly recommended.

DOCTOR OF PHILOSOPHY  
(PHARMACEUTICAL SCIENCES)

*Admission requirements:* same as for Master's degree

*Program requirements:* PHC 521, 522.

**Pharmacy Administration**  
*M.S.*

GRADUATE FACULTY

Professor Campbell, *chairman*. Associate Professors Crombe, Jacoff; Instructor Ciullo; Special Lecturer Hachadorian.

SPECIALIZATIONS

Development and utilization of pharmacy resources in health care systems involving the organization, financing, and delivery of health care services and materials and the legal and socio-economic constraints.

MASTER OF SCIENCE

*Admission requirements:* GRE or MAT and first professional degree in pharmacy.

*Program requirements:* thesis; PAD 599, 621, 622, 651, 652, EST 408 or equivalent.

SPECIAL FINANCIAL AID

Fellowships from the American Foundation for Pharmaceutical Education.

## Philosophy

M.A.

### GRADUATE FACULTY

Associate Professor, Wenisch, *chairman*. Professors Freeman, Young; Associate Professors Hanke, Kim, Peterson; Assistant Professors Fedoryka, Johnson, J.G. Kowalski, Zeyl.

### SPECIALIZATIONS

Programs of studies in the following general areas are offered: logic and philosophy of science, axiology and history of philosophy.

### MASTER OF ARTS

*Admission requirements:* GRE, 18 credit hours in basic philosophy courses (students whose undergraduate preparation did not include at least 18 credit hours in basic philosophy courses will be required to take these in addition to the graduate program requirements).

*Program requirements:* thesis option: 24 credit hours in course work, 6 credit hours in master's thesis research. Non-thesis option: 30 credit hours in course work, comprehensive examination. Students in both options will normally include 6 credits of course work in disciplines other than philosophy. Proficiency in a foreign language will be required if the student's program committee considers it essential for the topic of the thesis or of the substantial paper involving significant independent research to be written by a student choosing the non-thesis option.

## Physical Education

M.S.

### GRADUATE FACULTY

Professor Reid, *chairman*; Professors Massey, Nedwitek; Associate Professors Cohen, Crooker, DelSanto, Leathers, Mandell, O'Donnell, Polidoro, Sonstroem; Assistant Professors Bloomquist, Sherman.

### SPECIALIZATIONS

Physical education, health education, recreation education, physical education for mentally retarded, and psychology of sport.

### MASTER OF SCIENCE

*Admission requirements:* MAT or GRE with B.S. degree in physical education, health and

physical education, or health education. In exceptional cases, a candidate without a physical education major, but with a strong emphasis in physical education, is accepted.

*Program requirements:* thesis (30 credit hours) and PED 510, 530, 520 and 599; for non-thesis option (33 credit hours), PED 510, 530, 520, and 591. Non-thesis option requires a written comprehensive examination.

## Physics

M.S., Ph.D.

### GRADUATE FACULTY

Professor Pickart, *chairman*. Professors Desjardins, Dietz, Letcher, Malik; Associate Professors Choudry, Cuomo, Hartt, Kaufman, Kirwan, Northby; Emeritus Professor Quirk.

The department offers courses leading to the degrees of Master of Science (with or without thesis) and Doctor of Philosophy. At the doctoral level, research is concentrated in the areas of neutron physics and liquid state physics. Neutron scattering, diffraction, and radiational experiments are carried out at the Rhode Island Nuclear Science Center at the Narragansett Bay Campus and in conjunction with Brookhaven National Laboratory.

Liquid state research includes studies of physical acoustics, underwater acoustics, infrared spectroscopy, Brillouin scattering, and liquid helium studies. The department has a 16-inch reflecting optical telescope developed for photography and dual-channel photometry. Theoretical research areas include nuclear and particle physics.

### SPECIALIZATIONS

Neutron diffraction and scattering, hypernuclear physics, ultrasonic studies in liquid crystals and metals, underwater propagation of acoustic waves, infrared spectrophotometry, propagation of waves in stochastic media, Brillouin scattering, liquid helium, few nucleon systematics, computational physics, color centers, radiation effects in solids.

### MASTER OF SCIENCE

*Admission requirements:* GRE with advanced test; bachelor's degree with major in physics preferred.

*Program requirements:* thesis and PHY 520, 530, 570, 580. For non-thesis option, the student shall complete 36 course credits, with at least one course requiring a substantial paper involving significant independent study. Twelve

of the course credits shall be in the 500- or 600-level physics courses that are in addition to those core courses required of all master's degree candidates. The non-thesis student shall successfully complete a final oral examination that will not exceed one and one-half hours in length.

**DOCTOR OF PHILOSOPHY**

*Admission requirements:* GRE with advanced test; bachelor's degree with major in physics preferred. Master's degree is not required.

*Program requirements:* PHY 510, 511, 520, 530, 531, 570, 571, 580, 620, 650, 660 and either 651 or 661. There is no formal departmental language requirement; however, the candidate's committee may require language proficiency.

**Plant and Soil Science**

M.S.

**GRADUATE FACULTY**

Professor Larmie, *chairman*. Professors Hindle, Skogley, Stuckey, Wakefield; Associate Professors Brown, Duff, Gould, Hull, Jagschitz, McGuire, Shaw; Assistant Professors Golet, Wright.

Work beyond the M.S. degree in plant and soil science may be developed in cooperation with other departments offering the Ph.D. degree in biological sciences.

**SPECIALIZATIONS**

Emphasis on one or more of the following plant commodities: turfgrasses, woody ornamentals, flowers, fruits, vegetables, and field crops. Specific programs may feature one or more of the following: soil-plant-climate relationships, soil science and land use, physiology, post-harvest physiology, propagation, ecology, weed science and plant breeding. Work with radioisotopes, growth regulators and mineral nutrients is considered basic. Plant associations such as exist in the home landscape, along roadsides, and in salt marshlands are suitable for ecological study.

**MASTER OF SCIENCE**

*Admission requirements:* GRE and an undergraduate major in agronomy, horticulture, botany, soil science-plant science, or any of the natural sciences. Applications should be completed by March 15.

*Program requirements:* thesis and background study in plant and soil science, botany, chemistry and statistics.

**Plant Pathology-Entomology**

M.S., Ph.D. (Biological Sciences)

**GRADUATE FACULTY**

Professor Traxler, *chairman*. Professors Beckman, Jackson, Mueller; Assistant Professors Casagrande, Englander; Adjunct Professors Kaplan, Tarzwell.

**SPECIALIZATIONS**

*Plant Pathology:* disease resistance mechanisms, fine structure of pathogen-host interactions, epidemiology of turfgrass and woody ornamentals diseases. *Plant Protection:* plant disease and plant insect topics.

**MASTER OF SCIENCE**

*Admission requirements:* GRE with undergraduate major in biological, agricultural or physical sciences. Applications should be completed by March 15 (fall), September 15 (spring).

*Program requirements:* course work as determined by graduate committee, seminars and thesis.

**DOCTOR OF PHILOSOPHY  
(BIOLOGICAL SCIENCES)**

Limited to plant pathology specializations.

*Admission requirements:* GRE and preferably master's degree in botany or plant pathology. Applications should be completed by March 15 (fall) and September 15 (spring).

*Program requirements:* Qualifying examination covering Plant Pathology, Plant Physiology and Plant Anatomy; course work as determined by graduate committee; dissertation and reading knowledge of one foreign language.

**Political Science**

M.A., M.P.A.

**GRADUATE FACULTY**

Professor Leduc, *chairman*. Professors Stein, Warren, Wood, Zucker; Associate Professors Hennessey, Killilea, Milburn; Assistant Professors Rothstein, Tyler, Wirth.

**SPECIALIZATIONS**

American government, international relations, politics of the developing areas, urban affairs, comparative governments, public administration.

## MASTER OF ARTS AND MASTER OF PUBLIC ADMINISTRATION

*Admission requirements:* GRE with undergraduate credit in basic political science and political theory.

*Program requirements:* M.A. has a thesis and non-thesis option; non-thesis option requires oral examination in addition to comprehensive examination, PSC 553 required. M.P.A. has only the non-thesis option with comprehensive examination and internship required. Competency in two of three areas, accounting, computer science or statistics is required and can be demonstrated by a basic course at the undergraduate level or by examination.

Interdisciplinary programs involving 15 and 18 additional credits in associate fields lead to graduate certificates in International Development and in North Atlantic Regional Studies respectively, awarded by the Dean of the Graduate School as adjuncts to the M.A. in political science. See International Studies for details.

## Psychology

M.S., Ph.D.

### GRADUATE FACULTY

Professor Steinman, *chairman.*

*Full-time:* Professors Berger, Berman, Biller, Cain, Grebstein, A.J. Lott, Merenda, Silverstein, Smith, Vosburgh, Willoughby; Associate Professors Gross, Kulberg, Prochaska; Assistant Professors Collyer, Hurley, Makokian, Stevenson, Tyne, Valentino, Velicer.

*Part-time:* Professor B. Lott; Clinical Professors Mohrheim, Redmon.

### SPECIALIZATIONS

Clinical, general-experimental and school psychology; specialties are offered within the Ph.D. degree. Faculty areas of interest include neuropsychology, verbal learning, psychotherapeutic models and outcome, clinical psychodiagnosis, clinical-child, measurement, personality, exceptional child, aversive conditioning, behavioral modification techniques, learning disabilities, social learning, psychopharmacology and community.

### MASTER OF SCIENCE (SCHOOL PSYCHOLOGY ONLY)

*Admission requirements:* GRE with advanced test. Undergraduate major in psychology recommended.

Applicants are admitted for September only. Applications must be completed by February 15. *Program requirements:* non-thesis (45-54 credits); one semester internship.

### DOCTOR OF PHILOSOPHY (CLINICAL, GENERAL EXPERIMENT AND SCHOOL PSYCHOLOGY)

*Admission requirements:* GRE with advanced test; evidence of research competency. Applicants are admitted for September only. Applications must be completed by February 1 for clinical, by February 15 for school, and by March 15 for general experimental. Prospective applicants are asked to address initial inquiries concerning the desired specialization to the department, but formal application materials must be obtained from and returned directly to the Graduate School Office. Applicants to clinical program having post-baccalaureate experience are given special consideration.

Due to limited facilities, new admissions to the doctoral programs must be limited to a small number per year. Although test scores and cumulative averages are not the sole criteria for admission, those with overall quality point averages of less than 3.0 on a 4.0 scale, or whose two highest GRE scores do not total above 1200, are advised that there is little chance for admission.

*Program requirements:* academic core is required for all Ph.D. programs in psychology (emphasis in clinical, school or general-experimental). The core includes developmental, social personality, learning, cognitive perceptual processes, physiology, and research design. Students in all programs are required to complete dissertation research.

"The objective of our Ph.D. program is to give our students the knowledge and skills they will need to be effective psychologists in their chosen area. Scientific training and research experience as well as knowledge and technical skills are a part of each student's program, but his/her program is individually designed around his/her needs and goals.

"In the clinical and school programs, practicum and individual research projects can be specifically tailored to help the student prepare for the professional role of his/her choice. These programs also have a strong experiential base including field activity in each year. Students are expected to be involved in research for a substantial portion of their program.

"The department emphasizes a close working relationship between faculty and students. No single theoretical or philosophical model is espoused."

**Resource Economics**

M.S.

## GRADUATE FACULTY

Associate Professor Hueth, *chairman*. Professors Holmsen, Lampe, Norton, Rorholm, Spaulding; Associate Professors Gates, Grigalunas, Wallace; Assistant Professors Bockstael, McConnell, Sutinen, Seay, Weaver.

## SPECIALIZATIONS

Marine economics, resource economics, international resource development, land use and community development.

## MASTER OF SCIENCE

*Admission requirements:* GRE, including the advanced test in economics, and a strong undergraduate record in mathematics and statistics is highly desirable.

*Program requirements:* 24 hours of course work which must include advanced microeconomic theory and REN 534, written comprehensive examination and a thesis.

**Sociology**

M.A.

## GRADUATE FACULTY

Associate Professor Gardner, *acting chairman*. Professors England, Poggie, Rosengren, Spaulding; Associate Professors Gelles, Gersuny, Pollnac; Assistant Professors Bassis, Carroll, Guthrie, Loy, Lynch, Reilly, Sennott, Shea, Travisano, Turnbaugh.

## SPECIALIZATIONS

Population and demography, race relations, medical sociology, criminology, resource development, culture and personality, complex organizations, sociology of education, deviance, urban family.

## MASTER OF ARTS

*Admission requirements:* GRE (verbal, quantitative, and advanced) preferred, MAT acceptable; background in social sciences.

*Program requirements:* for thesis program, 24 credits comprised of at least six 500-level courses, including SOC 502, 505, 506 at least, and two other 500-level sociology courses; thesis; oral examination on thesis. For non-thesis program: 30 credits comprised of at least seven 500-level courses, including SOC 502, 505, 506 at least, and three other 500-level sociology

courses, written and oral comprehensive examinations in theory, methods and two specialities, and evidence of written scholarship.

**Spanish**

M.A.

## GRADUATE FACULTY

Professor Dornberg, *chairman*. Department of Languages; Associate Professor Navascués, *section head*. Professors Hutton, Kossoff; Assistant Professor T.A. Bryan

## SPECIALIZATIONS

Hispanic Studies, Spanish literature and the literature of the Spanish-speaking world.

## MASTER OF ARTS

*Admission requirements:* MAT or GRE, undergraduate major in Spanish or equivalent, including 12 credits in Spanish or Hispanic-American literature. Qualified students may be admitted with less than 12 credits but must make them up without graduate credit.

*Program requirements:* all work carried out in Spanish. For thesis option, SPA 591, seven courses (21 credits), and thesis (6 credits). For non-thesis option, SPA 591, and nine courses (27 credits).

**Speech Pathology and Audiology**

M.A., M.S.

## GRADUATE FACULTY

Assistant Professor Grubman, *director of graduate programs*. Professors Beaupre, Fitz-Simmons; Associate Professor Baily; Assistant Professor Gooding; Clinical Assistant Professor Regan.

## SPECIALIZATIONS

Audiology and speech pathology.

## MASTER OF ARTS AND MASTER OF SCIENCE

*Admission requirements:* MAT or GRE; 24 undergraduate credit hours in general speech, speech science, speech development, language development, child development, psychology, or education.

*Program requirements:* for M.A. in speech pathology (39 credit hours), thesis, SPE 504, 24 credit hours in speech pathology, 6 credit hours in audiology. For M.A. in audiology (39 credit

hours), thesis, SPE 504, 24 credit hours in audiology, 6 credit hours in speech pathology. For M.S. in speech pathology (39 credit hours), no thesis; written comprehensive examination; SPE 504, 30 credit hours in speech pathology and 6 credit hours in audiology. For M.S. in audiology (39 credit hours), no thesis; written comprehensive examination; SPE 504, 30 credit hours in audiology and 6 credit hours in speech pathology. For either the M.A. or M.S. programs in speech pathology or audiology, students must complete a minimum of 300 supervised clock hours of practicum in addition to the academic requirements. Because program requirements in both speech pathology and audiology include academic as well as clinical responsibilities, the average length of time to complete any of the programs is two academic years. Completed applications for either the summer or fall semester must be received no later than March. 1. Applications for the spring semester are not encouraged; however, under special circumstances they will be considered if the completed applications are received no later than November 1.

## Textiles, Clothing and Related Art

M.S.

### GRADUATE FACULTY

Professor V.V. Carpenter, *chairman*. Professor Fry; Assistant Professors Avery, Darling, Weeden.

The department offers a wide variety of individualized programs in close association with other departments such as history, art, chemistry, education, and various social science fields.

### SPECIALIZATIONS

Social-psychological and physical science aspects of textiles and clothing, historic textiles and costume.

### MASTER OF SCIENCE

*Admission requirements:* GRE and a bachelor's degree with adequate preparation for the proposed area of study.

*Program requirements:* thesis or non-thesis option, 30 credits. For thesis option: TXC 524, 533, 580, courses in statistics recommended; other courses chosen in accordance with student's background, interest, and needs; written comprehensive examination; oral defense of thesis. For non-thesis option: TXC 524, 533, 550, 560, 580; other courses chosen in

accordance with student's background, interest and needs; written comprehensive examination. A maximum of twelve credits may be elected in allied fields for either thesis or non-thesis option.

## Zoology

M.S., Ph.D. (Biological Sciences)

### GRADUATE FACULTY

Professor Wilde, *chairman*. Professors Chipman, Hammen, Harrison, Hyland, Saila, Shoop, Winn; Associate Professors Cobb, Costantino, Goertemiller, Heppner, Hill, Krueger, Mottinger; Assistant Professors Bibb, Bullock, Kass-Simon, Surver; Adjunct Professors Bass, Crenshaw, Dowling, Gibbs, Hutchison, LaMarche, Schaefer, Tilly, Yacowitz; Emeritus Professor Zinn.

### SPECIALIZATIONS

Acarology, animal behavior, cytology, ecology, electron microscopy, embryology, entomology, fisheries biology, genetics (developmental, ecological, population), herpetology, histology, ichthyology, invertebrate zoology, mammalogy, neurobiology, ornithology, parasitology, physiological ecology, physiology (cellular, comparative, exercise, mammalian), radioecology, reproductive biology, taxonomy, tissue culture, and molecular biology.

### MASTER OF SCIENCE

*Admission requirements:* GRE with advanced test (biology) and bachelor's degree with major in zoology, biology or allied field. Applicants are normally admitted for September only. Applications should be completed by February 15.

*Program requirements:* thesis; ZOO 595, 596.

### DOCTOR OF PHILOSOPHY (BIOLOGICAL SCIENCES)

*Admission requirements:* master's degree is not required. GRE with advanced test (biology) and bachelor's degree with major in zoology, biology or allied field.

*Program requirements:* dissertation, two languages (one of which may be substituted with faculty approval), qualifying examination required for all candidates except holders of M.S. degree from URI; ZOO 595.



## Courses of Instruction

All graduate-level courses are described in full on the following pages. Undergraduate courses numbered at the 400 level, permitted for graduate credit in some cases, are described in the *Undergraduate Bulletin* and are listed here for reference only. Courses at the 500 level comprise the majority of course work between the bachelor's and the master's degrees. Those at the 600 level are advanced graduate courses. The 900 level courses are special types of graduate courses including graduate courses for which no degree credit is given. They include courses offered to remedy deficiencies as well as workshops, institutes, and courses offered one time only by visiting faculty.

Courses with two numbers, e.g. APA 501, 502, indicate a year's sequence and the first course is either a prerequisite for the second or at least the two cannot be taken in reverse order without special permission. Parentheses after a course number enclose either the old course number, or in cases of multiple listings, the departments and numbers under which the course is also offered.

The roman numeral indicates the semester the course will normally be offered; some courses, however, are offered only in alternate years and a few less frequently. The *Schedule of Courses* issued by the registrar at the November and May registration period must therefore be consulted to determine which courses will be offered in the following semester. The arabic numeral indicates the credit hours; distribution of class hours each week is in parentheses. The instructor's name follows the course description.

### ACCOUNTING (ACC)

**413 Contemporary Accounting Issues** (I,3)

**415 Accounting-Computer Systems** (I, 3)

**422 Advanced Cost Accounting** (II, 3)

**431 Advanced Accounting** (II, 3)

**443 Federal Tax Accounting** (I, 3)

**444 Topics in Federal Taxation** (II, 3)

**461 Auditing** (II, 3)

**510 Financial Accounting** (I and II, 3) Concepts of financial accounting in the analysis and interpretation of financial statements; emphasis on accounting principles. (Lec. 3) Staff

**513 Accounting Systems** (I, 3) Principles and problems related to design and installation of accounting control systems with emphasis on automated data processing. (Lec. 3) Pre: 312 or permission of department. Staff

**535 Advanced Problems in Accounting** (II, 3) General and specialized accounting problems that constitute the subject matter of CPA examinations. (Lec. 3) Pre: 431. Staff

**548 Accounting for Non-Commercial Entities** (II, 3) Principles and practices of fund accounting as applied to municipalities, educational institutions, hospitals and similar organizations, with particular emphasis upon municipal records and statements. (Lec. 3) Pre: permission of instructor. Staff

**611 Managerial Accounting** (I and II, 3) Determination of accounting information for the purposes of decision making, control, and evaluation with emphasis on decision models using accounting information. (Lec. 3) Pre: 510, MGS 580, 581 or equivalent. Staff





**618 Current Accounting Theory (I, 3)** Critical examination of accounting theory and practice to develop research techniques with emphasis on financial accounting. (Lec. 3) Pre: 510. Staff

**619 Current Accounting Theory (II, 3)** Critical examination of accounting theory and practice with respect to cost and managerial accounting. (Lec. 3) Pre: 321 or 611. Staff

**662 Advanced Auditing (II, 3)** Statements on auditing standards, auditing electronic systems, auditor's reports, statistical sampling in auditing, regulations of SEC, and cases in auditing. (Lec. 3) Pre: 461, MGS 581. Staff

**681 Accounting Policy (II, 3)** Development of accounting policy with respect to managerial planning and control. Emphasis on analytical evaluation of cases with major research project. (Lec. 3) Pre: graduate standing and completion of all foundation courses. Staff

## ADULT AND EXTENSION EDUCATION (ADE)

**487 The Cooperative Extension Service in Today's Society (II, 3)**

**488 Methods and Materials for Adult Extension Education (I, 3)**

**489 Utilization of Paraprofessionals in Adult and Extension Education (I, 3)**

**491, 492 Special Problems in Adult Education (I and II, 1-3 each)**

## ANIMAL PATHOLOGY (APA)

**401 Introduction to Pathology (I or II, 3)**

**422 Avian Diseases (II, 3)**

**461 (or ACS 461) Laboratory Animal Technology (1, 3)**

**501, 502 Seminar (I and II, 1 each)** Preparation and presentation of scientific papers on selected subjects in animal pathology and virology. Staff

### COURSE TITLE CODE

ACC - Accounting	FNS - Food and Nutritional Science	NUE - Nuclear Engineering
ADE - Adult and Extension Education	FRC - Food and Resource Chemistry	NUR - Nursing
APA - Animal Pathology	FOR - Forest and Wildlife Management	OCE - Ocean Engineering
ASC - Animal Science	FRN - French	OCG - Oceanography
APG - Anthropology	GBA - General Business Administration	OMR - Organizational Management and Industrial Relations
ART - Art	GEG - Geography	PCG - Pharmacognosy
AST - Astronomy	GEL - Geology	PCL - Pharmacology and Toxicology
BCP - Biochemistry and Biophysics	GER - German	PHC - Pharmacy
BOT - Botany	HIS - History	PAD - Pharmacy Administration
BED - Business Education	HED - Home Economics Education	PHL - Philosophy
BSL - Business Law	HMG - Home Management	PED - Physical Education
CHE - Chemical Engineering	IDE - Industrial Engineering	PHY - Physics
CHM - Chemistry	INS - Insurance	PLS - Plant and Soil Science
CDF - Child Development and Family Relations	ITL - Italian	PLP - Plant Pathology-Entomology
CVE - Civil and Environmental Engineering	JOR - Journalism	PSC - Political Science
CPL - Community Planning	LAT - Latin	PSY - Psychology
CSC - Computer Science	LSC - Library Science	RDE - Resource Development Education
ECN - Economics	LIN - Linguistics	REN - Resource Economics
EDC - Education	MGS - Management Science	REM - Resource Mechanics
ELE - Electrical Engineering	MAF - Marine Affairs	RTH - Respiratory Therapy
ENG - English	MMG - Marketing Management	RUS - Russian
EHS - Environmental Health Science	MTH - Mathematics	SOC - Sociology
EST - Experimental Statistics	MCE - Mechanical Engineering and Applied Mechanics	SPA - Spanish
FIN - Finance	MCH - Medicinal Chemistry	SPE - Speech Communication
FMT - Fisheries and Marine Technology	MIC - Microbiology	TXC - Textiles and Clothing
	MUS - Music	THE - Theatre
		ZOO - Zoology

**534 Animal Virology** (II, 3) Basic properties, classification and evolution of animal viruses. Individual agents are studied in detail. (Lec. 3) Pre: MIC 432, 533 and permission of department. Yates and Chang

**536 Virology Laboratory** (II, 2) Methods employed in diagnosis and for the investigation of the biological, physical, and chemical properties of animal viruses. (Lab. 6) Pre: 534. (May be taken simultaneously.) Chang

**538 Epidemiology of Viral and Rickettsial Diseases** (II, 2) Principles of epidemiology. Interrelationships of host, environment and agent in viral and rickettsial diseases. (Lec. 2) Pre: 534. (May be taken simultaneously.) In alternate years, next offered 1977-78. Chang

**591, 592 Special Projects** (I and II, 1-3 each) Research projects in animal pathology and virology. Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

#### ANIMAL SCIENCE (ASC)

**412 Animal Nutrition** (II, 3)

**415 Physiology of Lactation** (I, 3)

**432 Biology of the Fowl** (II, 3)

**441 Food Analysis** (I, 3)

**442 Animal Breeding** (II, 3)

**444 Food Quality** (II, 3)

**452 (or FMT 452) Industrial Fishery Technology** (II, 3)

**461 (or APA 461) Laboratory Animal Technology** (I, 3)

**470 Population Genetics** (II, 3)

**472 Physiology of Reproduction** (II, 3)

**483 Salmonid Aquaculture** (I, 3)

**491, 492 Special Projects** (I and II, 1 each)

**501, 502 Animal Science Seminar** (I and II, 1 each) Preparation and presentation of papers on recent scientific developments and selected subjects in animal and poultry science and food science. (Lec. 1) Pre: senior standing. Staff

**512 Advanced Animal Nutrition** (II, 3) Digestion and metabolism of protein, carbohydrate, and fat by ruminant and nonruminant animals. Role of vitamins and minerals in metabolism. Experimental methods in animal nutrition. Emphasis on the ruminant animal. (Lec. 2, Lab. 2) Pre: 412, CHM 124 or BCP 581 and permission of department. In alternate years, next offered 1977-78. Hinkson

**532 Experimental Design**

See Experimental Statistics 532.

**584 Advanced Aquaculture Systems** (II, 3) Development of design criteria, operational analysis and management of selected species in water re-use systems. (Lec. 2, Lab. 2) Pre: MIC 361 or equivalent or permission of instructor. In alternate years, next offered 1977-78. Meade

**586 Fish Nutrition** (I, 3) Digestion and metabolism of carbohydrate, protein and lipids by fish. Role of

vitamins and minerals in metabolism and associative nutritional diseases resulting from deficiencies. Inadvertent toxic factors in fish feeds. (Lec. 3) Pre: 412 and CHM 228 or equivalent. In alternate years, next offered 1976-77. Meade

**591, 592 Research Problems** (I and II, 3 each) Research problems to meet individual needs of graduate and honors students in the field of animal breeding, nutrition, or physiology and food science. (Lab. 6, TBA) Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor program committee.

Note: for Biochemistry of Foods, see FRC 431, 432.

#### ANTHROPOLOGY (APG)

**401 History of Anthropological Theory** (I or II, 3)

**402 Methods of Anthropological Inquiry** (I or II, 3)

**405 Psychological Anthropology** (I or II, 3)

**407 Economic Anthropology** (I or II, 3)

**409 Anthropological Linguistics** (I or II, 3)

**411 Maritime Ethnology** (I, 3)

**412 Primate Behavior and Organization** (I or II, 3)

**470 Problems in Anthropology** (I and II, 3)

#### ART (ART)

**403, 404 Studio—Seminar I and II** (I and II, 3-6 each)

**405, 406 Studio—Seminar III and IV** (I and II, 3-6 each)

**461 Topics in Methods, Theory and Criticism** (II, 3)

**462 Modern Art Seminar: Art since 1945** (II, 3)

**469, 470 Art History—Senior Projects** (I and II, 3-6 each)

**480 Advanced Topics in European Art** (I, 3)

**484 Advanced Topics in Architectural History** (II, 3)

**501, 502 Graduate Studio Seminar I and II** (I and II, 3 each) Intensive independent studio work under guidance of instructors. Periodic critiques and discussions related to work of all participants in the course. (Studio 6) Pre: 48 credits in studio for 501; 501 for 502. Staff

#### ASTRONOMY (AST)

**408 Introduction to Astrophysics** (II, 3)

#### BIOCHEMISTRY AND BIOPHYSICS (BCP)

**401 (or MIC 401) Quantitative Cell Culture** (I, 3)

**403 (or MIC 403) Introduction to Electron Microscopy** (I, 2)

**405 (or MIC 405) Electron Microscopy Laboratory** (I, 2)

**411 Biochemistry Laboratory** (II, 3)

**435 (or CHM 435) Physical Chemistry for Life Sciences** (I, 3)

**491, 492 Research in Biochemistry and Biophysics** (I and II, 1-6 each)

**521 (BPH) Introductory Biophysics** (I, 3) Use of viscosity, diffusion, ultracentrifugation, light scatter-

ing, spectrophotometry and X-ray diffraction to study the size, shape, structure, and molecular weight of biological macromolecules. (Lec. 3) Pre: permission of instructor. Hartman

**523, 524 (BPH) Special Topics in Biochemistry and Biophysics (I, II, 1-6 each)** Advanced work arranged to suit the individual needs of the student. Lecture and/or laboratory according to the nature of the problem. Credits not to exceed a total of 12. Pre: permission of department. Staff

**541, 542 (BCH) Laboratory Techniques in Biochemistry (I, II, 3 each)** Biochemical techniques of enzyme preparation and purification, cell fractionation, ion-exchange and paper chromatography, manometry, fluorometry, polarography, radioactive tracer. Assigned research on advanced level using techniques. (Lab. 9) Pre: permission of department. Staff

**581, 582 (BCH) General Biochemistry (I, II, 3 each)** Systematic treatment of the principles of biochemistry. Basic course dealing with chemistry of biological substances and transformations in living organisms. (Lec. 3) Pre: CHM 228, 229. Staff

**595, 596 (BPH) Seminar in Biochemistry and Biophysics (I, II, 1 each)** Presentation of papers on selected subjects in biophysics. (Lec. 1) Staff

**599 (BCH, BPH) Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**601 (BCH) Enzymes (I, 3)** Factors affecting the rate of catalysis in enzymic reactions. Thermodynamic and kinetic characteristic of enzymes' profiles. (Lec. 1½, Lab. 8) Pre: 581, 582, and/or permission of department. In alternate years, next offered 1977-78. Purvis and Tremblay

**602 (BCH) The Mitochondrion (II, 3)** Detailed study of the structure, properties and functions of the mitochondrion. (Lec. 3) Pre: 581, 582, and/or permission of department. In alternate years, next offered 1977-78. Purvis

**611 (BCH) Metabolism (I, 3)** Intensive study of metabolic pathways of carbohydrates, lipids and nitrogenous compounds, their interrelationships. Effects of hormonal and nutritional status on activity of these pathways. (Lec. 3) Pre: 581, 582, and/or permission of department. In alternate years. Purvis and Tremblay

**612 Biochemical Regulation of Cellular Metabolism (II, 3)** Biochemical regulatory mechanisms of cellular metabolism in micro-organisms and mammalian systems, at the level of the genome, protein synthesis and enzyme catalysis. (Lec. 3) Pre: 581, 582, and/or permission of department. In alternate years. Tremblay

**622 Advanced Electron Microscopy**  
See Microbiology 622.

**624 Advanced Electron Microscopy Laboratory**  
See Microbiology 624.

**651, 652 (BPH) Research in Biochemistry and Biophysics (I, II, 3 each)** Student is required to outline a research problem, conduct necessary literature survey and experimental work and present his observations and conclusions in a report. (Lab. 6) Pre: graduate standing. Staff

**699 (BPH) Doctoral Dissertation Research (I, II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## BOTANY (BOT)

**402 Systematic Botany (I, 3)**

**417 Field Aquatic Plant Ecology (I, 3)**

**418 Marine Botany (II, 3)**

**419 Freshwater Botany (II, 3)**

**421 Advanced Practicum in Aquatic Plant Ecology (II, 3)**

**424 Plant Ecology (II, 3)**

**432 Mycology: Introduction to the Fungi (I, 4)**

**445 Advanced Plant Physiology (II, 3)**

**453 Cytology (I, 3)**

**455 (or Zoo 455) Marine Ecology (I, 3)**

**457 (or ZOO 457) Marine Ecology Laboratory (I, 1)**

**511 Developmental Plant Anatomy (II, 3)** Ontogeny of plant structures is studied from zygote through seed production with emphasis on recent experimental studies which elucidate the morphogenetic mechanisms. Ecological anatomy is included. (Lec. 2, Lab. 3) Pre: 311 or equivalent. In alternate years, next offered 1976-77. Hauke

**512 Morphology of Vascular Plants (II, 3)** Comparative survey of development, form and anatomy of extinct and extant vascular plants and modern interpretation of evidence concerning their interrelationships. (Lec. 2, Lab. 2) Pre: 311 or equivalent. In alternate years. Hauke

**520 Tidal Marsh Plant Ecology (I, 3)** Vegetation of tidal marshes and consideration of the ecological, geological, historical and sociological aspects. (Lec. 2, Lab. 2) Pre: 262; 315 and 323 recommended. Halvorson

**524 Methods in Plant Ecology (I, 3)** Methods in analysis of vegetation and microenvironments. Emphasis on quantitative techniques in analysis of vegetation, soil and microclimate, techniques in physiological ecology. (Lec. 3) Pre: 111 and 424 or equivalent; EST 412 desirable. In alternate years, next offered in 1976-77. Halvorson

**526 (or GEG 526) Plant Geography (II, 3)** Environmental and non-environmental factors controlling distribution of species and vegetative types; origin, development and senescence of floras; distribution of modern vegetation types and theories of modern-day species distribution. (Lec. 3) Pre: 402, 424, or permission of department. In alternate years, next offered 1977-78. Halvorson

**534 Physiology of the Fungi (I, 3)** Life processes of fungi with particular emphasis on chemical composition, organic and mineral nutrition, toxic and stimulating agencies, and metabolism. Also stresses phenomena of variation of growth and sporulation as affected by various environmental factors. (Lec. 2, Lab. 2) Pre: 332, or permission of department. In alternate years, next offered 1977-78. Caroselli

**536 Phytopathological Technique (I, 3)** Research procedures in plant pathology including isolation and inoculation practices, maintenance of pathogenes, dis-

ease diagnosis. Techniques for determining fungitoxic and phytotoxic properties of chemicals. Literature, methods for preparing manuscripts. (Lec. 1, Lab. 4) Pre: 332 or permission of department. In alternate years, next offered in 1976-77. Caroselli

**540 Experimental Mycology (II, 3)** Growth and reproduction of fungi as affected by nutritional, environmental and genetic factors, with emphasis on experimental methods. (Lec. 1, Lab. 4) Pre: 432 and MIC 201 or 211 or permission of instructor. In alternate years, next offered in 1977-78. Goos

**542 Medical Mycology (II, 3)** Fungi pathogenic for man and animals. (Lec. 2, Lab. 2) Pre: 432 or MIC 201 or 211 or permission of instructor. In alternate years, next offered in 1976-77. Goos

**551 Seminar in Aquatic Botany (I, 1)** Readings and discussion on current research involving algae and other aquatic plants. (Lec. 1) Pre: permission of instructor. Harlin, Wood

**554 Cytogenetics (I, 4)** Comparisons of various types of crossing-over, chromosomal aberrations and their effects, mutation and other cytogenetic phenomena in fungi and higher organisms. Laboratory studies of meiosis in maize, identification of chromosomes and induced rearrangements. (Lec. 2, Lab. 4) Pre: 352, 453, or permission of instructor. Mottinger

**559 Physiological Ecology of Marine Macroalgae (I, 4)** Comparative studies designed to investigate those environmental factors regulating distribution, physiology and development of macroalgae through field, laboratory and library research. (Lec. 2, Lab. 4) Pre: 416 or equivalent, or permission of instructor. In alternate years, next offered 1977-78. Harlin

**562 Seminar in Plant Ecology (II, 2)** Recent topics and investigations pertinent to plant ecology. Library research, oral presentation of reports, and group discussions. (Lec. 2) Pre: 424 or equivalent, and permission of instructor. Halvorson

**579 Advanced Genetics Seminar**  
See Zoology 579.

**581, 582 Botany Seminar (I and II, 1 each)** Preparation and presentation of papers on subject in selected areas relating to botany. (Lec. 1) Pre: required of graduate students majoring in botany. S/U credit. Staff

**591, 592 Botanical Problems (I and II, 1-3 each)** Special work arranged to meet the needs of individual students who are prepared for and desire advanced work in botany. Offered only by arrangement with staff. (Lec. 1-3, Lab. 2-6) Staff

**593, 594 Botanical Problems (I and II, 1-3 each)** Similar to 591, 592, but arranged to meet needs of students desiring further advanced work in botany. Offered only by arrangement with staff. (Lec. 1-3, Lab. 2-5) Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**616 The Biogeography of Marine Algae (II, 3)** Marine algae of the world, with consideration of the global distribution of taxa, geographic-ecologic ranges, and economic aspects. (Lec. 2, Lab. 3) Pre: permission of instructor. In alternate years, next offered 1976-77. Wood

**640 Advanced Mycology Seminar (I and II, 1 each)** Specialized and advanced treatment of biology and research in the major groups of the fungi, including systematics, physiology, and ecology. (Lec. 1) Pre: permission of instructor. May be repeated. Goos

**645 Environmental Plant Physiology (I, 3)** Environmental parameters influencing growth and development of the cellular and organismic levels of organization through physiological control mechanisms. Emphasis on flowering plants. (Lec. 3) Pre: 445, BCP 582 or FRC 452 or equivalent, or permission of instructor. In alternate years, next offered 1977-78. Albert

**659 Seminar in Physiological Ecology of Macroalgae (II, 1)** Readings and discussion of specialized and advanced research, stressing mechanism of environmental adaptation. (Lec. 1) Pre: 559, or permission of instructor. Harlin

**661 Phytoplankton Taxonomy**  
See Oceanography 661.

**663 Phytoplankton Physiology**  
See Oceanography 663.

**664 Phytoplankton Ecology**  
See Oceanography 664.

**667, 668, 669 Advanced Phytoplankton Seminars**  
See Oceanography 667, 668, 669.

**691, 692 Botanical Problems (I and II, 1-6 each)** Special work to meet needs of individual students who are prepared to undertake special problems. (Lec. 3 or Lab. 6) Pre: permission of department. Staff

**693, 694 Research in Botany (I and II, 3 each)** Assigned research, subject matter of which is to be arranged with a member of department and with the approval of the head of the department. (Lab. 6) Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## BUSINESS EDUCATION (BED)

**428 Coordinating and Developing Curriculum for Cooperative Vocational Business and Distributive Education (I, 3)**

**520 Research and Methods in Teaching Office Occupations Subjects (I, 3)** Psychological principles of skill building, content, methods of teaching, curriculum materials, current thought, and evaluation in the teaching of office occupations subjects. (Lec. 3) Staff

**522 Improvement of Instruction in Social Business Subjects (II, 3)** Research, objectives, methods of instruction, curriculum materials, current thought, and evaluation in the teaching of such subjects as economics, consumer economics, economic geography, business law and general business. (Lec. 3) Staff

**524 Foundations and Recent Developments in Business Education (II, 3)** Philosophy and objectives of business education, principles of curriculum development and evaluation, supervisory problems, organization and administration of cooperative part-time programs, historical developments, legislation, recent

developments, and current status of business education. (Lec. 3) Staff

**525 Research Seminar in Business Education (I, 3)** Analysis of research studies in the field. Research technique applied to business education. Emphasis on reading, interpretation and application of research findings. Planning research projects. Planning and approval of outline for a field study project required. (Lec. 3) Pre: a basic course in statistics and permission of department. Staff

**526 Field Study and Seminar in Business Education (I and II, 3)** Carrying out of the field study project approved in 525 with attendance and participation in seminar meetings. (Lec. 3) Pre: a basic course in statistics and 525. Staff

## BUSINESS LAW (BSL)

**442 (342) Property Interests (II, 3)**

**500 Legal Environment of Business (I and II, 2)** Outline of American legal system; substantive rules of law in contemporary business environment; legal aspects of business transactions. (Lec. 2) Staff

## CHEMICAL ENGINEERING (CHE)

**403, 404 (or OCE 403, 404) Introduction to Ocean Engineering Processes I and II (I and II, 3 each)**

**425 Process Dynamics and Control (II, 3)**

**437 Materials Engineering (I and II, 3)**

**447, 448 Unit Operations in the Food Industry (I and II, 4 each)**

**464 Industrial Reaction Kinetics (I, 3)**

**471 Analysis of Engineering Data (I or II, 3)**

**501, 502 Graduate Seminar (I and II, 1 each)** Seminar discussions including the presentation of papers based on research or detailed literature surveys. (Lec. 1) Attendance is required of all students in graduate residence, but a maximum of 1 credit per year is allowed, no more than 2 credits for the entire period. Staff

**530 Polymer Chemistry (I, 3)** Polymer structure, molecular forces, glass and crystalline transitions, solution properties, polymerization kinetics, molecular weight distribution, fractionation, viscoelastic properties and transport processes. (Lec. 3) Pre: CHM 222 and 332 or permission of instructor. Barnett

**531 Polymer Engineering (II, 3)** Polymer processing and mechanical properties of polymers. (Lec. 3) Pre: 342 or 344 and 530, or permission of instructor. Barnett

**532 Ceramic Engineering (I, 3)** Properties of ceramic materials as related to starting materials and forming, densification and finishing processes. Emphasis on resulting phases and microstructure. Application of physical and chemical principles to tailor properties to engineering needs. (Lec. 3) Pre: 437 or equivalent. Rockett

**533 Engineering Metallurgy (II, 3)** Structures and properties of metals and alloys required to meet typical engineering problems; proper selection of tool

materials; properties of stainless steels; materials of special importance in nuclear fields, etc. (Lec. 2, Lab. 3) Pre: 333 or consent of instructor. Mairs

**534 (or OCE 534) Corrosion and Corrosion Control (I, 3)** Chemical nature of metals, electrochemical nature of corrosion. Types of corrosion, influence of environment, methods of corrosion control, behavior of engineering materials, all with special emphasis on the ocean environment. (Lec. 3) Pre: permission of instructor. Staff

**535 (or OCE 535) Advanced Course in Corrosion (II, 3)** Various types of corrosion problems occurring in modern industry. In-depth comparison of the various methods available to avoid, reduce, or eliminate corrosion. Continuation of 534. (Lec. 3) Pre: 534 or permission of instructor. Staff

**537 Advanced Materials Engineering (II, 3)** Engineering properties, molecular design and applications of materials. Synthesis, fabrication and processing of materials. Effects of environment on materials, materials products devices and systems. (Lec. 3) Pre: 437 and PHY 340 or 341. Gielisse

**538 Nuclear Metallurgy**  
See Nuclear Engineering 538.

**539 Electron and Light Microscopy of Solids (I, 3)** Theory and physical principles governing the design and use of light and electron optical systems in identification, analysis and structural characterization of metals, ceramics, polymers, glasses and composites. Emphasis on polarized light and scanning electron microscopy. (Lec. 3) Pre: 437 or equivalent. Gielisse and Rockett

**540 Phase Equilibria (II, 3)** Interpretation, construction and thermodynamics of one, two, three to n-component phase diagrams with examples of their use in chemical, ceramic, metallurgical and mineral engineering. Pre: CHM 431 or equivalent. Rockett

**572 X-ray Diffraction and Fluorescence (I, 3)** Fundamentals, properties, and applications of X-rays for identification and chemical analysis of materials, determination of lattice parameters, phase transformations, textures, residual stresses, grain and particle sizes, film and plate thicknesses. (Lec. 2, Lab. 3) Pre: PHY 340 or 341. Mohnheim

**573 Mechanical Metallurgy (I or II, 3)** Behavior and response of metals to mechanical plastic forming. Property control by analysis and design of industrial metal processing. Principles of annealing, forging, rolling, extruding, rod, wire and tube drawing. Recent advances and developments. (Lec. 3) Pre: permission of instructor. Mohnheim

**574 Biochemical Engineering (I, 3)** Introduction to biotechnology. Includes properties of biological materials, dynamics, control and operation of biological systems and processing of biological materials. (Lec. 3) Pre: permission of instructor. In alternate years. Thompson

**581 Introduction to Nuclear Engineering**  
See Nuclear Engineering 581.

**582 Radiological Health Physics**  
See Nuclear Engineering 582.

**583 Nuclear Reactor Theory**  
See Nuclear Engineering 583.

**585 Measurements in Nuclear Engineering**

See Nuclear Engineering 585.

**586 Nuclear Reactor Laboratory**

See Nuclear Engineering 586.

**591, 592 Special Problems (I and II, 1-6 each)** Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problem. Credits not to exceed a total of 12.) Pre: permission of department. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**613 Advanced Chemical Engineering Thermodynamics (I, 3)** Applications of the first, second and third laws of thermodynamics and their relation to chemical engineering processes. Emphasis on properties of fluids, chemical and physical equilibria and refrigeration. (Lec. 3) In alternate years. Votta

**614 Advanced Chemical Engineering Thermodynamics (II, 3)** Continuation of 613. (Lec. 3) Pre: 613. In alternate years. Votta

**625 Automatic Process Control (II, 3)** Theory of automatic control as applied to industrial processing systems. (Lec. 3) In alternate years. Shilling

**627 (or IDE 641) Molecular Aspects of Materials Processing (I or II, 3)** Detailed analysis of fundamental physical and chemical aspects of generation, fabrication and application of materials in processing. Includes major material groups, molecular nature of material interaction, and mechanical, chemical, and thermal theories of specific processing modes. (Lec. 3) Pre: 437 or permission of instructor. Gielisse

**640 Transport Phenomena I (I, 3)** Analysis of transport processes in fluids with emphasis on diffusion of matter. (Lec. 3) Pre: MTH 244 and CHE 343 or permission of instructor. Knickle

**641 Transport Phenomena II (II, 3)** Interphase transfer, turbulent transport processes and boundary layer theory, with application to fixed and fluid bed processes, membrane processes, biochemical, biomedical and electrochemical systems. (Lec. 3) Pre: 640. Barnett

**643 Fluid Dynamics (II, 3)** Advanced problem course dealing with isothermal and nonisothermal flow of compressible and incompressible fluids. (Lec. 3) In alternate years. Staff

**644 Process Heat Transfer (II, 3)** Advanced study of heat transfer by conduction in the steady and unsteady state, radiation and convection. (Lec. 3) In alternate years. Knickle

**645 (or MCE 645) Boiling Heat Transfer and Two-phase Flow (I, 3)** Nucleation and bubble growth, pool boiling, and flow boiling. Hydrodynamics of two-phase flow, the boiling crisis, and instabilities in boiling systems. (Lec. 3) Pre: MCE 546, CHE 644 or permission of instructor. In alternate years. Test and Staff

**646 Radiation Heat Transfer**

See Mechanical Engineering 646.

**647 Mass Transfer I (I, 3)** Advanced course dealing with the application of mass transfer theory in the distillation of binary, multi-component, and complex mixtures. (Lec. 3) In alternate years. Thompson

**648 Mass Transfer II (II, 3)** Advanced study of vapor-liquid equilibria and mass-transfer theory applied to gas-liquid systems; humidification and gas absorption, simple and multicomponent systems, with and without chemical reaction. (Lec. 3) In alternate years, next offered 1977-78. Treybal

**651, 652 Advanced Design (I and II, 3 each)** Advanced course in the coordination of chemical or nuclear engineering principles and economics to the design of complete industrial plants. Students work design problems on an individual basis, with the guidance of one or more instructors. Staff

**664 Applied Reaction Kinetics (II, 3)** Application of principles of chemical reaction kinetics to industrial processes. (Lec. 3) In alternate years. Shilling

**682 Radiation Shielding**

See Nuclear Engineering 682.

**683 Advanced Nuclear Reactor Theory**

See Nuclear Engineering 683.

**687 Nuclear Chemical Engineering**

See Nuclear Engineering 687.

**691, 692 Special Problems (I and II, 1-6 each)** Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problem. Credits not to exceed a total of 12.) Pre: permission of department. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**CHEMISTRY (CHM)****401 Intermediate Inorganic Chemistry (I, 3)****412 Instrumental Methods of Analysis (II, 3)****414 Instrumental Methods of Analysis Laboratory (II, 2)****425 Qualitative Organic Analysis (I, 4)****431, 432 Physical Chemistry (I and II, 3 each)****435 (or BCP 435) Physical Chemistry for Life Sciences (I, 3)****501 Advanced Inorganic Chemistry I (I or II, 3)**

Systematic analysis of bonding schemes and structural aspects of molecular systems encountered in inorganic chemistry. Special emphasis on electron density distributions, physical methods of analysis, and practical applications of quantum mechanics. (Lec. 3) Pre: 401. Staff

**502 Advanced Inorganic Chemistry II (II, 3)**

Modern inorganic chemistry approached from experimental, theoretical and descriptive points of view. Includes electronic structure and bonding in coordination chemistry, topology, thermodynamics of complex formation, mechanisms, lanthanides and actinides. (Lec. 3) Pre: 401 or equivalent. Staff

**504 Physical Methods of Inorganic Chemistry (II, 3)**

Theory and application of principal physical methods used in the preparation, analysis, and investigation of properties of inorganic chemicals, with emphasis on investigations concerning molecular structure and electron density distributions in molecular systems. (Lec. 2, Lab. 3) Pre: 322. Petersen

**511 Advanced Analytical Chemistry I (I, 3)** Principles of aqueous and non-aqueous titration. Theory of separations including distillation, solvent extraction, and especially gas and liquid chromatography. Statistical treatment of experimental data. (Lec. 3) Pre: 412 or permission of instructor. Staff

**512 Advanced Analytical Chemistry II (II, 3)** Continuation of CHM 412 with emphasis on principles and recent developments in application of physicochemical phenomena to solution of chemical problems. (Lec. 3) Pre: 412, PHY 340, and MTH 243. Staff

**518 Radiochemistry (II, 3)** Theory and principles of nuclear science as applied to the various fields of chemistry. Radioactivity, radiation detection and measurement, preparation and separation of radionuclides, emphasis on solution of chemical and environmental research problems with the techniques of nuclear chemistry. (Lec. 3) Pre: 432, PHY 214 or permission of instructor. Fasching

**520 Radiochemistry Laboratory (II, 1)** Radioactivity, radiation detection and measurement, preparation and separation of radionuclides, instrumental neutron activation analysis, fission process, and uses of radioactive tracers. (Lab. 3) Pre: 518 concurrently, 432 and PHY 214, or permission of instructor. Fasching

**521 Advanced Organic Chemistry I (I, 3)** Emphasis on fundamental organic structure theory and reaction mechanisms. (Lec. 3) Pre: 228 and 230. Vittimberga

**522 Advanced Organic Chemistry II (II, 3)** Modern synthetic reactions and their applicability to such areas as natural products and heterocyclic chemistry. (Lec. 3) Pre: 521 or permission of instructor. Cheer

**529 Advanced Physical Chemistry I (I, 3)** Introduction to modern chemistry with emphasis on quantum chemistry and statistical thermodynamics. Includes development of quantum theory, applications of quantum theory, development and application of statistical distribution functions. (Lec. 3) Pre: 432 or permission of instructor. Staff

**532 Advanced Physical Chemistry II (II, 3)** Principles and applications of classical physical chemistry. Includes the three laws of thermodynamics, thermochemistry, phase equilibria, kinetic rate laws, and mechanisms of gas phase reactions. (Lec. 3) Pre: 432 or permission of instructor. Staff

**535 Chemical Applications of Group Theory (I, 2)** Fundamental principles of group theory developed as used in simplifying problems of a chemical nature. Group theoretical approach to several typical problems such as hybrid orbitals, molecular orbitals, and molecular vibrations. (Lec. 2) Pre 432. Brown

**536 Molecular Spectroscopy and Structure (II, 3)** Theory of molecular dynamics, interaction of electromagnetic radiation with matter. Absorption and emission spectra in infrared, far-infrared, and microwave regions. Raman scattering in the visible region. Use of spectral results in determining physical properties and elucidating molecular structures will be emphasized. (Lec. 3) Pre: 535 or permission of instructor. Brown

**542 Recording Techniques for Chemical Demonstrations (II, 3)** Demonstrations illustrating significant chemical principles are planned, rehearsed and presented for closed-circuit TV and class

criticism. (Lec. 3) Pre: permission of instructor. Designed to accompany the M.S. non-thesis degree in chemistry; may not be taken to fulfill required chemistry credits of other degrees. Hamlet and MacKenzie

**544 Applications of Chemical Data Processing (II, 3)** Chemical calculations in detail, individual program construction and execution. Includes inter-atomic repulsions, dipole moments, interaction of bond orbitals, filling ORD curves, calculation of spectra and quantum mechanical approximations. (Lec. 2, Lab. 3) Pre: 222, 332 and a one-semester course in FORTRAN programming or equivalent experience. In alternate years, next offered 1976-77. MacKenzie

**551, 552 Non-thesis Masters Research (I and II, 3 each)** Research on original problem for fulfillment of research requirement of non-thesis master's degree. Literature survey, laboratory work and detailed report required. (Lab. 9) Pre: permission of department.

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee. A minimum of six credits is required of students who have chosen the thesis option for the master's degree.

**602 The Transition Metals (I, 3)** Ligand theory and its applications. Basic quantum mechanical calculations involving thermodynamical, spectral and magnetic properties of complexions. (Lec. 3) Pre: 529. In alternate years, next offered in 1976-77. Nelson

**608 Inorganic Reaction Mechanisms (II, 3)** Kinetics and mechanisms of reactions in aqueous solution: techniques, results, and theoretical interpretation. Instrumentation for studying rapid reactions in solution, relaxation methods, electron transfer rates, hydrolytic and solvolytic reactions, metal ion complexation, reactions of biochemical significance. (Lec. 3) Pre: 502 or permission of instructor. Kirschenbaum

**615 Trace Analysis of Inorganic Substances (I, 3)** Principles of trace analysis. Emphasis on techniques and instrumentation. The advantages and limitations of such techniques as atomic absorption spectroscopy, neutron-activation analysis, flame emission X-ray fluorescence will be presented. (Lec. 3) Pre: 511 or permission of instructor. Fasching

**616 Applied Analytical Techniques (II, 3)** Application of analytical instrumentation and techniques to practical problems. Limitations and specific difficulties of analyzing complex matrices in practical research. Problem oriented presentation. (Lec. 3) Pre: 511 and 512 or permission of instructor. P.R. Brown

**617 Advanced Instrumentation (I, 3)** Basic design and theory of design of instruments. Discussion of advantages and limitations of specific instruments. Current research in instrument design and critical evaluation of designs. (Lec. 3) Pre: 511 and ELE 220 or 537 or its equivalent. Fasching

**618 Theory of Separations (II, 3)** Companion to 615. In-depth presentation of theory of separation processes. Emphasis on methods development, advanced topics and current advances using gas and liquid chromatography. (Lec. 3) Pre: 511 or permission of instructor. P.R. Brown

**622 Advanced Organic Synthesis (II, 3)** Discussion of modern synthetic methods for the construction of complex chemical structures. (Lec. 3) Pre: 522. Staff

**626 Free Radicals and Photochemistry (I, 3)** Theory of formation and detection of free radicals and photoexcited states. Bond homolysis, additions, oxidation, polymerization, rearrangements and other free radical reactions. (Lec. 3) Pre: 521, 522 or equivalent. Abell

**627 Organic Intermediates (I, 3)** The formation, reaction and decomposition of short-lived organic intermediates will be explored with special emphasis on the carbonium ion, carbanion and carbene species. (Lec. 3) Pre: 521. Staff

**628 Organometallic Chemistry (II, 3)** The interaction of the organic and inorganic moieties and their effects upon each other. Special emphasis will be placed on the interaction of organic moieties with the transition and main group metals. (Lec. 3) Pre: 502. Rosen

**634 Advanced Chemical Thermodynamics (II, 3)** Statistical thermodynamics is developed and applied to the calculation of thermodynamic properties. (Lec. 3) Pre: 532 or permission of department. In alternate years, next offered 1977-78. Staff

**638 Advanced Quantum Chemistry (II, 3)** Perturbation theory, the variational principle, time dependent perturbation theory, the helium atom, the hydrogen molecule, Hartree Fock calculations, pi electron systems, development of the Huckel molecular orbital methods. (Lec. 3) Pre: 529 or equivalent. Gonzalez

**641, 642, 643, 644 Graduate Seminar (I and II, 1 each)** Results of detailed literature surveys are presented orally and in writing. Required for candidates for advanced degrees in chemistry. (Lec. 1) S/U credit. Staff

**691 Special Topics (I and II, 2)** Covers the following special research interests: (a) carbohydrate chemistry, (b) chemical kinetics, (c) clinical chemistry, (d) computer techniques in analytical chemistry, (e) forensic chemistry, (f) free-radical rearrangements, (g) recent advances in analytical chemistry, (h) light scattering, (i) molecular orbital theory, (j) pericyclic reactions, (k) surface chemistry, (l) X-ray analysis of organic molecules. (Lec. 2) May be repeated up to a maximum of 6 credits. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## CHILD DEVELOPMENT AND FAMILY RELATIONS (CDF)

**400 Child Development: Advanced Course (I, 3)**

**403 Human Development during Adulthood (I or II, 3)**

**406 Growth and Development During Infancy (I, 3)**

**450 Family Interaction (I, 3)**

**460 Family Life Education (II, 3)**

**480 Children and Families in Poverty (II, 3)**

**497, 498 Special Problems (I and II, 2-4 each)**

**500 Child Development Seminar (I or II, 3)** Intensive study of selected topics, such as development of cognitive processes, individual and group differences in development of language, hereditary factors in physical growth. Review papers by students presented to class. (Lec. 3) Pre: 400 or permission of department. Staff

**501 The Study of Children and Families (I, 3)** Historical, philosophical, and procedural foundations of scientific inquiries of children and families. Exploration of various perspectives applicable to the acquisition of information about human development and family relationships. (Lec. 3) Pre: graduate standing or permission of department. Staff

**550 Family Relations Seminar (II, 3)** Intensive study of selected topics, such as maternal deprivation, child rearing practices and attitudes, homogamy and complementary needs in marital choice. Review papers prepared by students presented to the class. (Lec. 3) Pre: 355 or permission of department. Staff

**570 Field Experience with Exceptional Children (I and II, 3)** Interdisciplinary seminar and laboratory with observation and supervised projects with exceptional children. Psychological, physical and social factors pertinent to teaching in child development centers. (Lec. 1, Lab. 4) Pre: 370 or equivalent and permission of department. Staff

**595 Master Project: Action Research (I and II, 1-6)** Number of credits is determined each semester in consultation with the major professor. Minimum of six credits is required of students who have chosen the action-thesis option. One to six credits may be taken. S/U credit.

**597, 598 Advanced Study (I and II, 3 each)** Survey of important research contributions significant to understanding of human development and relationships. (Lec. 3) Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee. Minimum of six credits is required of students who have chosen the thesis option.

## CIVIL AND ENVIRONMENTAL ENGINEERING (CVE)

**442 Traffic Engineering (I, 3)**

**447 Highway Engineering (II, 3)**

**453 Computer Analysis of Structures (I, 3)**

**472 Industrial Air Pollution (I or II, 3)**

**473 Analysis of Air Pollutants (I or II, 3)**

**478 Solid Waste Disposal and Management (II, 3)**

**481 Soil Behavior (I, 3)**

**482 Soil Engineering (II, 3)**

**483 Foundation Engineering (II, 3)**

**491, 492 Special Problems (I and II, 1-6 each)**

**495 Civil and Environmental Engineering Systems (I, 3)**

**521 Advanced Strength of Materials (I or II, 3)**

Relations between stresses at a point on different planes passing through the point. Stress concentrations and localized stress. Introduction to the analysis of statically indeterminate stresses in which methods involving elastic strain energy are used. Consideration of the plastic analysis of structures. (Lec. 3) Staff

**524 (or OCE 524) Marine Structural Design (II, 3)** Includes the design of marine structures, consideration of marine construction materials, waterfront structures, ocean towers and underwater structures. (Lec. 2, Lab. 3) Pre: 351. McEwen



**551 Advanced Structural Analysis (I or II, 3)** Deflections of planar structures using energy concepts and elastic curve principles. Analysis of indeterminate planar structures using advanced techniques. Flexibility and stiffness matrices. (Lec. 3) Pre: permission of department. Staff

**565 Response of Structures to Dynamic Loads (I or II, 3)** Behavior of materials and components in civil engineering structures. Numerical and exact methods applied to response in the elastic and inelastic range. Matrix analysis. (Lec. 3) Pre: permission of department. Staff

**570 Sanitary Chemistry (I, 3)** Application of analytical chemistry to analysis of natural waters; physical chemistry and organic chemistry of aqueous media; chemical principles applicable to operations of sanitary engineering. (Lec. 3) Pre: permission of instructor. Sussman

**571 Sanitary Chemistry Laboratory (II, 3)** Applications of chemical laboratory procedures to control of water and waste water treatment processes. (Lec. 2, Lab. 3) Pre: 570. Sussman

**572 Biosystems in Sanitary Engineering (I or II, 3)** Microorganisms which constitute the biological systems in water pollution, water purification and waste water treatment. Application of principles of microbiology and biochemistry to analysis and design in fields of sanitary engineering and water resources. (Lec. 2, Lab. 3) Pre: permission of instructor. Poon

**575 Open Channel Hydraulics (I or II, 3)** Analysis of uniform, critical, varied flow, and unsteady flow in open channels. Principles will be applied to open channel design. (Lec. 3) Pre: MCE 354. Poon

**584 Principles of Pavement Design (I or II, 3)** Design of flexible and rigid type pavements. Design and control of concrete paving mixes, bituminous concrete paving mixes and current research on pavement design. Emphasis on soil engineering including stabilization, moisture movement and frost considerations. (Lec. 2, Lab. 3) Pre: 380 and permission of instructor. Moulthrop and Nacci

**585 Soil Stabilization (I or II, 3)** Factors that affect soil stability. Mechanisms of soil stabilization. Design and analysis of stabilized soils. (Lec. 2, Lab. 3) Pre: 380 and permission of instructor. Staff

**586 Physio-chemical Properties of Soils (I, 3)** Influence of physio-chemical properties of soils on engineering characteristics and performance. Application of mineralogy, ion exchange and colloidal theory; effect of marine environment, and the nature of soil water. Pre: 481 or permission of instructor. Staff

**587 Groundwater Flow and Seepage Pressures (I, 3)** Hydrodynamics of fluid flow through porous media. Analytical methods for steady and unsteady seepage in aquifers; theoretical analysis with practical modification of seepage problems involving foundations, drainage structures, earth dams and wells. (Lec. 2, Lab 3.) Pre: 380 and permission of instructor. Kelly

**588 Groundwater Hydrology (II, 3)** Quantitative methods of groundwater hydrology including determination of aquifer properties and yield. Modeling of groundwater systems for management quantity of water and movement of contaminants. Field and

laboratory measurements. (Lec. 2, Lab. 3) Pre: MCE 354 and CVE 380 or equivalent. Offered in spring of even calendar years. Kelly

**596 Numerical Methods in Structural Engineering (I or II, 3)** Methods of successive approximations and numerical procedures in the solution of stress, vibration and stability problems in structural members. Nonuniform members, elastic supports, plates, torsion. (Lec. 3) Pre: permission of department. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**601, 602 Graduate Seminar (I and II, 1 each)** Discussions and presentation of papers based on research or detailed literature surveys. (Lec. 1) Required of all students in graduate residence, but a maximum of 1 credit per year is allowed, no more than 2 credits for the entire period. Staff

**650 Advanced Structural Analysis (I or II, 3)** Continuation of 551. Analysis of indeterminate trusses, structures with nonprismatic members, and shell and folded plate structures. Investigation of secondary stresses. (Lec. 3) Pre: permission of department. Staff

**651 Plate Structures (I or II, 3)** Fundamental theories of bending and buckling of plates with practical application to the design of structural plate components of metal and reinforced concrete. (Lec. 3) Pre: permission of instructor. Staff

**652 Shell Structures (I or II, 3)** Membrane and bending theories of thin shells and their practical application to the design of shell and folded-plate structures of metal and reinforced concrete. (Lec. 3) Pre: 651 or permission of instructor. Staff

**653 Analysis of Space Structures (I or II, 3)** Analysis of three-dimensional determinate and indeterminate beams, frames, and trusses by matrix methods. Deflections and indeterminate analysis using virtual work, conjugate structure, and slope deflection procedures. Emphasis on numerical solutions using the digital computer. (Lec. 3) Pre: 396, 551. Lavelle

**655 Matrix Methods in Structural Analysis (I or II, 3)** Development of finite-element methods of structural analysis. Application to stress problems and to plate and shell structures. (Lec. 3) Pre: permission of instructor. Staff

**671 Advanced Waste Water Treatment (I or II, 3)** Latest developments in biological and physiochemical treatment processes. Emphasis on the tertiary treatment of sewage and the ultimate treatment of industrial wastes. Laboratory measurements. (Lec. 2, Lab. 3) Pre: 570 or permission of instructor. Poon and Sussman

**672 Water Pollution Control and Treatment of Waste Water (I or II, 3)** Waste water characteristics, effects and purification in natural water, government control strategies and impacts, cost of control, theory and mathematical concepts of secondary and tertiary treatment process, their limitations and late developments. (Lec. 3) Pre: one year chemistry, biology, MTH 243, CVE 572 or their equivalent and permission of instructor. Poon

**673 Theory of Water Purification and Treatment (I, 3)** Principles of modern water purification and engineer-

ing practices. Aeration, deodorization, sterilization, coagulation, filtration, water softening, iron removal, disinfection and corrosion control. (Lec. 3) Campbell

**674 Sanitary Engineering Laboratory** (I or II, 3) Advanced phases of sewage treatment and purification including sludge digestion, sludge gas analysis, biochemical oxygen demand, conditioning of sludge, activated sludge, sewage trickling filters and chemical precipitation. (Lec. 2, Lab. 3) Pre: permission of instructor. Poon

**675 Sanitary Engineering Design** (I or II, 3) Functional design of modern water treatment plant providing treatment of water for domestic and industrial consumption. (Lec. 1, Lab. 6) Pre: permission of instructor. Poon

**676 Sanitary Engineering Design** (I or II, 3) Functional design of modern sewage treatment works providing treatment of sewage. (Lec. 1, Lab. 6) Pre: 673. Campbell

**677 Stream and Estuarine Analysis** (I or II, 3) Functionals and mathematical concepts of physical and biological factors applied to the evaluation of the pollution capacity of streams and estuaries. (Lec. 3) Pre: MTH 244. Campbell

**678 Industrial Waste Water Treatment** (I or II, 3) Advanced considerations of industrial waste disposal problems of major waste producing industries, including waste producing processes, composition of waste waters, treatment methods, and in-plant abatement techniques. (Lec. 3) Pre: permission of instructor. Poon and Sussman

**681 Advanced Soil Mechanics** (I, 3) Index properties and physical properties of soils. Laboratory and field procedures for soil identification. Permeability and flow of water through soils. Compressibility characteristics of soils and consolidation theories as applied to settlement analysis. (Lec. 2, Lab. 3) Pre: 521 or equivalent. Staff

**682 Advanced Soil Mechanics** (II, 3) Stress analysis. Elastic theory of stress distribution in soils. Application of consolidation theory. Shearing phenomena in soils with application to bearing capacity, earth pressure and slope stability. Pile foundation analysis. Special topics. (Lec. 3) Pre: 681. Staff

**691, 692 Special Problems** (I and II, 1-6 each) Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problems.) Credits not to exceed a total of 12. Pre: permission of department. Staff

## COMMUNITY PLANNING (CPL)

**410 Fundamentals of Urban Planning** (I or II, 3)

**434 Introduction to Environmental Law** (I, 3)

**501 Introduction to Community Planning History and Theory** (I, 3) The development of community planning in the U.S., history of governmental planning and evolution of the planning profession, and theoretical elements and constructs basic to contemporary planning practice. (Lec.3) Foster

**503, 504 Interdisciplinary Seminar in Contemporary U.S. Environment** (I and II, 3 each) Comprehensive

survey of structural change in American society and its environmental and technological settings. (Lec. 3) Staff

**505 Planning Studio I** (I, 3) Understanding of the physical environment and application of analytical planning studies, tools, techniques and inventory procedures. Methods of analysis applied to a laboratory problem involving a specific geographic area. (Lec. 3, Lab. 3) Staff

**506 Planning Studio II** (II, 6) The community plan: community facilities, future land use, economic development, and general plan implementation. Functional requirements of physical elements and their relationship in space. Actual design projects in the laboratory. (Lec. 3, Lab. 3) Staff

**508 Research Methodology** (II, 3) A basic foundation for independent research directed toward the production of a thesis at the master's degree level. Basic concepts of problem definition, formulation and testing of hypotheses, and the relation of research to theoretical concepts. (Lec. 3) Brooks

**510 Survey of Regional, Inner-City, and Environmental Planning** (I, 3) Introductory course to acquaint students with areas of concentration within the curriculum. After initial period of lectures, student chooses an appropriate section depending on particular interest. (Lec. 3) Brooks, Foster, Mahayni

**520 Seminar in Regional Planning and Development** (II, 3) Regional development issues and policies in advanced and developing countries. Regional planning, development theories, methodologies, distribution of economic activities, and settlement patterns. Role of infrastructure in stimulating development processes. (Lec. 3) Mahayni

**521 (621) (or REN 532) Land Resources Economics** (I, 3) The study of economic relationships of man and scarce natural and man-made resources. Supply and demand, rent theory, resources conservation and the impact of public policy and law. (Lec. 3) Jeffrey

**531 (631) Seminar in Urban Design** (I, 3) Significant concepts of historical and contemporary urban form ranging in scale from the city as a whole to architectural detail of public projects. Use of slides and films to illustrate the visual impact and importance of excellence in design. (Lec. 3) Hammerschlag

**534 (634) Environmental Law** (II, 3) Alternative policy approaches involving economical, ecological, and political sciences, technological, planning and legal disciplines in the conceptualization of protection, control and development of the environment are examined. (Lec. 3) Brooks

**540 Housing in American Society** (II, 3) Housing, a process and facility; policy and market analysis at regional, state and local levels; role of government in providing housing for the poor; alternative strategies for housing the poor. (Lec. 3) Johnson

**541 (641) Manpower Planning** (I, 3) A review of manpower planning at all levels of government. Concentration on the problems of unemployment in the central city; labor supply and demand, manpower forecasting and projection techniques. (Lec. 3) Johnson

**544 Urban Planning and Politics in the Metropolis** (II, 3) Significance and impact of urban planning on growth and betterment of cities and metropolitan

areas. The planning process as it relates to the formulation of community development policies and the institutional framework from which they are produced. (Lec. 3) Pre: PSC 422 or equivalent. Foster

**552 (652) Values and Prediction in Planning (I or II, 3)** Examines human needs and wants, and how decisions are influenced by society and nature. Provides a framework for the measurement and analysis of qualitative data, and for the prediction of human behavior relative to planning. (Lec. 3) Jeffrey

**570 Plan Implementation (I or II, 3)** Survey of tools of plan implementation, including public tools such as zoning, subdivision control, capital budgets, renewal, taxation, federal and state programs, and private tools such as mortgaging and easements. (Lec. 3) Staff

**589 Masters Project Research (I and/or II, 1-6)** A substantial, self-directed planning project, by one or several students, under general guidance of a major professor. Number of credits to be determined each semester. Staff

**591, 592 Special Problems in Planning (I or II, 3 each)** Individual investigation of special problems in planning. Staff

**593-598 Special Problems in Planning (I or II, 3 each)** Group investigation of special problems in planning. Staff

**599 Masters Thesis Research (I or II, 6)** Number of credits is determined each semester in consultation with the major professor or program committee.

**601 Planning Law Seminar (I, 3)** General review and discussion of legal principles and thought concerned with property rights, political power, and the legal aspects pertinent to the planning and development of public and private activities. (Lec. 3) Brooks

**603 Planning Studio III (I, 6)** Semester-long project integrating and applying previously acquired knowledge and skills on graphic, audio-visual, oral and written communication. Preparation of an appropriate planning report. Emphasis varies depending on topic: urban design, regional analysis, capital budgeting, federal, state and legal requirements, transportation, commercial or industrial activities or ecology. (Lec. 3, Lab. 6) Hammerschlag

**606 Seminar in Professional Planning Practice (II, 3)** Current planning operations in public and private organizations, staff and client relations, ethical responsibilities, interdisciplinary cooperation; work programming, new trends, legislation and planning opportunities on local, state and national levels. (Lec. 3) Staff

**608 Seminar in Planning Theory (I or II, 3)** Critical survey of planning theories and contemporary planning concepts. Values, assumptions, and processes of various planning paradigms as they relate to decisions in community planning. (Lec. 3) Mahayni

**623 Seminar in Transportation Planning (I, 3)** The range of issues confronting planning for urban transportation systems; the variety of policies governments pursue in issues and problems; technical and political constraints; transportation studies, and demand analysis techniques. (Lec. 3) Barber

**624 State and Metropolitan Planning (II, 3)** Institutional aspects of state and metropolitan plan-

ning; the agencies in which planning is done and the intergovernmental context of coordination and implementation. Programming, staffing, budgeting and project evaluations are examined. (Lec. 3) Barber

**654 Advocacy Planning (I or II, 3)** Relationships between residents of an urban slum and public officials in governmental agencies; citizen participation in urban renewal areas, enforcement of housing laws, selected problems of city schools, public assistance, and civil disobedience. Relationships reviewed on the basis of statutory, administrative, or contractual material. (Lec. 3) Brooks

**691, 692 Special Problems in Planning (I or II, 3)** Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. Staff

**693-698 Special Problems (I or II, 3)** Advanced work, under the supervision of a member of the staff and arranged to suit the requirements of a group of students. Staff

## COMPUTER SCIENCE (CSC)

**410 Introduction to Computer Science and Algorithmic Processes (I and II, 3)**

**411 Computer Organization and Programming (I and II, 3)**

**412 Programming Systems (II, 3)**

**413 Data Structures (I, 3)**

**491, 492 Problems in Computer Science (I and II, 1-3 each)**

**500 Scientific Applications of Digital Computers I (I, 3)** Algorithms, techniques, practical procedures for digital computers related to applications of numerical methods. Approximation methods, numerical quadrature, solution of differential equations, zeros of functions, optimization methods, error analysis. (Lec. 3) Pre: 350 and permission of instructor. Carrano, Hemmerle

**502 Theory of Algorithmic Languages and Compilers (II, 3)** Formal description of procedure-oriented languages and the techniques used in translating algorithms written in these languages into computer programs. (Lec. 3) Pre: credit or concurrent registration in 413. Bass and Tetreault

**505 Design of Digital Circuits**  
See Electrical Engineering 505.

**512 Advanced Programming Systems (I, 3)** Advanced analysis of monitor and executive systems. Several topics from 412 will be studied in greater depth, along with recent developments in the field. (Lec. 3) Pre: 412 and 413. Bass, Tetreault and Weideman

**515 Theory of Computation (I, 3)** Formal examination of several abstract models of computing machines. Functions that can and cannot be computed on the various models are characterized. (Lec. 3) Pre: 6 credits of CSC at the 300 level or above or permission of instructor. Bass

**525 (or IDE 525) Simulation (II, 3)** Discrete simulation models. Comparison of discrete change simulation languages. Methodology including generation of random variates, design of simulation experiments for optimization, and validation of models and results.

Selected applications. Pre: 202, 6 credits of statistics. Carney and Shao

**535 Information Organization and Retrieval (II, 3)** Construction and accessing of large data bases; document classification, retrieval, and evaluation techniques; automatic dictionary and thesaurus construction; natural language content analysis; question answering systems. (Lec. 3) Pre: 413. Weideman

**551 Scientific Applications of Digital Computers II (II, 3)** Algorithms, techniques and practical procedures for digital computers emphasizing linear computations and statistical applications. Monte Carlo methods. Matrix calculations, simultaneous linear equations, matrix inversion. Least square analysis, multiple regression. Characteristic value problems. (Lec. 3) Pre: 350. Hemmerle

**581 (or ELE 581) Intelligence in Machines and Humans (I or II, 3)** Formal theories of human information processing. State-space representation and search. Problem-reduction representations. Predicate calculus for theorem-proving and problem-solving. Semantic information processing. Artificial intelligence programming languages. (Lec. 3) Pre: permission of instructor. Birk

**582 Robotics**

See Electrical Engineering 582.

**583 Computer Vision**

See Electrical Engineering 583.

**591, 592 Problems in Computer Science (I and II, 1-3 each)** Advanced work in computer science. Conducted as seminars or as supervised individual projects. (Lec. or Lab. arranged). Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**ECONOMICS (ECN)**

**401 Poverty in the United States (I or II, 3)**

**402 Urban Economics (I or II, 3)**

**403 Theory and Topics in the Economics of Crime (I or II, 3)**

**464 Comparative Economic Systems (I or II, 3)**

**503 Development of the United States Economy (I, 3)** Process of economic development, as illustrated by the economy of the United States. (Lec. 3) Pre: 126, and either HIS 141, 142 or ECN 302, or permission of instructor. Haller

**512 History of Economic Analysis (II, 3)** Advanced work on formative developments in economic thought from classical political economy to modern welfare economics. Emphasis on relationships between doctrines and their institutional setting. (Lec. 3) Pre: permission of instructor. Schurman

**515, 516 Economic Research (I and II, 1-3 each)** Independent research. S/U credit. Staff

**527 Macroeconomic Theory (I, 3)** Static and dynamic models of aggregate economic behavior developed and analyzed. (Lec. 3) Pre: 327 and 375 or equivalent, or permission of instructor. Hume

**528 Microeconomic Theory (I, 3)** Analytic tools of optimization. Neoclassical price and distribution theory.

Linear programming and production theory. General equilibrium and welfare economics. (Lec. 3) Pre: 328 and 375 or equivalent, or permission of instructor. Rayack

**532 Industrial Organization and Public Policy (II, 3)** Theoretical and empirical analysis of structure of industrial markets; behavior and performance of business firms in the American economy; government-business relationship and its effect on formulation of public economic policy. (Lec. 3) Pre: 337 or permission of instructor. Dirlam

**538 International Economics: Theory and Policy (I or II, 3)** Theory of international trade and applications to current problems. (Lec. 3) Pre: 327 and 328 or permission of instructor. Suzawa

**539 Welfare Economics (I or II, 3)** Welfare criteria; conditions of optimality; causes of non-optimality and implied correctives; alternative social decision-making techniques. (Lec. 3) Pre: 327 and 328 or permission of instructor. Hume

**543 Public Finance and Fiscal Policy (I, 3)** Analysis of private wants and public needs. Serves as introduction to a searching examination of such federal and federal-state fiscal problems as budgetary theory and procedures, tax theory and reform. (Lec. 3) Pre: 342 or permission of instructor. Starkey

**552 Monetary Theory and Policy (II, 3)** Analysis of structure and functioning of monetary and banking systems; discussion of contemporary monetary theories; evaluation of monetary policies. (Lec. 3) Pre: 334 or permission of instructor. Barnett

**566 Economic Planning and Public Policy in Developing Nations (II, 3)** Resource and financial planning in public and private sectors of developing nations with emphasis on planning tools, allocation of domestic and foreign resources, and on national economic policies. (Lec. 3) Pre: 327 and 363 or 464, or equivalent, or permission of instructor. Suzawa

**575 Introduction to Mathematical Economics (I, 4)** Application of basic quantitative methods to economic analysis. Dynamic and static economic models will be studied with emphasis on obtaining solutions. (Lec. 3, Lab. 2) Pre: 327, 328 and MTH 141 or permission of instructor. Staff

**576 Econometrics I (II, 4)** Application of statistics and mathematics to economic analysis. Implication of assumption required by statistical methods for testing economic hypotheses. Current econometric methods examined and discussed. (Lec. 3, Lab. 2) Pre: 575 or equivalent, EST 408 or equivalent, or permission of instructor. Staff

**577 Econometrics II (II, 3)** Continuation of Econometrics I. (Lec. 3) Pre: 576 or permission of instructor. Ramsay

**595 Problems of Modernization in Developing Nations** See Resource Economics, 595.

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**627 Advanced Macroeconomic Theory (II, 3)** Post-Keynesian macroeconomic theory, growth and cyclical models, current development in national income analysis. (Lec. 3) Pre: 527 and 528 or permission of instructor. Hume

**628 Advanced Microeconomic Theory (II, 3)** Neoclassical value and distribution theory. Theories of imperfect competition, general equilibrium theory and dynamic analysis. (Lec. 3) Pre: 527 and 528 or permission of instructor. Ramsay

**690 National Income (II, 3)** Advanced macroeconomic theory. (Lec. 3) Pre: 126 or 990 or permission of instructor. Hellman

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**990 Principles of Economics (I and II, 3)** Survey of micro- and macroeconomic theory. (Lec. 3) Graduate credit for matriculated M.B.A. students only. Staff

## EDUCATION (EDC)

**401 Development and Utilization of Instructional Materials (I and II, 3)**

**403 History of Education (I, 3)**

**407 Philosophy of Education (II, 3)**

**409 Health Aspects of Aging (I and II, 3)**

**410, 411 Seminar and Supervised Field Practicum in Education of the Aging (I and II, 3 each)**

**424 Teaching of Reading (I and II, 3)**

**450 Introduction to Counseling (I and II, 3)**

**478, 479 Problems in Education (I and II, 0-3 each)**

**501 Comparative Education in International Perspective (I or II, 3)** Comparing foreign systems of education with particular emphasis on cultural developments and significant education experiences; sampling of national systems in Western Europe, USSR, Far East, East Africa, and South America. (Lec. 3) Pre: senior or graduate standing. Whitcomb

**502 The Modern Curriculum Movement (I, 3)** Development of recent thinking of American curriculumists. The nature of curriculum development analyzed through the traditionalist, social scientific and reconceptualist schools of thought. (Lec. 3) Willis

**503 Education in Contemporary Society (II, 3)** Leading educators' responses to issues and challenges confronting American education. Emphasis upon identification and analysis of contemporary theories and practices reflecting relationship between characteristics of society and educational values. (Lec. 3) Russo, Willis

**504 Adult Basic Education (I and II, 3)** Teaching of adults whose educational level is below high school completion. Physical, social and psychological characteristics of disadvantaged adults and various techniques and materials useful in motivating and teaching them. (Lec. 3) Pre: permission of instructor. McCreight and Staff

**505 Principles and Practices of Leadership Development for Youth and Adult Programs (I or II, 3)** Philosophy and interrelationships of vocational-technical and general education with extension education and other community educational agencies; leadership concepts and implications; methods and techniques for increasing the effectiveness of organizations. (Lec. 3) Pre: permission of instructor. McCreight

**510 Practicum in Incorporating Televised Media (I, 3)** Students develop skills in scripting and producing

educational television programs. Application of knowledge of directing video tapes. (Lec. 1, Lab. 4) Pre: 401 or permission of department. Hicks

**511 Evaluation of Film and Recorded Material (I, 3)** Theory and principles of basic educational film processes. History of educational motion pictures, social and cultural implications of film, and standards for its evaluation and use in the schools. (Lec. 1, Lab. 4) Pre: 401 or permission of department. Howard

**512 Organization and Administration of Audiovisual Programs (II, 3)** Organization and administration of media departments in public schools. Media design and logistics, facility design, finance and organization. Planning in-service training programs. (Lec. 2, Lab. 2) Pre: 401 or permission of department. Staff

**513 Research and Theory in Instructional Technology (II, 3)** Research methodology in the field of media as it applies to education. Research designs including survey, descriptive and experimental types evaluated. (Lec. 2, Lab. 2) Pre: 401 or permission of department. Howard

**514 Current Trends in Elementary Education (I, 3)** For teachers and administrators, the most effective use of instructional materials, media of communication, and personnel in elementary school. (Lec. 3) Pre: 529 or permission of department. In alternate years, next offered 1977-78. Nally

**516 Teaching English as a Second Language to Adults (II, 3)** Methods and materials for educators who teach English as a second language to adults. (Lec. 3) Pre: permission of instructor. Jones

**520 Teaching of Arithmetic (I, 3)** For the experienced teacher, examination of the principles underlying teaching of arithmetic in the elementary school, comprehensive survey of materials and methods available for the classroom teacher of arithmetic. (Lec. 3) Pre: senior or graduate standing. In alternate years, next offered 1976-77. Nally

**523 Physical Factors Related to Reading Disability (I, 3)** Investigation and evaluation of various physical factors contributing to reading disability. Visual, hearing, and speech deficiencies, motor adjustments, glandular deficiencies, general health, brain damage and congenital word-blindness, lateral dominance. Screening tests and instructional procedures for use in various areas. (Lec. 3) Pre: 561 and permission of instructor. In alternate years, next offered 1977-78. Staff

**526 Teaching the New Grammars (I, 3)** Implications of the newer grammars for the teaching of English, including a review of the history of grammar, traditional grammar and, as needed, the linguistic theory necessary to an understanding of the newer grammars. (Lec. 3) Pre: graduate standing and/or certification to teach English. DiBiasio

**528 Teaching Language Arts (II, 3)** Phonics, grammar, lexicography, and usage in American English for the elementary school classroom teacher. Presentation, use, evaluation, and development of methods and materials for students in the classroom. (Lec. 3) In alternate years, next offered 1976-77. Nagel

**529 Foundations of Educational Research (I and II, 3)** Analysis of the current major research approaches to educational problems with emphasis on interpreting

published research involving the language of statistics. Functional skills in basic descriptive statistics needed prior to enrolling. (Lec. 3) Mac-Millan and Purnell

**534 Mathematics in the Secondary School (II, 3)** Implementation of a modern mathematics program in the secondary school through a study of modern mathematics concepts, experimental programs, and instructional planning. (Lec. 3) Pre: 15 credits in mathematics. Pezzullo

**541 Reading in Secondary School Content Subjects (I and II, 3)** Designed especially to help junior and senior high school teachers to cope with the reading problems in their subject areas. (Lec. 3) Pre: 313 or permission of department. Aukerman

**546, 547 Field Practicum in Reading (I and II, 3 each)** Practical application of classroom management and selection of materials to meet individual needs in a classroom situation. Pre: 424; enrollment in a non-degree certification program and concurrently teaching. Not for graduate program credit. (Lec. 3) In alternate years. Baker

**548 The Application of Secondary School Content Area Reading Skills (II, 3)** Teacher participation in planning and implementing a developmental reading approach to subject matter reading areas. Emphasis on teaching reading skills necessary for student understanding of subject area materials. (Lec. 3) Pre: 541 and actively teaching. Staff

**550 Vocational Information and Career Development (I and II, 3)** Classification and description of jobs and industries; study of occupational trends; needs of special groups entering the labor market; vocational development theories and counseling for long-range career planning. (Lec.3) Pre: 450 and graduate standing. Maynard

**551 Counseling Techniques (I and II, 3)** Foundation of the theory and practice, with special emphasis upon approaches to counseling in various educational settings; primarily designed for preparation of school counselors and student personnel educators. (Lec. 3) Pre: 450 and graduate standing. Rife

**552 Group Procedures in Counseling (I and II, 3)** Principles and techniques of group counseling applied to education, counseling, and student personnel work. An experiential and didactic approach with emphasis upon facilitation techniques, leadership patterns, and counseling skills. (Lec. 3) Pre: permission of instructor. Staff

**553 Counseling Practicum (I and II, 3)** Advanced counseling. Multiple counseling sessions using tapes and supervised observation included to help measure individual assessment of growth and competence. (Lec. 1, Lab. 5) Pre: 450, 550, 551, PSY 434, and permission of instructor. Gunning

**554 Individual Appraisal in Guidance (II, 3)** Nature of the appraisal process and data essential to understanding the educational, vocational and social needs of persons. Emphasis on the team approach in pupil personnel services and the use of case materials. (Lec. 3) Pre: PSY 434 and EDC 551. Gunning

**555, 556 Supervised Field Work and Seminar in Guidance and Counseling (I and II, 3 each)** Students apply and integrate guidance and counseling theories

and skills in selected school systems. 200 clock hours of laboratory experience required in addition to the seminar for two semesters' work. (Lec. 2, Lab. 3) Pre: 554 and permission of instructor. Pascale, Maynard, Rife and Quinn

**557 Principles and Practices of Student Personnel Services in Higher Education (I, 3)** Survey of the historical, psychological, organizational, and educational factors which have evolved and combined to form student personnel work. (Lec. 3) Pre: 553 and 554. Quinn

**558 Organization and Administration of Student Personnel Services in Higher Education (II, 3)** Systematic analysis of current practices in the alignment and operation of student personnel services, with continuing review of their interrelationships with the total educational program. (Lec. 3) Pre: 553, 554 and 557. Quinn

**561 Analysis of Reading Disabilities (I, 3)** Causes of reading difficulties and the administration of diagnostic reading tests. Emphasis on construction and use of informal tests and standardized measures. Practice in analyzing data from case histories and in making individual case studies. (Lec. 3, Lab. 2) Pre: 424 and permission of instructor. McGuire

**562 Techniques in Remedial Reading (II, 3)** Practices effective in teaching remedial reading in both the regular classroom and remedial reading clinics. Analysis of published materials. Methods of building new materials, discussion and demonstration of their practical application. (Lec. 3, Lab. 2) Pre: 561 and permission of instructor. McGuire

**563 Reading Programs for the Disadvantaged (I, 3)** Impact of the culture of the disadvantaged upon the child and his response to learning and the school, with special emphasis on reading and the adjustment of reading materials and methods to individual socioeconomic-cultural differences. (Lec. 3) Pre: 424 or permission of instructor. Bumpus

**564 Beginning Reading Programs (II, 3)** Analysis of various approaches to reading instruction (other than the basal method) including phonetic, linguistic, language arts, programmed, and other experimental systems. Current materials analyzed and classified. (Lec. 3) Pre: 424. Aukerman

**565 Analysis and Evaluation of Current Research in Reading (II, 3)** Concise analysis of the latest research in reading. Criteria for the evaluation of reading research data as it applies to both teacher and learner. Location and application of current research to reading programs. (Lec. 3) Pre: 424 and permission of instructor. In alternate years, next offered 1977-78. McGuire

**566, 567 Practicum in Reading (I and II, 3 each)** Supervised case studies, practicum and seminar reports on an individual reading project at either elementary or secondary level. Lecture and/or laboratory. 120 hours plus seminar. Pre: 562 and permission of instructor. McGuire

**570 Elementary School Curriculum (II, 3)** Modern curriculum in the elementary school with emphasis on the needs of children. Covers language arts, social studies, science, arithmetic and special subjects. (Lec. 3) Pre: 503, 529 or equivalent. In alternate years, next offered 1977-78. Staff

**571 The Secondary School Curriculum** (II, 3) Intensive study of basic principles and procedures utilized in developing curriculum materials. Emphasis given to content of all curriculum areas in junior and senior high schools. (Lec. 3) Pre: 503, 529. In alternate years, next offered 1976-77. Whitcomb

**572 Cooperative Supervision** (I and II, 3) Analysis of function, principles and techniques of democratic cooperative supervision of teachers and other school officials. Application of these principles to supervisory problems of principals, heads of departments, special supervisors and critic teachers. (Lec. 3) This course meets certification requirements for Critic Teacher Certificate. Heisler

**573 Seminar—Educational Research** (I and II, 1) For master's degree candidates developing a thesis. Presentations of thesis topics, research designs, and research findings. Orderly development of research studies. Graduate students who require assistance with their thesis problems must enroll for this course unless they are enrolled for thesis credit. Pre: registration for thesis. Staff

**574 Current Trends in Secondary Education** (I and II, 3) Effective use of instructional materials, media of communication, and organization of personnel and current research. Pre: 529, 571 or permission of department. Staff

**575, 576 Supervised Field Study and Seminar in Elementary or Secondary Education** (I and II, 3 each) For non-thesis candidates. Lectures, seminars and field work. Candidates plan and carry out a field study project approved by the instructor. The completed project report must be successfully defended during semester. Pre: admission to a master's program in education and permission of instructor. Kelly

**577 Organization and Administration in Elementary School** (I, 3) Functions and duties of elementary school principals. (Lec. 3) In alternate years, next offered 1977-78. Nagel

**580 Organizing and Administering Youth Programs** (I or II, 3) Planning, organization, instruction and supervision of youth programs. Includes vocational-technical and general education in their relationship to extension education and other community agencies. Youth guidance and psychological development emphasized. (Lec. 3) Pre: 505 or permission of instructor. McCreight

**581 Organizing and Administering Programs of Adult Education** (I or II, 3) Planning, organization, instruction and supervision of continuing education for adults in both vocational-technical and general education as conducted by extension education and other community agencies. (Lec. 3) Pre: 505, or permission of instructor. McCreight

**582 Curriculum Development in Vocational-Technical and Extension Education** (I, 3) Principles and processes involved in the basic concepts affecting vocational-technical and extension education programs. Emphasis on planning, execution and evaluation. (Lec. 3) Pre: 580 or 581 or permission of instructor. McCreight

**583 Analyzing Community Needs and Resources for Youth and Adult Programs** (I, 3) Helps the student function effectively in the role of change-agent in a community setting. Concepts of goals, change, power

and community will be considered in the relation to student's community experiences. (Lec. 3) Pre: permission of instructor. Bromley

**584 The Adult and the Learning Process** (I and II, 3) Examination of the adult as a learner with emphasis on the factors that affect adult learning. (Lec. 3) Pre: 581 or permission of instructor. Bromely

**585 Seminar on Leadership for Youth and Adult Programs** (II, 3) Students will participate in a non-structured group to observe the emergence of leadership and the effects of individual behavior on self and others. (Lec. 3) Pre: open to program majors with permission of instructor. Bromely

**586, 587 Problems in Education** (I and II, 3 each) Advanced work for graduate students in education. Courses conducted as seminars or as supervised individual projects. (Lec. or Lab.) Pre: permission of department. Staff

**588, 589 Supervised Field Practicum and Seminar in Youth and Adult Education** (I and II, 3 each) Leadership principles and practices applied in selected clinic systems. 200 clock hours of practicum are required in addition to the seminar. (Lec. 2, Lab. 3) Pre: 582, 583, or 584 and 529, or permission of instructor. Bromley, McCreight

**590 Social Issues in Urban Education** (II, 3) Current social problems confronting teachers in urban education. Emphasis on current problems from perspective of sociology, social welfare, psychology and education. Field trips, visiting lecturers and sensitivity training all utilized in development of issues. (Lec. 3) Pre: 102. Staff

**594 Organization and Supervision of Reading Programs** (II, 3) Various roles of the reading specialist in relation to the other line-staff personnel. Problems concerning the orientation of new teachers, reading research and development, in-service programs, and community support. (Lec. 3) Pre: 562. In alternate years, next offered 1977-78. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## ELECTRICAL ENGINEERING (ELE)

**405 Digital Computer Design** (II, 3)

**411 Microwave and Quantum Electronics** (I, 3)

**413 Microwave and Quantum Electronics Laboratory** (I, 3)

**417 Direct Energy Conversion** (II, 3)

**427 Electromechanical Devices and Systems** (I,3)

**432 Electrical Engineering Materials II** (II, 3)

**433 Electrical Engineering Materials Laboratory** (II, 3)

**436 Communication Systems** (I and II, 3)

**437 Introduction to Photo-electronic Devices** (I and II, 3)

**443 Electronics II** (I, 5)

**444 Electronics III, Pulse and Digital Circuits** (II, 4)

**457 Feedback Control Systems** (I, 3)

**458 Systems Laboratory** (II, 3)

**481, 482 Biomedical Engineering Seminar I and II** (I and II, 1 each)

**484 Modeling of Physiological Systems** (II, 3)

**491, 492, 493 Special Problems** (I and II, 1 each)

**495 Electrical Engineering Practice I** (I, II or SS, 3)

**496 Electrical Engineering Practice II** (II, 6)

**501 Linear Systems Theory** (I, 3) Transform analysis of discrete and distributed systems, functions of a complex variable, state variable description of systems and time domain analysis, matrices and linear spaces, feedback concepts. (Lec. 3) Staff

**503 (or MCE 503) Linear Control Systems** (I or II, 3) Concepts of controllability and observability, state feedback, quadratic performance indices and optimal linear control, frequency response properties of optimal feedback regulators, observer theory and state estimation, modern control system design. (Lec. 3) Pre: 501 or equivalent. Lindgren, Palm

**505 (or CSC 505) Design of Digital Circuits** (I, 3) Analytical development of methods for digital circuit design. Computer arithmetic, control, and memory elements. Design of sequence generators. Special purpose digital circuits for performing numerical operations such as integration, smoothing and filtering. (Lec. 3) Tufts

**506 Digital Signal Processing** (II, 3) Digital representations of signals and noise, digital filtering and spectral analysis, design of digital circuits for signal parameter estimation and signal detection. (Lec. 3) Pre: one course from: 509, OCE 561, IDE 411, or MTH 451. Tufts

**509 Systems with Random Inputs** (I or II, 3) Discrete and continuous linear systems with random inputs. Introduction to random processes in the context of linear systems. Applications to detection, smoothing and prediction. (Lec. 3) Pre: knowledge of differential equations, linear systems and transform methods. Staff

**511 Electromagnetic Fields** (I, 3) Review of electrostatics and magnetostatics. Maxwell's equations, wave propagation in dielectric and conducting media. Boundary phenomena. Radiation from simple structures. Relations between circuit and field theory. (Lec. 3) Staff

**514 Microwave Electronics** (I or II, 3) Electronic engineering at microwave frequencies, microwave circuit theory, impedance transformation and matching, passive microwave devices, microwave tubes, semiconductor microwave electronics, microwave masers, parametric amplifiers. (Lec. 3) Pre: 411 concurrently or permission of instructor. Daly

**515 Quantum Electronics** (I or II, 3) Laser engineering and applications, interaction of radiation with atoms, optical resonators, electro-optic modulation, harmonic generation, parametric oscillation and frequency conversion, noise in laser amplifiers and oscillators. (Lec. 3) Pre: PHY 341 or permission of instructor. Daly

**516 Planetary Electrodynamics** (I or II, 3) Introduction to description and theory of natural electric and magnetic phenomena on the earth and in the solar system such as lightning, natural geomagnetic and interplanetary magnetic fields, origin and properties of ionospheres, the "solar wind" and natural radio noise. (Lec. 3) Pre: permission of instructor. Polk

**517 Magnetofluidmechanics**

See Mechanical Engineering 517.

**520 Fourier Optics** (I or II, 3) Application of Fourier analysis in optical imaging and data processing.

Systems concepts are stressed. Scalar diffraction, lenses, coherent and incoherent imaging, spatial filtering and optical information processing, and holography. (Lec. 3) Pre: 313 or an equivalent basic knowledge of Fourier analysis. Spence

**531 Solid State Engineering I** (I and II, 3) Periodicity of solids; dielectric, thermal, optical and electromagnetic properties of electronically interesting solids. (Lec. 3) Pre: 331 or equivalent. Staff

**532 Solid State Engineering II** (I and II, 3) Semiconductor physics, transport properties. Applications including solid state lasers, piezoelectric, ferroelectric and magnetic devices. (Lec. 3) Pre: 531 or equivalent. Staff

**535 Transistor Circuits** (I and II, 3) Semiconductors, characteristics of junction transistors. Analysis and design of single and multistage amplifiers including feedback. High frequency considerations, applications to systems. (Lec. 3) Staff

**536 Semiconductor Electronics** (I or II, 3) Theory and technology of semiconductor devices. Junction, field effect, optoelectronic and microwave devices. Integrated circuits. (Lec. 3) Pre: 331 or equivalent. Sadasiv

**537 Electronic Instrumentation and Control Circuits** (I and II, 3) Analysis and design of special amplifiers, operational circuitry, measurement of non-electrical quantities, transducers. (Lec. 3) Staff

**538 Principles of Remote Sensing** (I or II, 3) Theory and techniques of remote sensing including spaceborne photometry and radiometry. Applications selected from the following topics: planetary atmospheres, geology and earth resources, environmental problems. (Lec. 3) Pre: 323, PHY 406, or permission of instructor. Staff

**539 Infrared Imaging Techniques** (I or II, 3) Elemental detectors and their application in radiometers and scanners. Principles of infrared imaging devices. Thermal radiation and its propagation through the atmosphere. (Lec. 3) Pre: 437 or equivalent. Staff

**545 Optimization and Variational Problems in Electrical Engineering** (I or II, 3) Application of variational and approximation techniques to boundary value field problems, extremal control of dynamic systems, optimization in communication theory and optimal filter theory. (Lec. 3) Pre: 501 or 511 or permission of instructor. Poularikas

**560 Introduction to Data Collection Systems**  
See Ocean Engineering 560.

**561 Information Transmission** (I or II, 3) Introduction to information theory. Discrete and continuous communications channels. Techniques for coding and decoding information. (Lec. 3) Pre: 509 or equivalent. Kelley and Spence

**571 (or OCE 571) Underwater Acoustics I** (I, 3) Wave equation, energy, pressure and particle velocity. Acoustic properties of the sea. Elementary sources, refraction, reflection, ray theory, normal modes and scattering, with emphasis on sound propagation in the ocean. (Lec. 3) Moffett

**575 Electroacoustical Engineering I** (I and II, 3) Theory and design of electroacoustic transmission channels and the psychoacoustic aspects of their use



for high-quality music transmissions. (Lec. 2, Lab. 3) Pre: permission of instructor. Etzold

**576 Electroacoustical Engineering II** (I and II, 3) Storage of sound, studio-design and acoustical measurements. (Lec. 2, Lab. 3) Pre: 575. Etzold

**581 Intelligence in Machines and Humans**  
See Computer Science 581.

**582 (or CSC 582) Robotics** (I or II, 3) Description, design and control of industrial and research robots. Tactual and visual sensing systems. Computer control of manipulators. Object descriptions for manipulation. Obstacle avoidance. Applications. (Lec.3) Pre: knowledge of matrix algebra and Laplace transforms or permission of instructor. Birk

**583 (or CSC 583) Computer Vision** (I, 3) Algorithms used to extract information from two-dimensional images. Picture functions. Template matching. Region analysis. Contour following. Line and shape descriptions. Perspective transformations. Three dimensional reconstruction. Image sensors. Interfacing. Applications. (Lec. 3) Pre: MTH 362 or equivalent. Staff

**584 (or EST 584) Pattern Recognition** (II, 3) Random variables, vectors, transformations, hypothesis testing and errors. Classifier design: linear, non-parametric, approximation procedures. Feature selection/extraction: dimensionality reduction, linear and non-linear mappings, clustering and unsupervised classification. (Lec. 3) Pre: 509 and CSC 410 or introductory probability and statistics, knowledge of computer programming. Kelley

**585 Clinical Engineering** (I or II, 3) Clinical training in engineering aspects of patient care. Technological problems of patient monitoring, diagnosis and treatment. Computers in chemical analysis, cardiac catheterization, surgery, medical research. Course held at neighboring hospitals. (Lec. 1, Lab. 6) Pre: one semester of residency in biomedical engineering graduate program, permission of department. Jaron

**586 Biomedical Electronics I** (I, 3) Measurement techniques in medical and biological research. Pressure, flow and temperature transducers. Bioelectric potentials and electrodes. Signal conditioners and display systems. Electrical safety. (Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing. Staff

**587 Biomedical Electronics II** (II, 3) Instrumentation systems in medical diagnosis and therapy. Cardiovascular, respiratory and chemical measurements. Patient monitoring, computers in biomedical systems. (Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing. Staff

**588 Biomedical Engineering I** (I, 3) Modeling of biosystems. Electrical properties of biological materials. Electrocardiography, vectorcardiography. Models of nerve propagation. (Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing. Staff

**589 Biomedical Engineering II** (II, 3) Mechanical properties of biological materials. Application of ultrasound to medical diagnosis and treatment. Hemodynamics, pulmonary and renal dynamics. Artificial

organs. (Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing. Staff

**591, 592 Special Problems** (I and II, 1-3 each) Advanced work under supervision of a staff member. Arranged to suit individual requirements of student. Credits not to exceed a total of 6. Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**601, 602 Graduate Seminar** (I and II, 1 each) Seminar discussions including the presentation of papers based on research or detailed literature surveys. (Lec. 1) Attendance is required of all students in graduate residence, but a maximum of 1 credit per year is allowed, no more than 2 credits for the entire period. Staff

**605 Non-linear System Analysis** (I and II, 3) Iteration and perturbation techniques, phase plane and state space concepts, Liapunov's direct method, stability criteria for non-linear systems. (Lec. 3) Pre: 501 or equivalent. Lindgren

**606 Digital Filter Synthesis** (I, 3) Review of z transforms and discrete-time systems, properties of digital-filter networks, design of finite and infinite-impulse-response filters, accuracy considerations for coefficients and data, hardware implementation, system examples. Pre: 506 or equivalent. Jackson

**616 Advanced Topics in Electromagnetic Theory** (II, 3) Electromagnetic theory of inhomogeneous and anisotropic media. Ferrite devices. Introduction to the theory of plasmas. Ionospheric radio propagation. (Lec. 3) Pre: 511, or equivalent. Daly or Polk

**631 Electronics of Solids I** (I and II, 3) Properties of conductors, semiconductors, and insulators from quantum mechanical principles. Band theory of solids, superconductivity, thermoelectricity. (Lec. 3) Pre: PHY 570 or equivalent. Mitra

**632 Electronics of Solids II** (I and II, 3) Extension of 631, directed toward the examination of theoretical concepts fundamental to solid state electronics. Topics on current research programs and selected from areas such as quantum electronics, transport properties in strong electric and magnetic fields, and superconductivity. (Lec. 3) Pre: 631 or equivalent. Mitra

**636 Solid State Electronic Devices** (I or II, 3) Selected topics of current research interest. Materials will be drawn from recent literature on solid state electronic devices. (Lec. 3) Pre: 536. Sadasiv

**637 Photo-electronics I** (I, 3) Optics, including photometry, radiometry, natural illumination, irradiance, luminance, radiance, temperature. Theory, analysis and specifications of photodetectors, scanners and associated systems. Direct viewing image tubes, their components and electron optics. (Lec. 3) Pre: 437 or equivalent. Staff

**638 Photo-electronics II** (II, 3) Continuation of 637: theory, analysis, specifications of signal generating (remote) tubes and solid state devices, including transfer characteristics, spectral responses, limiting resolution modulation transfer function, quantum detective efficiency. Applications to medicine, space, night vision. (Lec. 3) Pre: 637. Sadasiv

- 641 Advanced Engineering Analysis I** (I, 3) Analytical techniques for the solution of problems involving a finite number of degrees of freedom with applications to linear and non-linear systems. (Lec. 3) Pre: advanced graduate standing and permission of instructor. Staff
- 651 Feedback Control Systems I** (I, 3) Analysis of synthesis of complex control systems. Extension of feedback control theory to handle random disturbances, sampled data, and non-linearities. System optimization. (Lec. 3) Pre: 457 or equivalent. Staff
- 660 Advanced Topics in System Theory** (I or II, 3) Seminar for advanced students. Selected topics of current research interest. Material will be drawn primarily from recent literature. (Lec. 3) Pre: permission of instructor. Staff
- 665 Detection, Estimation and Modulation Theory** (I or II, 3) Advanced treatment of statistical detection, estimation and modulation theory. Applications to communication systems and radar and sonar systems. (Lec. 3) Pre: 509 or equivalent and competence in probability and statistics. Staff
- 672 (or OCE 672) Underwater Acoustics II** (II, 3) Transducers, radiators and receivers, directivity (array structures), equivalent circuits, efficiency; piezoelectricity, magnetostriction, sonar principles, measurements and calibration. (Lec. 3). Moffett
- 691, 692 Special Problems** (I and II, 1-3 each) Advanced work under supervision of a staff member. Arranged to suit individual requirements of student. Credits not to exceed a total of 6. Pre: permission of department. Staff
- 699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.
- ENGLISH (ENG)**
- 430 Structure and Development of American English** (I, 3)
- 440 Literary Heritage of New England to 1860** (I, 3)
- 444 The American Writer and the Negro** (II, 3)
- 446 Modern American Drama** (II, 3)
- 447\* Twentieth Century American Poetry** (I and II, 3)
- 448\* The Nineteenth Century American Novel** (I and II, 3)
- 449\* The Twentieth Century American Novel** (I and II, 3)
- 454 Modern British and European Drama** (I and II, 3)
- 455\* Twentieth Century British Poetry** (I and II, 3)
- 458\* The British Novel** (I and II, 3)
- 459\* The British Novel: Victorian and Modern** (I and II, 3)
- 462 The Medieval and Modern Epic** (II, 3)
- 468\* The European Novel to 1850** (I and II, 3)
- 469\* The European Novel After 1850** (I and II, 3)
- 470\* Chaucer** (I, 3)
- 472\* 473\* Shakespeare** (I and II, 3 each)
- 474\* Milton** (II, 3)
- 477 The Elizabethan Drama** (I or II, 3)
- 478 English Drama of the Restoration and Eighteenth Century** (I or II, 3)
- 485 American Authors** (I or II, 3)
- 486 British Authors** (I or II, 3)
- 510 Bibliography and Literary Research** (II, 3) Use of descriptive and analytical bibliography, various modes of literary criticism, and other scholarly tools in the solution of literary research problems. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Reaves
- 530 History of the English Language** (I, 3) Historical study of development of English syntax, sounds, vocabulary and usage. (Lec. 3) Pre: graduate standing or permission of the instructor. Staff
- 531 History of Critical Theory** (II, 3) Important critical theories from Aristotle to the twentieth century. Emphasis upon orientation of theories to various aspects of the literary situation. Some study of modern attitudes toward earlier critics. Open to graduate students and senior English majors. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1977-78. Murphy
- 532 Modern Literary Criticism** (I, 3) Dominant modes and schools of criticism exemplified by T. S. Eliot, T. E. Hulme, I. A. Richards, Edmund Wilson, John Crowe Ransom, and other important critics. Pertinent related literary works. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1976-77. Goldman
- 535 Old English** (I, 3) Introduction to the language and literature. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Malina and Mensel
- 536 Problems in Linguistics and Literature** (II, 3) Recent developments in linguistics and their application to the study of literature. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Arakelian
- 540 Modern American Novel** (I, 3) Important American novelists of the twentieth century with emphasis on major developments in ideas and techniques. (Lec. 3) Pre: graduate standing or permission of instructor. Hoffmann, Marshall and Gullason
- 545 Problems in American Realism and Naturalism** (I, 3) Readings, discussions, and papers on stylistic, thematic, and philosophic issues relating to literary artists like Howells, James, Crane, Dreiser, Hemingway, and others. (Lec. 3) Pre: graduate standing or permission of instructor. Gullason
- 546 Problems in American Romanticism** (II, 3) Major themes and works of such authors as Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, and others. (Lec. 3) Pre: graduate standing or permission of instructor. Robinson and Collins
- 547 Early American Literature to 1800** (I, 3) Thorough examination of colonial and federal literature, some discussion of beginnings of Romanticism. Special attention to Taylor, Edwards, Franklin, Freneau and Charles Brockden Brown. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1977-78. Schoonover and Marshall
- 548 American Poetry to 1900** (I, 3) Important colonial and nineteenth century American poets with emphasis on major trends in ideas and techniques. (Lec. 3) Pre:

\*Not acceptable for graduate degree program credit in English.

graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Robinson, Potter and Collins

**549 Modern American Poetry (II, 3)** In-depth study of several major American poets, such as Eliot, Pound, Frost, Stevens, Williams, and others; or of a school, such as the Imagists, the Fugitives, and others. (Lec. 3) Pre: graduate standing or permission of instructor. Goldman and Potter

**550 Middle English Literature (II, 3)** Selections from Middle English literature exclusive of Chaucer. Works by Malory, the Pearl Poet, Gower, the Wakefield Master, and others. (Lec. 3) Pre: graduate standing or permission of instructor. MacLaine

**551 The Metaphysical Poets (I, 3)** Intensive analysis and interpretation of poetry of Donne, Herbert, Vaughan, Crashaw, and Marvell. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1977-78. Sorlien

**554 Modern British Poetry (I, 3)** In-depth study of several major British poets, such as Yeats, Lawrence, Auden, Thomas, MacNeice, and others; or of a school such as the War Poets (WWI), and others. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1977-78. Goldman and Matthews

**555 Modern British Novel (I, 3)** Important British novelists of twentieth century with emphasis on major trends in ideas and techniques. (Lec. 3) Pre: graduate standing or permission of instructor. Hoffmann

**556 English Literature of the Sixteenth Century (I, 3)** Early humanism. Tudor poetry and its continental antecedents. Satire and translation. Elizabethan voyage literature. Writers chosen from More, Erasmus, Skelton, Wyatt, Surrey, Sidney, Spenser, Marlow, Hakluyt, Lodge, Shakespeare and others. (Lec. 3) Pre: graduate standing or permission of instructor. Murphy, Sorlien and Hills

**557 English Literature of the Seventeenth Century (II, 3)** Selected poets and prose writers, studied for their contribution to the dominant themes and modes of expression of the Stuart and Cromwellian eras. (Lec. 3) Pre: graduate standing or permission of instructor. Sorlien and Jacobs

**558 English Literature of the Eighteenth Century (I, 3)** Intensive study of major and selected minor figures of the eighteenth century. Emphasis on verse and non-fiction prose, some attention to developments of the drama. (Lec. 3) Pre: graduate standing or permission of instructor. Kunz and Reaves

**559 English Literature of the Romantic Period (II, 3)** Selections from the major works and writers of the Romantic Movement. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Petrie, Seigel and Tutt

**560 English Literature of the Victorian Period (II, 3)** Selections from the major works and writers of the Victorian Period. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1977-78. Goldman and Seigel

**561 Modern European Novel (II, 3)** Major developments in European novel during twentieth century. Special attention to Proust, Mann, Kafka, Moravia, Silone, Lagerkvist, Malraux and Camus.

(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1977-78. Gullason

**570 Anglo-Irish Writers (II, 3)** The Celtic Renaissance as a literary movement, its importance and influence. AE, Lady Gregory, Joyce, O'Casey, O'Flaherty, Stephens, Synge, Yeats, and others. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1976-77. Murphy

**571 Problems in Chaucer (I, 3)** Intensive study of selected aspects of Chaucer's achievement as a poet. Emphasis on *The Canterbury Tales*. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. MacLaine, Malina, Mensel and Neuse

**572 Spenser (I, 3)** The major poetry, with special emphasis on *The Faerie Queen*. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1976-77. Neuse

**573 Problems in Shakespeare (II, 3)** Primarily a discussion course, concentrating on plays and characters that offer most interesting problems for student analysis. Solutions by leading critics are examined. (Lec. 3) Pre: permission of instructor. Smith

**574 The Scots' Poetic Tradition through Robert Burns (II, 3)** Intensive study of the poetry of Robert Burns, Ferguson, Ramsay, and others who sparked the Scottish revival. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1977-78. MacLaine

**575 Modern Southern Literary Renaissance (II, 3)** Comprehensive study of a major literary movement. Representative works by Faulkner, Wolfe, Warren, Williams, Porter, Welty, O'Connor, and others. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Gullason

**576 English Novel of the Eighteenth Century (I, 3)** Selected novels of Defoe, Richardson, Fielding, Smollett, Sterne, and Austen, with consideration of major criticism and of disparate influences on the emergence of the novel. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered 1977-78. Kunz and Reaves

**577 English Novel of the Nineteenth Century (I, 3)** Important British novelists of the nineteenth century with emphasis on trends in ideas and techniques of Victorian novelists. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1976-77. Hoffmann, McCabe and Seigel

**578 Problems in Milton (II, 3)** Emphasis on the major poetic works. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years, next offered in 1977-78. Neuse

**590 Selected Topics (I and II, 3)** Selected topics in American and British literature, and topics of special interest not covered by traditional department offerings. (Lec. 3) Pre: graduate standing or permission of instructor. Spring, 1977: *The Literature of the American 1890s*, Gullason. Fall, 1977: *Satire*, MacLaine. Spring, 1978: *Biography*, Jacobs. Fall, 1978: *The Picaresque Novel*, Gullason.

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**631 Seminar in Old English** (II, 3) Advanced readings in Old English literature (Lec. 3) Pre: 535. In alternate years, next offered 1976-77. Malina and Mensel

Courses 640 through 661 are lectures, discussions, extensive readings, individual research, and a substantial research paper. (Lec.3) Pre: permission of department.

**640,641 Seminar in American Literature before 1900** (I and II, 3 each) Fall, 1976: Melville, Marshall. Spring, 1977: Poe, Robinson. Fall, 1977: Transcendentalism, Marshall

**642, 643 Seminar in Modern Literature (American)** (I and II, 3 each) Fall, 1976: Hemingway, Gullason. Spring, 1977: Faulkner, Hoffman. Fall, 1977: The Non-Fiction Novel, Kunz. Spring, 1978: Annus Mirabilis 1922, Hoffmann. Fall, 1978: 20th Century Novel, Marshall

**650, 651 Seminar in English Literature of the Middle Ages** (I and II, 3 each) Fall, 1977: Medieval Allegory, Malina. Spring 1978: Troilus, MacLaine

**652, 653 Seminar in English Literature of the Sixteenth Century** (I and II, 3 each) Fall, 1978: Renaissance Humanism, Murphy.

**654, 655 Seminar in English Literature of the Seventeenth Century** (I and II, 3 each) Fall, 1976: Restoration Drama, Kunz. Spring, 1977: Andrew Marvell, Jacobs. Fall, 1978: Restoration Satire, Kunz

**656, 657 Seminar in English Literature of the Eighteenth Century** (I and II, 3 each) Spring, 1977: Burns, MacLaine

**658, 659 Seminar in English Literature of the Nineteenth Century** (I and II, 3 each) Fall, 1976: Carlyle, Seigel

**660, 661 Seminar in Modern Literature (English)** (I and II, 3 each) Spring, 1978: Synge and Yeats, Murphy

**691, 692 Special Problems** (I and II, 3 each) Advanced study of an approved topic, under the supervision of a member of the staff. (Lec. 3) Pre: permission of department. Staff

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## ENVIRONMENTAL HEALTH SCIENCE (EHS)

**562 Interdisciplinary Seminar** (I, 2) Topics in environmental health are examined in light of underlying general principles of economics, quantitative analysis, management, politics and government. (Sem. 2) Pre: permission of director. Curtis

## EXPERIMENTAL STATISTICS (EST)

**408 or 409 Statistical Methods in Research I** (I and II, 3)

**412 Statistical Methods in Research II** (II, 3)

**413 Data Analysis** (II, 3)

**491, 492 Problems in Experimental Statistics** (I and II, 1-3 each)

**500 Nonparametric Statistical Methods** (II, 3) Rank and sign tests, permutation tests and randomization, run test, tests of goodness of fit, order statistics, estimation, and comparison with parametric procedures. Examples illustrating the applications of non-parametric techniques. (Lec. 3) Pre: 408 or 409. Lawing and Hanumara

**511 Linear Statistical Models** (I, 3) Review of mathematical and statistical concepts. Multivariate normal distribution. Distribution of quadratic forms. Power of the F-test. Basic linear models: general linear hypothesis, regression models, experimental design models, variance component models, mixed models. (Lec. 3) Pre: MTH 215 and EST 412 or MTH 452. Carney

**520 Fundamentals of Sampling and Applications** (II, 3) Simple random sampling; properties of estimates, confidence limits. Sample size. Stratified random sampling; optimum allocation, effects of errors, and quota sampling. Regression and ratio estimates; systematic and multi-stage sampling. (Lec. 3) Pre: 408 or 409. Carney, Hanumara, and Lawing

**532 (or ASC 532 or PSY 532) Experimental Design** (I or II, 3) Application of statistical methods to biological and psychological research and experimentation. Experimental situations for which various ANOVA and ANCOVA designs are most suitable. (Lec. 3) Pre: 408 or 409 or equivalent. Smith or Velicer

**541 Multivariate Statistical Methods** (I, 3) Review of matrix analysis. Multivariate normal distribution. Tests of hypotheses on means, Hotelling's  $T^2$ , discriminate functions. Multivariate regression analysis. Canonical correlations. Principal components. Factor analysis. (Lec. 3) Pre: 412 or PSY 510. Hanumara and Hemmerle

**550 Ecological Statistics** (I, 3) Application of statistical methodology to the following topics: population growth, interactions of populations, sampling and modeling of ecological populations, spatial patterns, species abundance relations, and ecological diversity and measurement. (Lec. 3) Pre: 409 or permission of instructor. Heltshe

**576 Econometrics I**

See Resource Economics 576.

**577 Econometrics II**

See Resource Economics 577.

**584 Pattern Recognition**

See Electrical Engineering 584.

**591, 592 Problems in Experimental Statistics** (I and II, 1-3 each) Advanced work in experimental statistics. Conducted as seminars or as supervised individual topics. Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**610 Factor Analysis**

See Psychology 610.

**635 Response Surfaces and Evolutionary Operations**

See Industrial Engineering 635.

**FINANCE (FIN)**

- 410 Capital Markets** (I and II, 3)  
**433 Bank Financial Management** (I, 3)  
**440 Portfolio Theory and Management** (II, 3)  
**452 International Financial Management** (II, 3)  
**491, 492 Directed Study** (I and II, 3 each)  
**495 Advanced Financial Management** (I and II, 3)  
**496 Advanced Financial Institutions and Capital Markets** (II, 3)
- 540 Theory of Finance** (I and II, 2) Uses of financial instruments, problems of capital financing, financial expansion and reorganization, operations of specialized financial institutions. (Lec. 2) Pre: ACC 510, MGS 580. Staff
- 641 Advanced Financial Theory** (I and II, 3) Role of the financial manager in analysis, profit planning and control activities. Emphasis on goals, basic concepts and tools of decision-making as applied to working capital management, capital budgeting and capital structure decisions. (Lec. 3) Pre: 540. Dash
- 645 Managerial Economics** (I and II, 3) The applications of economic theory and methodology to business problems. (Lec. 3) Pre: all foundation courses. Booth
- 648 Financial Cases and Readings** (I and II, 3) Problems and decisions as to the management of funds. Case method used. (Lec. 3) Pre: 641. Staff
- 649 Seminar in Finance** (I and II, 3) Independent research. Individual topics based on readings and research interests of the students. (Lec. 3) Pre: 641. Staff

**FISHERIES AND MARINE TECHNOLOGY (FMT)**

- 416 Marine Transportation** (II, 3)  
**452 Industrial Fishery Technology** (II, 3)
- 518 Marine Fisheries Technology** (I, 3) The commercial resource, its exploitation and use. Capture techniques and equipment. Aspects of commercial activities, fishing vessel operations and technology. (Lec. 3) Pre: permission of instructor. Sainsbury
- 521 Fishing Gear Technology** (II, 3) Evaluation of fishing gear behavior and performance using theoretical, model scaling and statistical analysis techniques. Field and laboratory measurement procedures. (Lec. 3) To be taken concurrently or following 518. Pre: permission of instructor. Motte
- 591, 592 Special Problems** (I and II, 1-3 each) Advanced work, under the supervision of a staff member, arranged to suit individual needs of students in various fields of fisheries and marine technology. (Lec. and/or Lab. according to nature of problem). Pre: permission of department. Staff

**FOOD AND NUTRITIONAL SCIENCE (FNS)**

- 401, 402 Special Problems** (I and II, 2-4 each)  
**438 Experimental Food Science** (II, 3)  
**441 Advanced Human Nutrition** (I, 3)  
**444 Nutrition and Disease** (II, 3)  
**445 Readings and Reports in Nutrition** (II, 3)

**502 Advanced Experimental Foods** (II, 3) Application of the principles of food science and technology in the development of food products, considering effective methods of preparation, processing and preservation, and the control and evaluation of food product quality. (Lab. 6) Pre: permission of department. Staff

**503 Nutrition Research Methods** (I, 3) Comprehensive study of literature. Practice in techniques and methods as applied to animal and human nutrition research. (Lec. 1, Lab. 4) Pre: permission of department. Staff

**505, 506 Marine Foods Seminar** (I and II, 1 each) Study of current problems of marine foods such as those concerned with the resource, supply, health safety, nutritive value, preservation and consumer acceptability. Participation by students, faculty, and visiting lecturers. (Lec. 1) Pre: permission of department. Staff

**511, 512 Food Science and Nutrition Seminar** (I and II, 1 each) Studies and discussions of recent research and other significant developments in the field. Oral and written presentation of papers on selected topics or on individual research. (Lec. 1) Graduate students must earn a total of 2 credits. Pre: graduate standing or permission of department. Staff

**531 Teaching of Nutrition**  
 See Education 531.

**542 Minerals and Vitamins** (II, 3) Recent research in minerals and vitamins as related to human nutrition. Discusses the inter-relationship between minerals, vitamins and other nutrients as they relate to nutrition status. (Lec. 3) Pre: 441 or permission of department. In alternate years, next offered 1977-78. Caldwell and Bergan

**591, 592 Special Research Problems** (I and II, 2-4 each) Advanced work under supervision of staff member. Arranged to suit individual requirements of students. Pre: permission of department. For graduate students only. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**FOOD AND RESOURCE CHEMISTRY (FRC)**

- 411 (or PLS 411) Soil Chemistry and Fertilizers** (I, 3)  
**412 (or PLS 412) Soil Biochemistry** (II, 3)  
**431 Biochemistry of Foods** (I, 3)  
**432 Biochemistry of Food Processing** (II, 3)  
**452 Plant Biochemistry** (II, 3)  
**491, 492 Special Projects** (I and II 1-3 each)
- 501, 502 Seminar** (I and II, 1 each) Preparation and presentation of papers on subjects in selected areas relating to Food and Resource Chemistry. Staff
- 521 Pesticide Chemistry** (I, 3) Nomenclature, chemical and physical properties, mode of action, and methods of analysis of insecticides, fungicides and herbicides. (Lec. 2, Lab. 3) Pre: organic chemistry. Olney
- 526 (or MCH 526) Lipid Chemistry** (I, 3) Advanced course in the chemistry of biologically important lipids such as the fatty acids, neutral glycerides, phospholipids, steroids, and the chemistry and

biochemistry of the carotenoids. (Lec. 3) Pre: BCP 581. Next offered in 1977-78. Olney, Simpson, and Turcotte

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**691, 692 Research in Food and Resource Chemistry (I and II, 1-3 each)** Assigned research on an advanced level. Student is required to outline problem, conduct the necessary literature survey and experimental work, and to present his observations and conclusions in a report. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

#### FOREST AND WILDLIFE MANAGEMENT (FOR)

- 401 Forest Influences (I, 3)**  
**402 Wildlife Populations (II, 3)**  
**421 The Wetland Environment (I, 3)**  
**491, 492 Special Projects (I and II, 1-3 each)**

#### FRENCH (FRN)

- 402 French Phonetics (II, 3)**  
**411 Medieval French Literature (I, 3)**  
**422 French Literature of the Renaissance (II, 3)**  
**431, 432 French Literature of the Seventeenth Century (I and II, 3 each)**  
**441, 442 French Literature of the Eighteenth Century (I and II, 3 each)**  
**451 Romanticism (I, 3)**  
**452 Realism and Symbolism (II, 3)**  
**461 Drama of the Twentieth Century (I, 3)**  
**462 Poetry of the Twentieth Century (II, 3)**  
**463 Twentieth-Century Prose through 1950 (I, 3)**  
**464 Twentieth-Century Prose since 1950 (II, 3)**  
**471 Black French Prose and Poetry (I or II, 3)**  
**472 Black French Theater (II, 3)**  
**473 French Canadian Literature (I, 3)**  
**497, 498 Directed Study (I and II, 3 each)**  
**501 Advanced Composition (I, 3)** Stylistics to prepare undergraduate and graduate majors to write expository French prose. (Lec. 3) Pre: graduate status or permission of instructor. Porter  
**502 Stylistics (II, 3)** Emphasis on acquisition of ability to write at length in an acceptable literary style. Each student prepares a study of monograph length on an appropriate subject. (Lec. 3) Pre: 501 or equivalent. Porter  
**503, 504 History of the French Language (I and II, 3 each)** Linguistic development of French from the Serments de Strasbourg to the end of the Middle Ages. Particular attention to sound and form changes. (Lec. 3) Pre: graduate status or permission of instructor. Porter  
**511, 512 French Literature of Middle Ages (I and II, 3 each)** Intensive study of French literature in the medieval period. Reading of selected texts and discussion of the literary values of Old French. (Lec. 3) Pre: graduate status or permission of instructor. Porter

**521 The French Renaissance (I, 3)** Examination of the origins and development of the Renaissance in France as seen in the writings of Rabelais and the poets of his time. (Lec. 3) Pre: graduate status or permission of instructor. Staff

**522 The Rise of Introspective Writings in Sixteenth Century France (II, 3)** Thematic study of self-analysis as practiced by Montaigne and his contemporaries. (Lec. 3) Pre: graduate status or permission of instructor. Staff

**531 The Tragic Theater of the Seventeenth Century (I, 3)** French tragic theater in the seventeenth century, with particular attention to the works and influence of Corneille and Racine. (Lec. 3) Pre: graduate status or permission of instructor. Morello

**532 The Comic Theater of the Seventeenth Century (II, 3)** French comic theater of the seventeenth century, with particular attention to the works and influence of Molière. (Lec. 3) Pre: graduate status or permission of instructor. Morello

**541 The Age of Enlightenment (I, 3)** Intellectual trends in seventeenth-century French literature as it relates to the important eighteenth century philosophical production of Montesquieu, Voltaire, Buffon, Diderot and others. (Lec. 3) Pre: graduate status or permission of instructor. Rothschild

**542 The Theater of the Eighteenth Century (I, 3)** Theater of the eighteenth century, with emphasis on the dramatic works of Regnard, LeSage, Marivaux, Voltaire and Beaumarchais. (Lec. 3) Pre: graduate status or permission of instructor. Rothschild

**543 The Novel of the Seventeenth and Eighteenth Centuries (I, 3)** Evolution of the French novel, with emphasis on writers such as D'Urfé, Scarron, Mme. de Lafayette, LeSage, Marivaux, Prévost, Voltaire and Diderot. (Lec. 3) Pre: graduate status or permission of instructor. Rothschild

**551 The Romantic Movement (I, 3)** Detailed study of the chief proponents of the movement: Chateaubriand, Mme. de Staël, Constant, Lamartine, Hugo, Vigny, Musset, Sand, et al. (Lec. 3) Pre: graduate status or permission of instructor. Toloudis

**552 Realism and Naturalism (I, 3)** French Realism and Naturalism: Balzac, Flaubert, Zola, de Maupassant, the Goncourt, et al. (Lec. 3) Pre: graduate status or permission of instructor. Chartier

**553 The Symbolist Movement (II, 3)** Intensive study of poetry of Baudelaire, Verlaine, Rimbaud, Mallarmé and of their sources and influence. (Lec. 3) Pre: graduate status or permission of instructor. Chartier

**561 Contemporary French Theater through 1950 (I and II, 3)** Survey of important dramatists and metteurs en scène from Symbolism and Realism through 1950. (Lec. 3) Pre: graduate status or permission of instructor. Waters

**562 French Theater since 1950 (II, 3)** Emphasis on recent developments such as the theater of the absurd and social theater. (Lec. 3) Pre: graduate status or permission of instructor. Waters

**563 The Novel of the Twentieth Century (II, 3)** Intensive study of major novelists with emphasis on trends in philosophies and in techniques as illustrated by such authors as Gide, Mauriac, Malraux, Saint-

Exupéry, Sartre, Camus, et al. (Lec. 3) Pre: graduate status or permission of instructor. Toloudis

**591 Proust and Claudel (II, 3)** Analysis and interpretation of the imaginative writings of Proust and Claudel. (Lec. 3) Pre: graduate status or permission of instructor. Waters

**594 Special Problems (I and II, 3)** Group and/or individual investigation of special problems in French literature. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**901, 902 Reading Course in French for Graduate Students (I and II, 0)** 901: Fundamentals of grammar and syntax necessary to develop reading knowledge. Assumes no prior knowledge of French. 902: Exercises in reading scholarly and scientific texts. Hyland

### GENERAL BUSINESS ADMINISTRATION (GBA)

**671 Methods of Business Research (I and II, 3)** An understanding of research methodology and the culmination of such methodology into a term project. (Lec. 3) Pre: MGS 581 or equivalent and permission of department. Staff

**691 Directed Study in Administration (I and II, 1-3)** Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. 1-3) Pre: permission of M.B.A. director. Staff

### GENETICS

#### Animal Science

470 Population Genetics

#### Botany

554 Cytogenetics

579 Advanced Genetics Seminar

#### Microbiology

552 Microbial Genetics

#### Plant and Soil Science

472 Plant Improvement

#### Zoology

475 Causes of Evolution

476 Human Genetics

518 Mechanisms of Development

573 Developmental Genetics

576 Ecological Genetics

579 Advanced Genetics Seminar

### GEOGRAPHY (GEG)

**403 Meteorology and Climatology I (I, 3)**

**404 Meteorology and Climatology II (II, 3)**

**405 Introduction to Synoptic Meteorology and Climatology (I, 3)**

**406 Microclimatology (II, 3)**

**411 Urban Geography (I, 3)**

**421 Introductory Cartography (I, 3)**

**422 Advanced Cartography (II, 3)**

**432 Seminar in Political Geography (II, 3)**

**446 Geography of the Polar Regions (II, 3)**

**452 Transportation Geography (II, 3)**

**481 History and Philosophy of Geography (I, 3)**

**482 Quantitative Methods in Geography (I, 3)**

**491, 492 Special Problems in Geography (I and II, 3 each)**

**499 Directed Study (I and II, 1-3)**

**502 Research Methods in Geography (I, 3)** Fundamentals of geographic research, including techniques of field observation and interpretation, and the introduction to the use of the computer laboratory and computer package program. (Lec. 3) Pre: 482 or permission of department. Staff

**503 Seminar in Climatology (I or II, 3)** Selected topics in theoretical and applied climatology. (Lec. 3) Pre: 403, 404 or equivalent. Havens

**512 Seminar in Urban Geography (I, 3)** Urban patterns, their development, sizes, spacing, structure, and relationship to the global urban network. The urban environment as a context for geographic studies. (Lec. 3) Pre: 100 or permission of department. In alternate years, next offered in 1977-78. Higbee

**526 Plant Geography**

See Botany 526.

**542 Seminar in Economic Geography (II, 3)** Analytical approaches to rational utilization of the world's resources. Emphasis on agricultural and industrial location theory, diffusion of ideas and innovations, and recreational analysis. (Lec. 3) Pre: permission of department. Staff

**543 Geography of Megalopolis (II, 3)** Analysis of northeastern seaboard of the United States in terms of its physical and economic foundations, its distinctiveness as a region, key role the analysis of Megalopolis plays in understanding incipient major conurbations in the United States and the world. (Lec. 3) Pre: 333 or permission of department. In alternate years, next offered 1977-78. Higbee

**545 Geography of the North Atlantic Basin (II, 3)** Description and analysis of the North Atlantic Ocean and its borderlands, including northeastern North America, western littoral of Europe. Emphasis on orientation to, and use of, the marine environment, the role of the North Atlantic as a uniting and divisive force in the western community. (Lec. 3) Pre: 131 or permission of department. Alexander

**551 Land Utilization (I, 3)** Physical differences in land quality and the various functions of land in the modern community. Consideration given to the principles of land planning for effective use and conservation in rural and urban areas. (Lec. 3) Pre: ESC 104. In alternate years, next offered 1976-77. Higbee

**571 Marine Geography (I, 3)** The marine region as a unique complex of physical and cultural elements. The purpose is to analyze functional relationships within the region and to assess forms of regional organization and control. (Lec. 3) Pre: permission of department. Alexander

**591, 592 Directed Study or Research (I and II, 3)** Areas of special research interests of graduate students. (Lec. 3) Pre: permission of department. Staff

**595 Problems of Modernization in Developing Nations**  
See Resource Economics 595.

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## GEOLOGY (GEL)

**410 Geomorphology (I, 4)**

**425 Principles of Geochemistry (I, 3)**

**440 Introduction to Paleontology (I, 4)**

**450 Introduction to Sedimentation and Stratigraphy (I, 4)**

**465 Introduction to Geophysics (I, 3)**

**510 Coastal Geomorphology (II, 3)** Coastal development and interpretation in relation to endogenetic and exogenetic shore processes. Experimental model wave tank studies and applied field studies. (Lec. 3) Pre: 410, 450, or permission of instructor. Offered in spring of odd calendar years. Fisher

**525 Advanced Mineralogy and Petrography (I, 3)** Crystal-chemical relationships of the petrologically important mineral groups and advanced petrographic study (including U-stage methods) of textures, and mineral reactions. (Lec. 2, Lab. 2) Pre: 330 or permission of instructor. Offered in fall of odd calendar years. Hermes

**527 Analytical Geochemistry (II, 3)** Fundamentals and principles of rapid chemical analyses of geological materials. Application of atomic absorption spectroscopy, selected gravimetric methods, and miscellaneous techniques currently used in student research. (Lec. 1, Lab. 6) Pre: CHM 212 and senior status, or permission of instructor. Offered in spring of even calendar years. Hermes

**530 Igneous Petrology (I, 3)** Tectonic and chemical bases for igneous phenomena stressing the association concept of igneous activity. Evaluation of the criteria used in petrogenetic interpretations. (Lec. 2, Lab. 3) Pre: 330 or permission of instructor. Offered in spring of even calendar years. Hermes

**531 Metamorphic Petrology (I, 3)** Facies concept and other methods of interpreting metamorphic mineral assemblages. Chemical and fabric changes during metamorphism, including principles of structural petrology. (Lec. 2, Lab. 3) Pre: 330 or permission of instructor. Offered in fall of even calendar years. Cain

**541 Animal Micropaleontology (I, 3)** Concentrated study of animal microfossils with primary emphasis on taxonomy, morphology, ecology, and stratigraphic occurrence. (Lec. 2, Lab. 3) Pre: 440 or permission of instructor. Offered in fall of even calendar years. Tynan

**542 Plant Micropaleontology (II, 3)** Concentrated study of plant microfossils with primary emphasis on taxonomy, morphology, ecology, and stratigraphic occurrence. (Lec. 2, Lab. 3) Pre: 541 or permission of instructor. Offered in spring of odd calendar years. Tynan

**550 Sedimentary Processes (I, 3)** Physical and chemical processes of sedimentation with emphasis on fluvial, beach and estuarine environments. Stress on field applications of theory, with independent project and reading. (Lec. 3) Pre: 450 or permission of instructor. Offered in fall of even calendar years. Boothroyd

**551 Sedimentary Petrology (II, 3)** Characteristics of sediments and sedimentary rocks as a function of the environments of source, transportation, deposition, and diagenesis. (Lec. 2, Lab. 3) Pre: 550 or permission of instructor. Offered in spring of odd calendar years. Boothroyd

**555 Biostratigraphy (II, 3)** Principles and methods used to analyze and interpret areal and time relationships of stratified rocks and history of life contained in the rocks. (Lec. 2, Lab. 3) Pre: 440 and 450 or permission of instructor. Offered in spring of odd calendar years. Tynan

**565 Advanced Interpretation in Applied Geophysics (II, 3)** Interpretation of geophysical data using theoretical models. Reflection, refraction and surface propagation of seismic energy. Computer analysis of gravity and magnetic potential data. D.C. geoelectrical potential over horizontally stratified medium. (Lec. 2, Lab. 2) Pre: MTH 243, PHY 214, GEL 465 or equivalent course in physics with permission of instructor. Offered in spring of odd calendar years. Frohlich

**566 Seismology and Plate Tectonics (II, 3)** Earthquakes, intensity and magnitude determination, fault plane solution; earth's interior, crustal and upper mantle structure related to plate boundaries. Seismic zones and margins of tectonic plates. Earthquake control and prediction. (Lec. 2, Lab. 3) Pre: MTH 142, PHY 214, GEL 465, or equivalent course in physics or mathematics with permission of instructor. Offered in spring of even calendar years. Frohlich

**581 (or OCE 581) Coastal Engineering Geology (II, 3)** Interaction of geological factors and coastal structures. Shore materials, energy-material relationships, interference of man-made structures with the natural regimen emphasized. (Lec. 3) Pre: 302 or 410 and 450, or OCG 540 or permission of instructor. Offered in spring of even calendar years. Fisher

**585 Geohydrology (I, 3)** Ground-water hydrology and drainage basin analysis related to geomorphology, glacial geology and environmental impact. Analysis of water resources in various geologic environments. Geophysical methods of investigation. (Lec. 3) Pre: 302 or 410 and 450 and permission of instructor. Offered in fall of odd calendar years. Fisher

**590 Special Problems (I and II, 1-3)** Advanced work under the supervision of a member of the staff arranged to suit the individual requirements of the student. (Lec. and/or Lab. according to the nature of the problem.) Pre: permission of instructor. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

Note: for other related courses see PHY 522 and OCG 540, 630, 631, 643, 644, 645, 647.

## GERMAN (GER)

**409 History of the German Language (I, 3)**

**431 German Literature from 800 to 1700 (II, 3)**

**441, 442 German Literature of the Eighteenth Century (I and II, 3 each)**

**451, 452 German Literature of the Nineteenth Century (I and II, 3 each)**



- 485, 486 Special Studies** (I and II, 3 each)  
**497, 498 Directed Study** (I and II, 3 each)  
**901, 902 Reading Course in German for Graduate Students** (I and II, 0) 901: Fundamentals of grammar and syntax necessary to develop reading knowledge. Assumes no prior knowledge of German. 902: Exercises in reading scholarly and scientific texts. Staff

## HISTORY (HIS)

- 405 Western Europe in the High Middle Ages** (I, 3)  
**406 The Renaissance** (II, 3)  
**408 History of Europe, 1648-1789** (I, 3)  
**409 The French Revolution and Napoleon** (I, 3)  
**410 History of Europe, 1815-1914** (I, 3)  
**411 History of Europe since 1914** (II, 3)  
**426 German History, 1640-1871** (I, 3)  
**432 History of Russia to 1917** (I, 3)  
**469 The Protestant and Catholic Reformation I** (I, 3)  
**470 The Protestant and Catholic Reformation II** (II, 3)  
**473 History of Modern China** (II, 3)  
**474 History of Modern Japan** (I, 3)  
**475 History of Modern Korea** (II, 3)  
**501 Colloquium in European History** (I or II, 3) Intensive study of major interpretative works in European history (Lec. 3) Pre: graduate or senior standing, permission of department. Staff  
**502, 503 Special Readings in European History** (I and II, 3 each) Intensive tutorial work, research and readings in European history. Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated. Staff  
**515 Seminar in Twentieth-Century Diplomacy** (II, 3) Research in the history of international relations since 1900. (Lec.3) Pre: 410 or 411 or permission of department. In alternate years. Schach  
**521, 522 Readings and Research in European History** (I and II, 3 each) Intensive study of selected topics in European history. With permission of the department, this course may be taken twice for credit. (Lec. 3) Pre: graduate or senior standing, permission of department. Staff  
**535 Colloquium in American History** (I or II, 3) Intensive study of major interpretative works in American history. (Lec. 3) Pre: graduate or senior standing, permission of department. Staff  
**536, 537 Special Readings in American History** (I and II, 3 each) Intensive tutorial work, research and readings in American history. Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated. Staff  
**540 Seminar in American Colonial History: The Seventeenth and Eighteenth Centuries** (I or II, 3) Intensive research on selected topics in the Colonial period of American history. (Lec. 3) Pre: permission of department. Staff  
**541 Seminar in Nineteenth-Century American History** (I and II, 3) Intensive research on selected topics in the broad period between adoption of the Constitution and World War I. (Lec. 3) Pre: permission of department. Staff  
**542 Seminar in Twentieth-Century United States History** (I and II, 3) Intensive research on selected topics in United States history since 1900. (Lec. 3) Pre: permission of department. Staff  
**543 Seminar in the History of the United States, Foreign Relations** (II, 3) Research in the history of U.S. foreign relations since 1775. All aspects of foreign relations, including both internal and external factors and historiographical problems will be considered. (Lec. 3) Pre: permission of instructor. Costigliola  
**550 Seminar in Black Nationalism and the International Race Problem** (I or II, 3) Examination of the historical roots of black nationalism in the United States and the international implications of racial conflicts in selected areas of the world. (Lec. 3) Pre: permission of instructor. Weisbord  
**560 Research in Local History** (II, 3) Directed research in secondary and primary materials on topics of interest to the individual. (Lec. 3) Pre: 141 and 142. Metz  
**580 Colloquium in Latin-American History** (I or II, 3) Intensive study of major interpretative works in Latin-American history. (Lec. 3) Bryan  
**588, 589 Special Readings in Third World History** (I and II, 3 each) Intensive tutorial work, research and readings in Third World history. (Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated. Staff  
**591 Directed Study or Research** (I and II, 3) Directed readings, research, or study designed to meet the particular needs of individuals or small groups of graduate students. Staff  
**593 Seminar in Historical Studies** (I and II, 3) Advanced study in the major literature of American or European history. Emphasis placed upon problems of historiography and historical criticism. (Lec. 3) Pre: permission of department. Staff  
**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## HOME ECONOMICS EDUCATION (HED)

- 478, 479 Problems in Home Economics Education** (I and II, 3 each)  
**490 Teaching Home Economics: Grades 1 through 6** (I and II, 2)  
**491 Teaching Home Economics: Adults** (I or II, 3)  
**506 Methods of Teaching Home Economics** (I or II, 3) Selection, organization and use of instructional materials, methods and techniques of teaching home economics. (Lec. 3) P. Kelly  
**507 Curriculum Study in Home Economics** (I or II, 3) Developing a philosophy and acquiring findings about students, school programs, communities, and current trends as a basis for constructing a scope and sequence plan for a homemaking program. Units of work developed for various age groups. (Lec. 3) P. Kelly, May, MacKenzie  
**508 Supervision of Student Teachers** (I or II, 3) For teachers desiring to supervise students preparing for

provisional certificates in agriculture, business, distributive education or home economics. Meets requirements for a Critic Teacher Certificate in the areas listed. (Lec. 3) Pre: at least one year teaching experience and permission of department. Staff

**509 Seminar in Home Economics Education (I or II, 3)** Critical study of research literature and research techniques appropriate to solution of problems in home economics. (Lec. 1-3) P. Kelly

**531 (or FNS 531) Teaching of Nutrition (I or II, 3)** Development of curriculums in nutrition education for teachers in grades K through 12 and appropriate programs for community nutrition educators. Emphasis on innovative teaching techniques using latest nutrition knowledge. (Lec. 3) Pre: graduate standing and permission of department. Dymsha and MacKenzie

**586, 587 Problems in Home Economics Education (I and II, 3 each)** Advanced work for graduate students in home economics education. Conducted as seminars or as supervised individual projects. (Lec. or Lab.) Pre: permission of department. Staff

**595 Masters Project: Action Research (I and II, 1-6)** Candidates plan and carry out an action research project approved by the instructor. Number of credits is determined each semester in consultation with major professor. A maximum of six credits is allowed. Pre: admission to a master's program in home economics education, a course in research methods and permission of instructor. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## HOME MANAGEMENT (HMG)

**401 Home Management Problems of Deprived Families (II, 3)**

**470 Special Problems in Home Management (I and II, 2-4)**

**570 Special Problems in Home Management (I, 3)** Advanced study to be selected from areas of home management theory and its application, work simplification, family economics and equipment. (Lab. TBA) Staff

## INDUSTRIAL ENGINEERING (IDE)

**404 Engineering Economy (I, 3)**

**411 Engineering Statistics I (I, 3)**

**412 Engineering Statistics II (II, 3)**

**422 Production Facilities Design (II, 3)**

**430 Design and Analysis of Compensation Systems (II, 3)**

**432 Operations Research I (I, 3)**

**433 Operations Research II (II, 3)**

**435 Introduction to Operations Research (I and II, 3)**

**440 Materials Processing and Metrology I (II, 3)**

**491, 492 Special Problems (I and II, 1-6 each)**

**500 Network Application in Industrial Engineering (II, 3)** Industrial system problems that can be formulated in terms of flows in networks. Critical path scheduling, transportation problems, allocation, se-

quencing, line balancing, etc. (Lec. 3) Pre: 432 and permission of instructor. In alternate years. Shao

**510 Human Factors (II, 3)** Analytic relationships between man and his working environment. Design of equipment, facilities and environmental controls to meet the capabilities and limitations of the human being. (Lec. 3) Pre: permission of instructor. Rubinsky

**513 Statistical Quality Control (I, 3)** Topics in statistical quality control systems. Single, multiple, and sequential sampling. Design and analysis of a wide variety of statistical control systems used in conjunction with discrete and continuous data, for several kinds of data emission. (Lec. 3) Pre: 412 or equivalent. Nichols

**517 Applied Control Theory in Industrial Engineering (I, 3)** Complex control mechanisms will be studied and applied to production and manufacturing operation. Automatic control systems for production and manufacturing will be designed and analyzed. (Lec. 3) Pre: 404, MTH 244 and permission of instructor. Staff

**520 Material Handling (I, 3)** Development of principles for engineering design and evaluation of equipment to move industrial materials in and between processes, including chemical and physical characteristics of material to be handled, rates of material flow, queuing and economics. (Lec. 3) Pre: MCE 263, CVE 220, IDE 404. Rubinsky

## 525 Simulation

See Computer Science 525.

**533 Advanced Statistical Methods for Research and Industry (I, 3)** Estimation and testing; regression and correlation; analysis of variance and related topics. Applications in industrial operations and engineering research. (Lec. 3) Pre: 411 or permission of instructor. James

**535 Industrial Reliability Engineering (II, 3)** Theories of reliability applicable to the design and operations of manufacturing processes and product quality assurance control systems. Quantitative analyses of economic specifications, performance levels, maintenance levels, and redundancy systems. (Lec. 3) Pre: permission of instructor. Nichols

**540 Production Control and Inventory Systems (I, 3)** Theory and practice of industrial production control and inventory systems. A broad spectrum of mathematical models for static, dynamic, perpetual, and periodic inventory systems as they affect and relate to production. (Lec. 3) Pre: permission of instructor. Staff

**541 Materials Processing and Metrology II (I, 3)** Continuation of 440. Engineering analyses in the processing of materials. Dynamic coupling, tool-work-piece interaction, energy and thermal analysis; mechanics of material removal and displacements, advanced topics in mechanical electrical systems for processing of materials. (Lec. 3) Pre: 440 or permission of instructor. Staff

**545 (645) Manufacturing Engineering: Design, Analysis, Synthesis (II, 3)** Production and logistic systems, quantitative models introduced in and applied to congestion problems, industrial planning, control, scheduling, other problem areas of the industrial enterprise. (Lec. 3) Pre: 350 or permission of the instructor. Nichols

**550, 551 Advanced Topics in Probabilistic Operations Research I and II** (I and II, 3 each) Concepts of simple random processes and their application in the analysis of industrial problems. Random walk, branching processes, recurrent events, discrete and continuous Markov chains, birth and death models and their application to inventory, replacement, reliability, and waiting line problems. (Lec. 3) Pre: 411, MTH 215, or equivalent. Branson

**555, 556 Engineering Applications of Mathematical Programming I and II** (I and II, 3 each) Sensitivity analysis and pricing problems, practical problems in degeneracy and duality, decomposition methods for large-scale systems, applied convex, integer, nonlinear and quadratic programming methods. An introduction to stochastic programming. (Lec. 3) Pre for 555: 432 and permission of instructor. Pre for 556: 555 and permission of instructor. In alternate years. Staff

**565 Theory of Scheduling** (II, 3) Sequencing problems, finite sequencing for a single machine n/m job shop problems with analytical and heuristic procedures, networks, applied to scheduling, queuing systems in scheduling, probabilistic scheduling problems. Survey of selected literature (Lec. 3) Pre: permission of instructor. In alternate years, next offered 1977-78. Shao

**570 Operations Research Modeling in Health Care** (II, 3) Introduction to major areas of application of operations research in health care systems; emphasis on modeling and other analytical techniques used in hospitals, ambulatory care centers, planning and regulatory agencies and health systems research organizations. (Lec. 3) Pre: 435 and EST 409 or equivalent. Staff

**591, 592 Special Problems** (I and II, 1-6 each) Advanced work under supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to the nature of the problem) Credits not to exceed a total of 12. Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**610 Topics in Applied Queuing Theory** (I, 3) Poisson and Erlang queues, imbedded chains, M/G/1 and G/M/1 queues, and related topics in queuing theory. Analysis of a wide variety of queues with an applications orientation. (Lec. 3) Pre: 433 or permission of instructor. In alternate years, next offered 1977-78. Branson

**634 Design and Analysis of Industrial Experiments** (II, 3) Further development of topics in analysis of variance. Randomized blocks, Latin squares and related designs, factorial experiments, confounding and fractional replications, and split-plot designs. Design and analyses of engineering experiments. (Lec. 3) Pre: 533. Lawing

**635 (or EST 635) Response Surfaces and Evolutionary Operations** (II, 3) Methods of determining the response surface for multiple factors over a specified range and techniques for seeking an optimum. First and second order response surfaces. Rotatable second order design. Central composite rotatable designs. Multivariable EVOP programs and other topics in evolutionary operations. (Lec. 3) Pre: 533 or equivalent. Lawing

**641 Molecular Aspects of Materials Processing**  
See Chemical Engineering 637.

**642, 643 Advanced Topics in the Processing of Materials I, II** (I or II, 3 each) Extensive studies of contemporary and classical research in material processing. Systems study of problems of processing modern materials and technological achievements in processing. 642: Metallic materials. 643: Non-metallic materials. (Lec. 3) Pre: 541 or permission of instructor. In alternate years, next offered 1977-78. Staff

**657 Geometric and Dynamic Programming** (II, 3) Basic concepts of geometric programming, the duality theorem, approximation and limiting techniques. Nature of dynamic programming, deterministic and stochastic sequential decision problems. Lagrange multipliers in both geometric and dynamic programming. (Lec. 3) Pre: 555. In alternate years, next offered 1977-78. Shao

**660 Methods of Optimization** (II, 3) Methods of optimization: indirect, direct elimination, climbing. Geometric programming. Problems and other topics in applied optimization. (Lec. 3) Pre: CSC 500 and permission of instructor. In alternate years, next offered 1977-78. Staff

**691, 692 Advanced Special Problems in Industrial Engineering** (I and II, 1-6 each) Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problems) Credits not to exceed a total of 12. Pre: permission of department. Staff

## INSURANCE (INS)

**491, 492 Directed Study** (I and II, 3)

**560 Management of Insurance Enterprises** (I, 3) Functional analysis of the operations and problems of stock and mutual insurance organizations in the life, property, and liability insurance industry. Emphasis is upon legal organization, management and control, and financial management of insurers. (Lec. 3) Pre: permission of instructor. Fitzgerald

**570 Risk Management** (II, 3) Analysis of nature of risk, the identification, measurement and control of pure risk within firm and society. Teaching methodology includes lectures, group discussion and analysis of case problems. (Lec. 3) Pre: permission of instructor. Staff

## ITALIAN (ITL)

**408 The Italian Language** (I or II, 3)  
**433 Prose Forms in Italian Literature** (I or II, 3)  
**444 Poetic Forms in Italian Literature** (I or II, 3)  
**453 Literature of the Italian Theater** (I or II, 3)  
**455 Selected Italian Authors** (I or II, 3)  
**465 Topics in Italian Literature** (I or II, 3)  
**481, 482 The Works of Dante Alighieri** (I and II, 3)  
**497, 498 Directed Study** (I and II, 3 each)

## JOURNALISM (JOR)

**400 Opinion and Interpretation in Journalism**  
(I and II, 3)

- 434 Contemporary Issues in Mass Communication** (II, 3)  
**435 Theory of Communication** (I, 3)  
**436 Fundamentals of Communication Research** (II, 3)  
**438 Governmental and Legal Aspects of Mass Communication** (I, 3)  
**441 International Communications** (I, 3)  
**442 Independent Study and Projects in Mass Communications** (I and II, 1-3)  
**443 Mass Communication Media in Africa** (II, 3)  
**452 Public Relations Principles and Publications** (I, 3)

#### LATIN (LAT)

- 497, 498 Directed Study** (I and II, 3 each)

#### LIBRARY SCIENCE (LSC)

- 500 Introduction to Libraries and Librarianship** (I and II, 3) Overview of the field covering the language and literature of librarianship, the history and functions of libraries, the nature of the various types of libraries, the library profession, and library operations. (Lec. 3) Bergen and Staff
- 502 Library Administration** (I and II, 3) Libraries and their governing agencies, scientific management principles, organization and operation of library departments, personnel problems and procedures, budget preparation, statistics, quarters and planning. (Lec. 3) Bohnert and Staff
- 503 Selection of Library Materials** (I and II, 3) Study of and practice in using the principles involved in the selection of books and nonbook materials for collections of all types of libraries. (Lec. 3) Tryon
- 504 Basic Reference** (I and II, 3) Practical experience in the use of basic reference materials, with readings and discussion of the philosophy and administrative aspects of reference work. (Lec. 3) Schneider
- 505 Cataloging and Classification** (I and II, 3) Introduction to the principles and practice of descriptive and subject cataloging and classification using the Dewey decimal classification and Sears subject headings, with an introduction to the Library of Congress classification. Emphasis is on books and book-like materials. (Lec. 3) Chin
- 506 Technical Services** (I and II, 3) Principles and policies employed in the acquisition, organization, conservation, and circulation of book and nonbook materials in libraries of various kinds. (Lec. 3) Chin
- 510 History of Books and Printing** (I or II, 3) Western civilization as affected by the book arts and the extension of culture through the printed book, with stress on literary property and censorship as related to printing and libraries. (Lec. 3) Tryon
- 511 Comparative Librarianship** (I and II, 3) The practice of librarianship in selected countries, including the social, economic, and political factors influencing its development, with consideration of the role of cooperation among international organizations. (Lec. 3) Bergen
- 513 Intellectual Freedom and Censorship** (I or II, 3) Historical development and current status of the concept of intellectual freedom and the restraints that past

and present societies have imposed on it. Special attention given the librarian's role in defense of intellectual freedom. (Lec. 3) Tryon

**514 The Library in Society** (I, 3) Character and function of the library as a social agency, with special attention to the philosophies of contemporary librarianship. (Lec. 3) Bergen

**515 The Library and the Communication Process** (I, 3) The importance of applying communication theories to the study of librarianship. Basic concepts and models of the communication and information transfer process. (Lec. 3) Staff

**516 History of Libraries and Librarianship to the Renaissance** (I, 3) The development of libraries and librarianship within a cultural, social, and economic context, from ancient times to the Renaissance. Western civilization will be emphasized. (Lec. 3) Bergen

**517 History of Libraries and Librarianship from the Renaissance to the Present** (II, 3) The development of libraries and librarianship within a cultural, social, and economic context, from the Renaissance to the present. Western civilization will be emphasized. (Lec. 3) Bergen

**520 The School Library** (I and II, 3) The school library in relation to the school curriculum, other community library resources, and extra-curricular needs of the students. Special problems in the selection of materials, budgets, and standards for the library as a materials center with an active part in the teaching function of the school. (Lec. 3) Pre: 502. Salvatore

**521 Public Library Service** (I or II, 3) Reading on and discussion of the backgrounds, aims, and problems of the American public library, with particular attention to larger unit systems. (Lec. 3) Pre: 502. Staff

**522 College and University Library Service** (I or II, 3) Philosophic and practical considerations implicit in the functions, organization, and management of college and university libraries as these differ from other types of libraries. (Lec. 3) Pre: 502. Tryon

**523 Special Library Service** (I or II, 3) Organization, management, and regular and special procedures as they apply to special libraries, with particular emphasis upon standards and planning for space and equipment. (Lec. 3) Pre: 502. Bohnert or Chin

**526 Automation in Libraries** (I or II, 3) The application of technology and systems analysis to the operation of various types of libraries. (Lec. 3) Pre: permission of instructor. Staff

**527 Seminar in Library Administration** (I and II, 3) Intensive study of selected problems in important areas of library administration by means of discussion, readings, special lectures, and the presentation of papers based on literature surveys or research. (Lec. 3) Pre: permission of instructor. Staff

**528 Multi-Media and the Library** (I and II, 3) The role of A-V materials in media centers and other types of libraries. (Lec. 3) Pre: 520. Staff

**529 Library Cooperation** (II, 3) Library cooperation including the development of library systems, the role of government in the development of such systems, and the problems inherent in the development of cooperation. (Lec. 3) Staff

**530 Reading Interests of Children** (I or II, 3) Survey of children's literature, analyzing current trends, the limited-vocabulary book at various levels, and the significance of illustrations for the reading process. Main emphasis on informational books as recreational reading. (Lec. 3) Pre: 503. Salvatore

**531 Reading Interests of Adolescents** (I or II, 3) Materials of special interest to high school students in school and public libraries, stressing nonfiction but including fiction for the age group and for adults and the responsibility of the library in the drop-out problem. (Lec. 3) Pre: 503. Salvatore

**532 Reading Interests of Adults** (I or II, 3) Examination of the range and depth of books as a source of appeal to adults with emphasis on reading, annotations and discussion to develop critical faculties. (Lec. 3) Tryon

**533 Children's Library Materials** (I and II, 3) Books and related library materials in the area of creative literature for children: history, bibliography, selection, evaluation and presentation. (Lec. 3) Pre: 503. Salvatore

**536 Storytelling** (I, 3) Selection, adaptation, and presentation of stories for children of all ages, including attention to sources of materials, planning the story hour, and training and practice in the art of storytelling. (Lec. 3) Staff

**540 Library Materials in the Humanities** (I and II, 3) Important library resources in the humanities, including the major works, serial publications, and reference and bibliographical materials thereof. (Lec. 3) Pre: 504. Schneider

**541 Library Materials in the Social Sciences** (I and II, 3) Important library resources in the social sciences, including the major works, serial publications, and reference and bibliographical materials thereof. (Lec. 3) Pre: 504. Bergen or Schneider

**542 Library Materials in Science and Technology** (I and II, 3) Important resources in science and technology including the major works, serial publications, and reference and bibliographical materials thereof. (Lec. 3) Pre: 504. Bohnert or Chin

**543 Government Publications** (I or II, 3) Survey of the publishing activities and publications of national, state, and local governments with emphasis on the publications of the United States government. (Lec. 3) Pre: 504. Schneider

**544 Information Science for Librarians** (I or II, 3) Introduction to information storage and retrieval (analysis, semantics, thesaurus building, and data banks and their implications) as it applies to librarianship. (Lec. 3) Bohnert

**545 Technical Information Centers** (I and II, 3) Study of centers which provide publication, consultant, and question-answering services, emphasizing the differences between them and technical libraries and professional societies. (Lec. 3) Pre: permission of instructor. Bohnert

**550 Advanced Cataloging** (I or II, 3) Theory and problems in descriptive and subject cataloging. Comparative analysis of different classification schemes with emphasis on the use of Library of Congress classification and subject headings. Includes organization of non-book materials. (Lec. 3) Pre: 505. Chin

**551 Organization of Nonprint Materials** (II, 3) A practical and theoretical study of the development of procedures for intellectual and physical access to materials not in conventional print form, such as audio, graphic, audiovisual, and video material, as well as microforms, maps and vertical file materials. (Lec. 3) Pre: to be taken concurrently with or following 505. Staff

**560 Research in Librarianship** (I or II, 3) Methods of investigating problems in library science and an introduction to and evaluation of the literature of the field. (Lec. 3) Pre: permission of instructor. Bohnert

**562 Administration of Special Collections, Archives, and Manuscripts** (I or II, 3) Principles and techniques for administering manuscript and archival repositories, including acquisitions policies, appraisal criteria, methodology, and preservation practices. (Lec. 3) Pre: core courses in library science or permission of the instructor. Maslyn

**564 Introduction to Library Conservation** (I or II, 3) Fundamentals of library conservation essential for effective management of programs of preventive and restorative conservation for books, documents, prints, maps, broadsides, works of art on paper, and other library materials. (Lec. 3) Staff

**591, 592, 593 Independent Work** (By Appt., 1-3 respectively) Supervised reading or investigation in areas of special interest to students who obtain written approval for such study prior to registration for the semester for which it is proposed. Pre: 18 hours of library science with a B average. Staff

## LINGUISTICS (LIN)

**431 Applied Linguistics in the Language Laboratory** (I, 1)

**497, 498 Directed Study** (I and II, 3 each)

The following are related, specialized courses in historical linguistics offered in the Departments of English and Languages.

ENG 530, History of the English Language  
FRN 503, 504 History of the French Language  
GER 409 History of the German Language  
ITL 409, 410 History of the Italian Language  
SPA 409 History of the Spanish Language

## MANAGEMENT SCIENCE (MGS)

**445 Managerial Application of Simulation** (I, 3)

**458 Advanced Production Management** (II, 3)

**476 Management Systems Analysis** (II, 3)

**491, 492 Special Problems** (I and II, 3 each)

**579 Computing in Management** (I, 2) Computer concepts and programming in a high level language such as BASIC, FORTRAN, PL/1. Assigned problems emphasize the use of computing as an administrative and analytical tool for applications in management. (Lec. 2) Staff

**580 Quantitative Methods for Management Analysis** (I, 3) Mathematical tools useful to managers. Depth coverage given to differential and integral calculus, vectors and matrices. (Lec. 3) Staff

**581 Management Statistics** (II, 3) Statistical methods as tools of management; the collection and interpretation of data; statistical inference and decision-making; regression and correlation. (Lec. 3) Pre: 580 or equivalent. Staff

**585 Production and Operations Management** (II, 2) Concepts and problems associated with the design and development of systems for the creation of products and services. (Lec. 2) Staff

**601, 602 Advanced Management Statistics** (I and II, 3 each) Theory and application of regression and correlation analysis, analysis of variance and experimental design, and other multivariate data analyses. (Lec. 3) Pre: 581 or permission of instructor. Staff

**663 Management Information Systems** (II, 3) Concepts and problems associated with the design, implementation, and management of information systems. (Lec. 3) Pre: 579 or equivalent or permission of instructor. Staff

**681 Advanced Operations Management** (I, 3) Problems facing the manager of production and other business processes which are devoted to the creation of capital as well as consumer goods and services are examined and analyzed, employing modern decision-making techniques. (Lec. 3) Pre: 581 and 585 or permission of instructor. Staff

**682 Quantitative Management Analytical Techniques** (I and II, 3) Development and application of the principal mathematical and statistical techniques used in model building and decision-making under certainty and uncertainty. (Lec. 3) Pre: 581 or permission of instructor. Staff

**683 Business Decision Theory** (I, 3) A statistical analysis of managerial decision-making under uncertainty. Bayesian statistical inference and subjective probability are stressed. Comparisons between Bayesian method and classical statistics are discussed and applications to business problems are emphasized. (Lec. 3) Pre: 580, 581 or equivalent. Staff

**684 Advanced Programming Methods in Management Decisions** (II, 3) Introduction to integer, nonlinear and dynamic programming. Emphasis on application of modern mathematical optimization techniques in single-stage and multiple-stage management decision problems. (Lec. 3) Pre: 580 and 682 or equivalent. Staff

## MARINE AFFAIRS (MAF)

**521 Coastal Zone Law** (II, 3) Examination of the authority of different levels and agencies of government to make decisions affecting coastal regions. Survey of existing and proposed state and national legislation affecting coastal regions. (Lec. 3) Cameron

**523 Fisheries Law and Management** (II, 3) Examination of the relationship between law and fisheries policy on the international and national level, law relating to fisheries, jurisdictional levels, function of law in implementing fisheries management policy. (Lec. 3) Pre: permission of instructor. Cameron

**651, 652 Marine Affairs Seminar** (I and II, 3 each) Interdisciplinary seminar conducted by Marine Affairs Program faculty supplemented by guest speakers

from industry and government. Focuses on problems of marine resources development and management at the local/state, national and international policy levels. (Lec. 3) Pre: permission of director. Alexander, Gamble and Cameron

## MARKETING MANAGEMENT (MMG)

**410 Product Management** (I, 2)

**411 Marketing Communications** (I, 2)

**417 Channels of Distribution** (II, 2)

**419 Pricing Decisions** (II, 2)

**443 Retail Store Management** (I, 3)

**452 International Marketing** (II, 3)

**462 Marketing Research** (II, 3)

**464 Marketing Policy and Problems** (II, 3)

**466 Quantitative Marketing Management** (II, 3)

**474 Advertising Seminar** (I, 3)

**475 Advertising Campaigns** (II, 3)

**481, 482 Directed Study** (I and II, 3 each)

**550 Marketing Theory and Practice** (I and II, 2) Analytical approach to contemporary theory and practice of marketing management. (Lec. 2) Staff

**651 Marketing Management** (I, 3) Analysis of marketing problems and determination of marketing policies in product development, promotion, pricing, channel selection; legal aspects. (Lec. 3) Pre: 550 or equivalent. Staff

**656 International Marketing Management** (I and II, 3) Marketing policy-making for the multinational firm; organizing for international marketing; its opportunities, pricing, channels, promotion, research. (Lec. 3) Pre: 550 and 651. Staff

**658, 659 Seminar in Marketing** (I and II, 3 each) Preparation and presentation of papers on selected topics in marketing. (Lec. 3) Pre: 550, 651, or permission of instructor. Staff

## MATHEMATICS (MTH)

**418 Matrix Analysis** (II, 3)

**423 Introduction to Differential Geometry** (I, 3)

**425 Topology** (I, 3)

**437, 438 Advanced Calculus and Applications** (I and II, 3 each)

**441 Introduction to Partial Differential Equations** (I, 3)

**442 Vector and Tensor Analysis** (II, 3)

**444 Ordinary Differential Equations** (II, 3)

**451 Introduction to Probability and Statistics** (I, 3)

**452 Mathematical Statistics** (II, 3)

**456 Probability** (II, 3)

**461 Methods of Applied Mathematics** (I, 3)

**462 Functions of a Complex Variable** (II, 3)

**471 Introduction to Numerical Analysis I** (I and II, 3)

**472 Introduction to Numerical Analysis II** (I, 3)

**492 Special Problems** (I and II, 1-3)

**513 Linear Algebra** (I or II, 3) Linear spaces and transformations, linear functionals, adjoints, projections, diagonalization, Jordan form of matrices, inner products; positive, normal, self adjoint and unitary operators; spectral theorem, bilinear and quadratic forms. (Lec. 3) Papadakis

**515, 516 Algebra I, II** (I and II, 3 each) Groups, rings, modules, commutative algebra. (Lec. 3) Pre: 316. Beauregard

**525 Topology I** (I, 3) Topological spaces, separation properties, connectedness, compactness, uniformities. Function spaces, spaces of continuous functions and complete spaces. (Lec. 3) Pre: 425 or equivalent. Grove

**526 Topology II** (II, 3) Homotopy, fiberspaces, homology and cohomology. Notions of homological algebra. Products. (Lec. 3) Pre: 525. Staff

**535, 536 Measure Theory and Integration** (I and II, 3 each) Elements of topology and linear analysis. Lebesgue measure and integration in  $\mathbb{R}$ , in  $\mathbb{R}^n$  and in abstract spaces. Convergence theorems. Bounded variation, absolute continuity, and differentiation. Lebesgue-Stieltjes integral. Fubini and Tonelli theorems. The classical Banach spaces. (Lec. 3) Pre: 336. Pakula

**545, 546 Ordinary Differential Equations I, II** (I and II, 3 each) Existence and uniqueness theorems. Continuous dependence on parameters and initial conditions. Singularities of the first and second kinds, self-adjoint eigenvalue problems on a finite interval. Oscillation and comparison theorems. Elements of asymptotic theory. Elements of stability theory of Lyapunov's second method. (Lec. 3) Pre: 335 and 462. Staff

**550 Probability and Stochastic Processes** (I, 3) Review of probability theory. Generating functions, renewal theory, Markov chains and processes, Brownian motions, stationary processes. (Lec. 3) Pre: 451, 335, or 437, or permission of instructor. Liu

**551 Mathematical Statistics** (I, 3) Theory of estimation and hypothesis testing. Large sample methods. Regression and analysis of variance. (Lec. 3) Pre: 451, 335 or 437 or permission of instructor. Staff

**561 Advanced Applied Mathematics** (II, 3) Linear spaces, theory of operators, Green's functions, eigenvalue problems of ordinary differential equations. Application to partial differential equations. (Lec. 3) Pre 461. Verma

**562 Complex Function Theory** (I, 3) Analytic continuation, Riemann surfaces. The theory of conformal mapping. Representation theorems and applications. Entire functions. (Lec. 3) Pre: 462. Sine

**572 Numerical Analysis** (II, 3) Further numerical methods of solution of simultaneous equations, partial differential equations, integral equations. Error analysis. (Lec. 3) Pre: 472. Staff

**591, 592 Special Problems** (I and II, 1-3 each) Advanced work, under the supervision of a member of the department and arranged to suit the individual requirements of the student. Pre: permission of department. Levine

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**629, 630 Functional Analysis I, II** (I and II, 3 each) Banach and Hilbert spaces, basic theory. Bounded linear operators, spectral theory. Applications to analysis. Application to a special topic such as differential operators, semigroups and abstract

differential equations, theory of distributions, or ergodic theory. (Lec. 3) Pre: 536 and permission of instructor. Staff

**641 Partial Differential Equations I** (I, 3) First order systems. The Cauchy-Kowalewsky theorem. The Cauchy problem. Classification of partial differential equations. Hyperbolic equations. Mainly the theory of the subject. Students interested in techniques for the solution of standard equations should take 441. (Lec. 3) Pre: 215, 335, and 462. Levine

**642 Partial Differential Equations II** (II, 3) Elements of potential theory. Elliptic equations. Green's function. Parabolic equations. Introduction to the theory of distributions. (Lec. 3) Pre: 641. Levine

**645, 646 Selected Topics in Differential Equations I, II** (I and II, 3 each) Advanced topics of current research in differential equations will be presented with a view to expose the students to the frontiers of the subject. (Lec. 3) Pre: permission of department. Staff

**691, 692 Special Topics I, II** (I and II, 3 each) Advanced topics of current research in mathematics will be presented with a view to expose the students to the frontiers of the subject. (Lec. 3) Pre: permission of department. Staff

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## MECHANICAL ENGINEERING AND APPLIED MECHANICS (MCE)

**417 (or ELE 417) Direct Energy Conversion** (II, 3)

**423 Design of Machine Elements** (I, 3)

**424 Dynamics of Machines** (I, 3)

**425 Lubrication and Bearings** (I, 3)

**426 Advanced Mechanics of Materials** (II, 3)

**427 (or ZOO 427) Modeling and Analysis of Dynamic Systems** (I, 3)

**428 Mechanical Control Systems** (II, 3)

**429 Comprehensive Design** (II, 3)

**437 Rocket Propulsion** (II, 3)

**438 Internal Combustion Engines** (I, 3)

**439 Applied Energy Conversion** (II, 3)

**448 Heat and Mass Transfer** (I, 3)

**455 Advanced Fluid Mechanics** (I, 3)

**457 (or OCE 457) Fluidics** (II, 3)

**463 Intermediate Dynamics** (I, 3)

**464 Vibrations** (II, 3)

**491, 492 Special Problems** (I and II, 1-6 each)

**501, 502 Graduate Seminar** (I and II, 1 each) Discussions, presentation of papers based on research or detailed literature surveys. Attendance is required of all students in graduate residence. (Lec. 1) Staff

**503 Linear Control Systems**

See Electrical Engineering 503.

**515 (or CHE 515) Combustion** (II, 3) Combustion phenomena including chemical reactions and kinetics, ignition and quenching, flame propagation, detonation waves, propellant combustion; applications to heat engines, propulsion devices, control of unwanted fires, and pollution due to combustion. (Lec. 3) Pre: 342 and 354 or CHE 313 and 342 or 344 or equivalent. Conta

- 517 (or ELE 517) Magnetofluidmechanics (I or II, 3)** Basic concepts and equations governing the interaction between electromagnetic fields and a moving, electrically conducting, continuum fluid. Wave motions in MFM systems and engineering applications. (Lec. 3) Pre: 455 and ELE 511 or PHY 431, or permission of instructor. Lessmann
- 521 Reliability Analysis and Prediction (II, 3)** Statistical analysis of failure of complex engineering systems, design factors contributing to functional system survival, failure, distribution functions, redundancy, confidence, reliability testing. (Lec. 3) Pre: MTH 451 or equivalent, MCE 423 or permission of instructor. Nash
- 524 Advanced Kinematics and Linkage Design (I, 3)** Systematics of mechanisms and synthesis of linkage design. (Lec. 3) Pre: 423. Hatch
- 531 Underwater Power Systems**  
See Ocean Engineering 531.
- 532 Coastal Zone Power Plants**  
See Ocean Engineering 532.
- 540 Environmental Control in Ocean Engineering**  
See Ocean Engineering 540.
- 541 Thermodynamics (I, 3)** Advanced study of classical thermodynamics with emphasis on basic concepts, laws, and thermodynamic relations. (Lec. 3) Pre: 341, 354. Brown, DeLuise, Wilson
- 542 Statistical Thermodynamics (II, 3)** Irreversible thermodynamics, kinetic theory of gases, statistical thermodynamics and the development and application of the partition function. (Lec. 3) Pre: 341. Wilson
- 545 Heat Transfer (I, 3)** Conduction in two and three dimensions and conducting systems with radiation and fluid motion. Solutions obtained by mathematics, computer-numerical methods, and analog devices. (Lec. 3) Pre: 448. Schenck, Test
- 546 Convection Heat Transfer (II, 3)** Relationship between heat transfer and fluid flow with emphasis on the solution of governing equations by exact methods, integral methods and similarity techniques. (Lec. 3) Pre: 448. Test
- 550 Theory of Continuous Media (I, 3)** Basic course for first-year graduate students which develops and unifies the laws of mechanics as applied to the behavior of continua. Application to solids and fluids. (Lec. 3) Pre: CVE 220, MCE 354, 372, or permission of instructor. Dowdell, Kim
- 551 Fluid Mechanics I (I, 3)** Basic treatment of real fluid flows using the continuum approach. Solutions of the fundamental system of equations with and without temperature variations. (Lec. 3) Pre: 354 or its equivalent. Dowdell, Hagist, White
- 552 Fluid Mechanics II (II, 3)** Continuation of MCE 551 including incompressible irrotational flow, laminar and turbulent shear flows and other special topics of current interest. (Lec. 3) Pre: 551. Dowdell, Hagist, White
- 553 Flow of Compressible Fluids (II, 3)** Fundamental equations of compressible fluid flow. Solutions of these equations for subsonic, transonic, supersonic, and hypersonic velocities. (Lec. 3) Pre: 551 or permission of instructor. Staff
- 563 Advanced Dynamics (I and II, 3)** Dynamics of a system of particles, Lagrange's equations from an advanced point of view. Variational methods, non-conservative and non-holonomic systems; matrix-tensor specifications of rigid body motions, normal coordinates. Hamilton's equation of motion, canonical transformation, Hamilton-Jacobi theory. (Lec. 3) Pre: 463 or permission of instructor. Velletri
- 564 Advanced Vibrations (I, 3)** Theory of vibration of systems with concentrated masses and stiffness; systems with one degree of freedom, vibration isolation systems with many degrees of freedom, matrix methods, dynamic vibration absorbers, torsional vibration, approximate numerical methods. Experimental methods and design procedures. (Lec. 3) Pre: 464. Bradbury, Palm, Nash
- 565 Advanced Vibrations (II, 3)** Theory of vibration with continuously distributed mass and stiffness. Wave, characteristic function and integral equation methods of solution of string, longitudinal and torsional systems. Vibration and critical speeds of beams and rotating shafts, the methods of Rayleigh, Ritz, and Stodola, and self-excited vibrations. (Lec. 3) Pre: 564. Bradbury, Nash
- 572 Theory of Elasticity (II, 3)** Advanced theory of elasticity of isotropic and anisotropic bodies; plane stress and plane strain analysis via classical and Muskhelishvili's method, three-dimensional applications in torsion, bending, and semi-infinite solids. (Lec. 3) Pre: 550 or permission of instructor. Kim
- 573 Theory of Plates (I and II, 3)** Theory of plates and application to plates of various shapes under various loadings. (Lec. 3) Pre: CVE 220, MTH 244, MCE 372, or permission of instructor. Goff, Kim, Nash
- 575 Elastic Stability (I and II, 3)** Stability analysis of bars under separate and combined axial, lateral, and torsional loadings; buckling of plates and shells, energy methods and numerical methods. (Lec. 3) Pre: CVE 220, MTH 244, MCE 372, or permission of instructor. Goff
- 599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.
- 645 Boiling Heat Transfer and Two-phase Flow**  
See Chemical Engineering 645.
- 646 (or CHE 646) Radiation Heat Transfer (I or II, 3)** Radiant exchange between surfaces. Radiative properties of surfaces. Exchange among non-ideal surfaces. Gas-radiative exchange. Radiative exchange with volume emitters. Furnace design applications. (Lec. 3) Pre: 545 or CHE 644 or permission of instructor. Brown
- 651 Turbulent Flows (I, 3)** Turbulent flows from both the phenomenological and statistical points of view. Applications to meteorology, boundary layers and turbulent diffusion. (Lec. 3) Pre: 551 or permission of instructor. Hagist, Lessmann, White
- 652 Experimental Methods in Fluid Mechanics (II, 3)** An overview of measurement techniques and instrumentation used in the current practice of experimental fluid mechanics. Course emphasizes hot wire, hot film and laser anemometry. Provides practical laboratory experience. (Lec. 2, Lab. 3) Pre: 551 or permission of instructor. Dowdell, Hagist, Lessmann



**666 Nonlinear Mechanics** (I and II, 3) Dynamics of nonlinear systems, free and forced oscillations; graphical methods, integral curves, singular points, limit cycles and stability. Van der Pol equation, perturbation methods, approximate methods, application to ecological systems. (Lec. 3) Pre: 564. Nash, White

**673 Thermal Stress Analysis** (I, 3) Theory of stress and deformation in bodies subjected to thermal environments and restraints. Application to problems in thermoelasticity, thermal fatigue, thermoplasticity, and creep analysis. (Lec. 3) Pre: 448, 550. Kim, White

**674 Theory of Shells** (I and II, 3) Development and application of membrane and bending theories of shells of various shapes. Variational methods and buckling of shells. (Lec. 3) Pre: CVE 220, MCE 573, or permission of instructor. Kim

**677 Fatigue Failure and Fracture Mechanics** (II, 3) Advanced study of fracture induced by repeated loading, damage theories, fundamental theories of microscopic crack initiation and growth, statistical aspects of fatigue failure, theory of crack propagation. (Lec. 3) Pre: 429, 550, MTH 451, or permission of instructor. Nash

**679 Plasticity and Creep** (II, 3) Stress-induced flow of nominally solid materials, effect of temperature, combined stress problems; stress-dependent creep of metals at elevated temperatures, creep buckling, anelastic creep, related dislocation theory. (Lec. 3) Pre: 550 or permission of instructor. Goff

**691, 692 Special Problems** (I and II, 1-6 each) Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problem.) Credits not to exceed a total of 12. Pre: permission of department. Staff

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## MEDICINAL CHEMISTRY (MCH)

**443, 444 Organic Medicinal Chemistry** (I and II, 3 each)

**497, 498 Special Problems** (I and II, 1-5 each)

**501 Radiopharmaceuticals** (I, 3) The theoretical and applied aspects of the commonly used isotopes of pharmaceutical significance with emphasis on the diagnostic, therapeutic, and tracer applications in biological systems and techniques of development, formulation, quality control, and safe utilization. (Lec. 2, Lab. 3) Pre: CHM 228 or PHY 112, or permission of department. Smith

**526 Lipid Chemistry**

See Food and Resource Chemistry 526.

**533 Advanced Drug Assay** (I and II, 2-4) Advanced chemical and physical methods of analytical control related to pharmaceutical research and industrial pharmacy. (Lec. 1, Lab. 3-9) Pre: 342. Smith

**548 (or PCG 548) Physical Methods of Identification** (II, 3) Utilization of physical methods (primarily spectroscopic) in the structure elucidation of complex organic molecules. Emphasis on interpretation of ul-

traviolet, infrared, nuclear magnetic resonance, mass and optical rotatory dispersion spectra. (Lec. 3) Pre: CHM 425 and/or permission of instructor. Abushanab, Shimizu and Turcotte

**549 Synthesis** (I and II, 3) Theoretical and applied aspects in synthesis of selected organic compounds of medicinal significance. (Lab. 9) Pre: permission of department. Abushanab and Turcotte

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**621, 622 Seminar** (I and II, 1 each) Seminar discussions including presentation of papers on selected topics in medicinal chemistry. (Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed. No more than 3 credits allowed for the entire period of residence. Staff

**643 Advanced Organic Medicinal Chemistry** (II, 3) Synthesis, modes of action, and effects on pharmacological activity. Analgesics, cholinergics, folic acid antagonists, diuretics, and sulfonamides are included. (Lec. 3) Pre: CHM 522 and permission of instructor. In alternate years, next offered 1977-78. Staff

**646 Alkaloids** (I, 3) Advanced course dealing with proof of structure, synthesis, chemical properties and biological activity of various alkaloids. (Lec. 3) Pre: permission of department. Abushanab

**697, 698 Research in Medicinal Chemistry** (I and II, 1-3 each) Literature survey, laboratory work and a detailed research report on one or more assigned topics in medicinal chemistry. (Lab. 3-9) Pre: permission of department. Staff

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## MICROBIOLOGY (MIC)

**401 (or BCP 401) Quantitative Cell Culture** (I, 3)

**403 (or BCP 403) Introduction to Electron Microscopy** (I, 2)

**405 (or BCP 405) Electron Microscopy Laboratory** (I, 2)

**408 (or ZOO 408) Introduction to Protozoology** (II, 4)

**411 (401) Advanced Bacteriology** (I, 4)

**412 Food Microbiology** (II, 3)

**422 (or PLP 422) Industrial Microbiology** (II, 3)

**432 Pathogenic Bacteriology** (II, 3)

**491, 492 Research in Microbiology** (I and II, 1-6 each)

**495, 496 Seminar in Microbiology** (I and II, 1 each)

**521 Recent Advances in Cell Biology** (I, 1) Reading of current papers in the area of cell biology and preparation of written and oral reports. Emphasis on animal cells. (Lec. 1) Pre: at least one of the following courses or an equivalent course emphasizing cell structure and function: ZOO 315, 441, BOT 453, 432, 445 and MIC 408; graduate status or permission of instructor. Hufnagel and Goertemiller

**533 Immunity and Serology** (I, 3) Various immune reactions, nature of antigens and antibodies, and formation and action of latter. (Lec. 2, Lab. 3) Pre: 201 or

211 and 1 semester organic chemistry and senior standing. Carpenter

**552 Microbial Genetics (II, 3)** Recent research on the mechanisms of mutation and genetic recombination, the process of DNA replication, the genetic code, and regulation of DNA, RNA, and protein synthesis in microorganisms. (Lec. 2, Lab. 3) Pre: 201, BOT 352, and BCP 311. Cohen

**567 Marine Bacteriology**

See Oceanography 567.

**593, 594 The Literature of Bacteriology (I and II, 2 each)** Thorough study of original literature of some phase of bacteriology. Written abstracts or papers on assigned topics are discussed in weekly conferences with instructor. (Lec. 1-2) Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**621 Systematic Bacteriology (I, 4)** Conferences, assigned readings, and laboratory work designed to give a knowledge of principles of classification of bacteria as well as methods of identifying and describing unknown species. (Lec. 3, Lab. 3) Pre: 432 and either 412 or 533. In alternate years, next offered 1977-78. Houston

**622 (or BCP 622) Advanced Electron Microscopy (II, 2)** The physical functioning of electron microscopes; high resolution microscopy of macro-molecules; newly available EM histochemical procedures; and computer processing of electron images. (Lec. 2) Pre: 403, 405 or permission of department. Hufnagel

**624 (or BCP 624) Advanced Electron Microscopy Laboratory (II, 2)** Cleaning and aligning the electron microscope; development of independent projects utilizing advanced techniques, and formal presentation of results of individual projects to the class. (Lab. 6) Pre: prior or concurrent registration in 622 or permission of department. Hufnagel

**641 (541) Physiology of Bacteria (I, 4)** Bacterial structure and function, including growth, nutrition, environmental factors, metabolism, biosynthesis, and energy-yielding reactions. (Lec. 3, Lab. 3) Pre: 201 or 211, 2 semesters of organic chemistry and 1 semester of biochemistry. Wood

**654 Advances in Immunology (II, 2)** Assigned readings concerning latest developments in the field of cellular and humoral immunity presented and discussed by students. Research paper and critical review of a scientific paper required. (Lec. 2) Pre: 553, BCP 311, or permission of instructor. In alternate years, next offered 1977-78. Laux

**656 Mechanism of Bacterial Pathogenesis (II, 4)** Study of recent research on the mechanisms of pathogenesis. Students expected to participate in roundtable discussions of recent pertinent literature. (Lec. 3, Lab. 3) Pre: 432, 552, BCP 311. In alternate years, next offered 1976-77. Thorne

**691, 692 Research in Microbiology (I and II, 3 each)** Assigned research on an advanced level. Student required to outline problem, conduct the necessary literature survey and experimental work, and present his observations and conclusions in a report. (Lab. 6) Pre: graduate standing. Staff

**695, 696 Graduate Research Seminar (I and II, 1 each)** Reports of research in progress or completed. (Lec. 1) Required of all graduate students in microbiology. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

Note: for Virology, see Animal Pathology and Plant Pathology; for Mycology, see Botany.

**MUSIC (MUS)**

**407 The Symphony (II, 3)**

**408 The Opera (II, 3)**

**418 Composition (II, 3)**

**419 Composition (I, 2)**

**420 Counterpoint (I, 3)**

**422 Advanced Orchestration (II, 2)**

**423 (427, 428) Sixteenth Century Counterpoint (I or II, 3)**

**431 The Baroque Era (I, 3)**

**432 The Classical Era (II, 3)**

**433 The Romantic Era (I, 3)**

**434 The Modern Era (I, 3)**

**441 Special Projects (I and II, 3)**

**445 Music in the Elementary School (I, 3)**

**446 Teaching General Music (II, 3)**

**451 Performance as Minor or Elective (I and II, 2)**

**461 Performance Major (I and II, 4)**

**481, 482 Piano Literature and Pedagogy (I and II, 2 each)**

**539 Advanced Principles of Music Education I (I, 3)** Analysis of philosophical, psychological, and historical foundations of music education. Development and significance of objectives and principles of music education in the United States. (Lec. 3) Pre: graduate standing in music. Motycka

**540 Advanced Principles of Music Education II (II, 3)** Critical study of principles of objectives, program, method, administration, supervision, and evaluation of music education in the United States. (Lec. 3) Pre: 539. Motycka

**545 Musical Aptitude and Achievement (I, 3)** Intensive analysis of musical aptitude and achievement, from a thorough examination of existing devices to the consequent realization of research data via basic statistical concepts. (Lec. 3) Pre: graduate standing in music, EDC 371 or PSY 434 or equivalent. Motycka

**548 Research in Music Education (II, 3)** Examination of research techniques as applied to the art of music. Extant major project procedures and data in the research categories: historical, analytical, experimental, descriptive, and philosophical. (Lec. 3) Pre: 545. Motycka

**551 Performance as Minor or Elective (I and II, 2)** Private instruction. One 40-minute lesson and scheduled practice hours each week. One level, one year, as prescribed in performance minor syllabi. Afternoon recital required each semester. (Studio 6) Pre: completion of applied minor in undergraduate upper division and permission of department. Staff

Select area of instruction from the following and add to course number as MUS 551B, Piano:

A Voice	H Bass Viol	Q French Horn
B Piano	J Flute	R Trombone
C Organ	K Oboe	S Baritone Horn
D Harpsichord	L Clarinet	T Tuba
E Violin	M Bassoon	U Percussion
F Viola	N Saxophone	V Guitar
G Violoncello	P Trumpet	

## NUCLEAR ENGINEERING (NUE)

**538 (or CHE 538) Nuclear Metallurgy (II, 3)** Metallic materials of particular interest in nuclear engineering. Production and physical metallurgy of uranium, thorium, the transuranium elements, and the rare earths; protection against corrosion, radiation damage. (Lec. 3) Pre: CHE 332.

**581 (or CHE 581) Introduction to Nuclear Engineering (I and II, 3)** Survey course of the field emphasizing the special application of principles learned in the several specialized branches of engineering. Major topics are nuclear physics, problems in design of reactor cores, materials of construction, instrumentation and control, and health physics. (Lec. 3) Pre: PHY 340 or 341. Knickle

**582 (or CHE 582) Radiological Health Physics (I, 3)** Fundamentals of health physics and radiation protection are covered. Calibration and use of survey and monitoring equipment are emphasized in the laboratory. (Lec. 2, Lab. 3) Pre: permission of instructor. In alternate years. Rose

**583 (or CHE 583) Nuclear Reactor Theory (II, 3)** Elementary theory of self-sustained nuclear reactors. Diffusion and slowing-down theory of neutrons and the determination of the critical size and homogeneous thermal reactors with and without reflectors. One-group, two-group and modified two-group approaches. (Lec. 3) Pre: PHY 340 or 341. Knickle

**585 (or CHE 585) Measurements in Nuclear Engineering (I, 3)** Basic techniques used in measuring the interaction of radiation and matter. Principles of ionization chambers, proportional and Geiger-Mueller counters, scintillation counters, related circuitry. Laboratory stresses thorough familiarization with these instruments. (Lec. 2, Lab. 3) Pre: PHY 340 or 341 or permission of department. Rose

**586 (or CHE 586) Nuclear Reactor Laboratory (II, 3)** Theoretical and experimental determination of reactor characteristics. Experimental equipment includes a neutron howitzer, a subcritical training reactor and a one megawatt swimming pool reactor. Digital and analog computer facilities are utilized in calculation. (Lec. 1, Lab. 4) Pre: 585. Rose

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**682 (or CHE 682) Radiation Shielding (II, 3)** Detailed study of the problems involved in radiation shielding. The principles of radiation protection are briefly reviewed first. (Lec. 3) Pre: 581. In alternate years. Knickle

**683 (or CHE 683) Advanced Nuclear Reactor Theory (II, 3)** Advanced treatment of nuclear reactor theory, emphasizing the transport theory and multi-group calculations. Determination of critical size of heterogeneous reactors. Time-dependent transient behavior and basic theory of reactor control. Use of digital and analog computers. (Lec.3) Pre: 583. Rose

**687 (or CHE 687) Nuclear Chemical Engineering (II, 3)** Applications of chemical engineering to the processing of materials for and from nuclear reactors. (Lec. 3) Pre: 581 and permission of instructor. In alternate years. Rose

## NURSING (NUR)

**501, 503 Advanced Clinical Nursing (I or II, 3 each)** Cross-clinical seminar through which the graduate student is helped to broaden and deepen knowledge of theory, concepts and problems that are common to all nursing. (Lec. 3) Must be taken concurrently with 502, 504. Staff

**502, 504 Advanced Clinical Nursing Practicum (I or II, 3 each)** Intensive study of significant nursing problems in health agencies, selected cooperatively by student and instructor with regard to student's needs and interests. A substantial paper involving independent study in 501, 502, 503, 504 is required. (Lec. 1, Lab.6) Must be taken concurrently with 501, 503. Required of all graduate students in nursing. Staff

**505 Research in Nursing (I, 3)** Current research in nursing, emphasizing interpretation and applications. Methodology related to clinical nursing and community health. Students select a problem and develop a project as a learning experience. Pre: graduate standing and a basic course in statistics. Staff

**506 Independent Study in Nursing (I and II, 2-6)** Intensive study of a specific area of interest, a problem or issue in nursing under guidance of the faculty. Pre: permission of graduate faculty. Staff

**507 Comparative Study of Functions in Nursing (I or II, 3)** Seminar for the study of theories basic to the development of philosophy and practice in education and administration in nursing. (Lec. 3) Pre: 501, 502. Must be taken concurrently with 508 or 509. Staff

**508 Practicum in Teaching (I and II, 3)** Supervised teaching experience in the student's chosen area of clinical interest. (Lec. 1, Lab. 6) Pre: 501, 502. Must be taken concurrently with 507. Staff

**509 Practicum in Administration of Nursing Service (I and II, 3)** Supervised experience in nursing service in a clinical setting chosen by the student. (Lec. 1, Lab. 6) Pre: 501, 502. Must be taken concurrently with 507. Staff

## OCEAN ENGINEERING (OCE)

**401, 402 (or MCE 401, 402) Introduction to Ocean Engineering Systems I and II (I and II, 3 each)**

**403, 404 (or CHE 403, 404) Introduction to Ocean Engineering Processes I and II (I and II, 3 each)**

**410 (or MCE 410) Basic Ocean Measurements (I or II, 3)**

**457 (or MCE 457) Fluidics (II, 3)**

**500 Basic Ocean Engineering (II, 3)** Introduction for non-engineering students to the classic engineering disciplines as they relate to marine affairs. Course is descriptive and deals with current engineering practice. (Lec. 3) Pre: senior standing. No program credit for graduate engineering students. Sheets

**512 Hydrodynamics of Floating and Submerged Bodies I (I, 3)** Hydrodynamic principles associated with floating and submerged bodies: resistance, propulsion, static and dynamic stability. (Lec. 3) Pre: MCE 455 or equivalent. Kowalski

**513 Hydrodynamics of Floating and Submerged Bodies II (II, 3)** Continuation of 512. Problems of maneuvering, control, and motions in waves. (Lec. 3) Pre: MCE 455 or equivalent. Kowalski

**521 Materials Technology in Ocean Engineering (I, 3)** Requirements for ocean engineering materials. Material characteristics, fracture toughness, notch sensitivity, energy absorption, speed of loading and fatigue in salt water. Steel, aluminum, titanium, plastics, concrete, and applicable regulations. (Lec. 3) Pre: permission of instructor. Sheets

**524 Marine Structural Design**  
See Civil Engineering 524.

**531 (or MCE 531) Underwater Power Systems (II, 3)** Low output power systems. Overall considerations appropriate to the determination of power requirements for underwater systems. (Lec. 3) Pre: MCE 342, 448 or permission of instructor. Brown and Rose

**532 (or MCE 532) Coastal Zone Power Plants (I, 3)** Overall systems consideration for coastal zone power plants. Consideration of factors such as political and legal problems, thermal pollution, and multi-use of plants (aquaculture, etc.) (Lec. 3) Pre: MCE 342, 448 or permission of instructor. Brown and Rose

**534 Corrosion and Corrosion Control**  
See Chemical Engineering 534.

**535 Advanced Course in Corrosion**  
See Chemical Engineering 535.

**540 (or MCE 540) Environmental Control in Ocean Engineering (II, 3)** Application of the principles of thermodynamics, heat transfer, and fluid dynamics to the requirements of human survival and engineering operations in deep and shallow water. (Lec. 3) Pre: permission of instructor. Schenck

**560 (or ELE 560) Introduction to Data Collection Systems (I, 3)** Practical problems of data collection. Probes and sensors, interfaces, signal conditioning, and storage. Examples found among the current research areas within ocean engineering will be emphasized. (Lec. 3) Pre: graduate standing in engineering or permission of instructor. Haas

**561 Introduction to the Analysis of Oceanographic Data (I, 3)** Design of oceanic experiments to determine spatial and temporal sampling rate,recision, accuracy, signal-to-noise ratio, etc. Description of typical ocean data collection and analysis systems. Development of relevant techniques. (Lec. 3) Pre: IDE 411, MTH 451 or equivalent. LeBlanc

**565 Ocean Laboratory I (I or II, 3)** Measurements, experiments, operation of apparatus in the ocean and in the laboratory. Statistical theory, planning mul-

tivariable experiments, checking of data, etc. (Lec. 1, Lab. 6) Pre: graduate standing in engineering or oceanography, or permission of instructor. Schenck and LeBlanc

**566 Ocean Laboratory II (I or II, 3)** Planning long-term experiments in the ocean. Carrying out a synoptic ocean program using vessels, buoys, underwater sensors and locations of opportunity. Student manages experiment, and writes technical report. (Lab. 6-8) Pre: 565. Schenck and LeBlanc

**571 (or ELE 571) Underwater Acoustics I (I, 3)** Wave equation, energy, pressure and particle velocity. Acoustic properties of the sea. Elementary sources, refraction, reflection, ray theory, normal modes and scattering, with emphasis on sound propagation in the ocean. (Lec. 3) Middleton and Stepanishen

**581 Coastal Engineering Geology**  
See Geology 581.

**587 Submarine Soil Mechanics (I, 3)** Soil mechanics principles as applied to submarine slope stability, heaving, sinkage and anchorage problems with emphasis on effective stress principle and selection of shear strength of marine sediments. (Lec. 3) Pre: CVE 380 or equivalent. Nacci

**591, 592 Special Problems (I and II, 1-6 each)** Advanced work under the supervision of a member of the staff and arranged to suit the individual requirement of the student. (Lec. or Lab. according to nature of problem) Pre: permission of department. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**605, 606 Ocean Engineering Seminar (I and II, 1 each)** Seminar discussions including presentation of papers based on research or literature survey. (Lec. 1) Attendance is required of all students in graduate residence. A maximum of 1 credit per year is allowed, no more than 2 credits for the entire period. Staff

**610 Engineering Ocean Mechanics (II, 3)** Applied concepts of ocean flow processes; waves due to gravity, wind, and layered media; large and small scale turbulence; prediction of flow instability; wave forces on structures. (Lec. 3) Pre: CHE 344, MCE 354 or equivalent. White

**653, 654 Ocean Engineering System Studies (I and II, 3 each)** Systems engineering study of an advanced ocean engineering problem. Students will operate as a complete engineering team with specific subsystems designs done with individual faculty members. (Lec. 3) Sheets

**661 Analysis of Oceanographic Data Systems (I, 3)** Design of systems for deep ocean and estuarine data collection and processing. Space-time sampling, multivariate analysis and convergence of moments as applied to ocean data estimation and system design. Current topics in ocean data systems. (Lec. 3) Pre: ELE 506 or equivalent. LeBlanc

**672 (or ELE 672) Underwater Acoustics II (II, 3)** Transducers, radiators and receivers, directivity (array structures) equivalent circuits, efficiency; piezoelectricity, magnetostriction, sonar principles, measurements and calibration. (Lec. 3) Stepanishen

**673 Advanced Course in Underwater Acoustic Propagation (I, 3)** Analysis of propagation from a con-

centrated acoustic source in the ocean by methods such as advanced normal mode theory, numerical integration and fast Fourier transforms. Applications to ocean features such as surface ducts, shadow zones, deep sound channel, etc. (Lec. 3) Pre: 571 or equivalent. DiNapoli and Stepanishen

**674 Nonlinear Acoustics (II, 3)** Topics in the nonlinear acoustics of fluids. Propagation and interactions of finite-amplitude sound waves. Parametric sonar. Sound generation by turbulence. Cavitation noise. Shock waves. Underwater explosions. Radiation pressure and acoustic streaming. (Lec. 3) Pre 571 or permission of instructor. Moffett

**675 Processing of Underwater Acoustic Data (II, 3)** Description of the underwater acoustic environment. Methods of measuring underwater acoustic signals. Data analysis of passive and active signals. Applications of underwater acoustics to oceanographic survey. (Lec. 3) Pre: ELE 506 or equivalent. LeBlanc

**676 Acoustic Radiation from Underwater Vibrators (II, 3)** Fundamentals of acoustic radiation from submerged structures. Radiation from planar, cylindrical and spherical surfaces. In-vacuo and in-fluid vibration of elastic bodies. Acoustic coincidence and fluid loading effects on radiation from elastic bodies. Pre: 571 or approval of instructor. Stepanishen

**691, 692 Special Problems (I and II, 1-6 each)** Advanced work under supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problem) Pre: permission of department. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## OCEANOGRAPHY (OCG)

**401 General Oceanography (I, 3)**

**501 Physical Oceanography (I, 3)** Basic course covering physical properties of seawater, heat budget, distribution of variables, dynamics, water masses and general circulation, waves and tides. (Lec. 3) Pre: PHY 213, MTH 141. Knauss

**509 Ecological Aspects of Marine Pollution (II, 3)** Biological, chemical, physical aspects of selected domestic agricultural, industrial wastes discharged into saline environments. Case histories emphasizing toxicological effects. The concept of bioassay is developed. Research paper required. (Lec. 3) Pre: 401 or permission of instructor. Eisler

**510 Descriptive Physical Oceanography (II, 3)** Observed distributions of temperature, salinity, currents; methods of deducing deep flow; physical properties of seawater; flow in estuaries; practical work in the analysis of oceanographic data; study of recent literature. (Lec. 3) Pre: 501. Watts

**521 Chemical Oceanography (II, 3)** Processes regulating the composition of seawater, and the distribution of chemical species. The interaction of marine chemistry with the ocean floor, atmosphere and marine organisms. (Lec. 2, Lab. 2) Pre: CHM 101, and 112 or 109, PHY 213. Pilon

**524 Chemistry of the Marine Atmosphere (II, 3)** Chemistry and physics of marine aerosols, trace gases, and precipitation; cycles and budgets of atmospheric nitrogen, sulfur, halogen, and carbon compounds; effects of man on the marine atmosphere. (Lec. 3) Pre: 521 and CHM 432 or permission of instructor. In alternate years, next offered 1976-77. Duce

**540 Geological Oceanography (II, 3)** Origin of ocean basins; geomorphology, sediments, volcanism, structure and tectonics of the deep-sea floor; character and development of continental margins, beaches and estuaries. (Lec. 2, Lab. 2) Pre: GEL 103 or ESC 105 and 106, or permission of instructor. McMaster

**545 Geomagnetism and Paleomagnetism (I, 3)** Description of past and present magnetic fields of the Earth. Principles, methods, results of the application of paleomagnetism to diverse geological, geophysical, and paleontological problems. Lectures and seminars. Pre: PHY 213 and/or 214 and MTH 142 and/or 243 and/or 244 and some geology, GEL 103 and/or 104, or permission of instructor. Watkins

**547 Seminar in Biomagnetism (I, 2)** Effect of weak and strong magnetic fields on marine and terrestrial organisms in the present and in the past. Introductory lectures on artificial and natural magnetic fields, followed by seminars by students and guests. (Lec. 2) Pre: permission of instructor. Watkins

**561 Biological Oceanography (I, 3)** Nature of life in the sea; adaptations, patterns of distribution and production of plankton, nekton and benthos, their interrelationships and interaction with the environment. (Lec. 2, Lab. 2) Pre: ZOO 111. Pratt

**567 Marine Bacteriology (II, 3)** Present concepts of the distribution, nature, and functions of bacteria and related microorganisms in the marine environment. Methodology includes sampling, culture, taxonomy and study of their physical and physiological ecology. (Lab. 6) Pre: CHM 104 and MIC 201 or 211 or permission of instructor. Sieburth

**568 Fishery Biology (II, 3)** Biology of fish populations and methods of fishery research, including influence of environmental factors on morphology, physiology, abundance and distribution of fishes, estimation of stocks, growth, aging, mortality, measurement of fish production and theory of fishery regulation. (Lec. 3) Pre: permission of instructor. Sails

**571 Benthic Environment (I, 3)** Lectures, readings, seminar presentations, discussion and project work on the physical-chemical properties and total ecology of the benthic marine environment. Includes tidal marshes, rocky intertidal areas, estuarine shoals, coral reefs and deep-sea benthos. (Lec. 2, Lab. 2) Pre: permission of instructor. Nixon

**574 Biology of Marine Mammals (II, 2)** Migration, reproduction, social organization, classification, anatomy, populations, physiology and communications of cetaceans and pinnipeds. (Lec. 1, Lab. 3) Pre: permission of instructor. In alternate years, next offered 1976-77. Winn

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**605 Dynamical Oceanography (I, 3)** Simple steady state theories applied to ocean motion. Review of well-

known force balances in oceanography, wind driven circulation, thermohaline circulation, the thermocline, oceanic boundary layers, near shore circulation, diffusion. (Lec. 3) Pre: 501. Staff

**607 Geophysical Models (I, 4)** Selected laboratory experiments modeling the motions of oceans and atmospheres. Comparison of effects of rotation and stratification. Thermal and thermohaline convection, inertial waves and boundary layer phenomena. Emphasis on experimental research techniques and preparation of technical reports. (Lec. 3, Lab. 3) In alternate years, next offered 1977. Lambert

**609 Dynamics of Mixing (I, 3)** Theories of the thermocline and the problem of vertical mixing. Relation of mean vertical mixing coefficients to detailed mechanisms of mixing. Internal waves, shear instabilities, lateral spreading and entrainment, thermohaline convection, small scale turbulence. (Lec. 3) Pre: permission of instructor. In alternate years, next offered fall 1978. Lambert

**610, 611 Geophysical Fluid Dynamics (I and II, 3 each)** Physics of ocean circulation: surface wave generation, rotating fluids, density currents, quasi-geostrophic motion, laminar viscous flow, turbulence, wind driven ocean circulation, stratification, convection, thermohaline convection, horizontal convection and thermoclines. (Lec. 3) Pre: a prior course in fluid dynamics, and permission of instructor. Stern

**613 Waves (I, 3)** Generation, propagation and decay of surface waves, internal waves, and Rossby waves in the ocean. (Lec. 3) Pre: MCE 550 or permission of instructor. Staff

**614 Tides (II, 1)** Generation, propagation, and dissipation of ocean tides. Relation between theory and observation. (Lec. 1) Pre: 501. Staff

**621 (or REN 621) The Estuary and Coastal Zone (I, 3)** Multi-disciplinary course on characteristics of estuaries and adjacent coastal waters and ecological, economic, engineering and other considerations applicable to development, management, and conservation of such waters. (Lec. 2, Rec./Proj. 1) Pre: advanced (second year) graduate standing and approval of course chairman. Marshall and Lampe

**623 Physical Chemistry of Seawater (I, 3)** Characterization of dissociation, solubility and redox equilibria in seawater. Partial molar volumes, conductivity and diffusion of ions in seawater. Kinetic studies in seawater; effects of temperature, salinity and pressure on physicochemical properties in seawater. (Lec. 3) Pre: 521 and CHM 432 or permission of instructor. Kester

**625 Organic Geochemistry (I, 3)** Chemistry of organic matter in seawater and recent marine sediments. Topics include source, characterization, significance and fate of dissolved, particulate and sedimentary organic compounds. (Lec. 3) Pre: CHM 228 or permission of instructor. Quinn

**630 Geochemistry (I, 3)** Introduction to the study of distribution of the elements in the natural environment. Emphasis on an understanding of the chemical principles and chemical processes which govern this distribution. (Lec. 3) Pre: CHM 104 or 112 and GEL 103 or permission of instructor. In alternate years, next offered 1977. Schilling

**631 Seminar in Marine Chemistry (I and II, 1)** Discussion of problems of current interest in marine chemistry. (Lec. 1) Pre: 521 or permission of instructor. Staff

**641, 642 Geology of Continental Margins I and II (I and II, 3 each)** 641: geomorphology, sedimentology, and structure of continental shelves, borderlands, slopes and rises with consideration of origin and developmental sequence of continental margins. 642: characteristics of continental margins compared with those of island arcs, small ocean basins and geosynclines. Origin and evolutionary relationships considered within the framework of global tectonics. (Lec. 3) Pre: 540, 641 (for 642), GEL 470 and 550. In alternate years, next offered 1977 for 641, 1978 for 642. McMaster

**643 Seminar in Deep-Sea Geology (I, 3)** Class discussion of selected topics in deep-sea geology based on extensive reading in the scientific literature. A research paper by each student and lectures will supplement the discussions. (Lec. 3) Pre: permission of instructor. Staff

**644 Thermodynamics of the Earth's Interior (I, 3)** Review and application of thermodynamics to geological problems. Crystal-melt equilibria, phase transitions, hydration reactions; coprecipitation laws and fractionation processes; effect of the geothermal and pressure gradients, convection. (Lec. 3) Pre: GEL 103 and a course in thermodynamics such as CHM 431, 432, or PHY 420, or CHE 313 and 314, or MCE 341 or permission of instructor. In alternate years, next offered 1978. Schilling

**645 Petrology of the Oceanic Crust (I, 3)** Nature and origin of igneous and metamorphic rocks of the oceanic crust of the earth; mineralogy, petrology and petrogenesis of sea-floor rocks; metamorphism of the ocean crust. (Lec. 3) Pre: permission of instructor. In alternate years, next afforded 1978. Sigurdsson

**646 Deep-Sea Sediments and Process (II, 3)** Deep-sea sediments and their relation to oceanic processes such as solution, productivity and dilution. Sedimentary distributions in time and space as related to tectonic models. Paleoclimatology, and past water mass distributions and conditions. Term paper. (Lec. 3) Pre: permission of instructor. In alternate years, next offered 1978. Heath and Moore

**647, 648 Recent Sedimentary Environments I and II (I and II, 3 each)** Concentrated study of sedimentary environments with primary emphasis on the relationships between sediment properties of each environment and its environmental conditions. 647: beach, lagoon, estuary and bay. 648: continental shelf, slope and rise. (Lec. 3) Pre: 501, 540, GEL 550. In alternate years, next offered 1976-77. McMaster

**649 Marine Paleocology (I, 3)** Concepts of paleocology. Review of Pleistocene and Tertiary paleo-oceanography, paleoclimatology and paleocology. Criteria and methods used in marine paleocology especially those related to foraminifera radiolaria. Biogeography and paleocology of Cenozoic planktonic faunas. (Lec. 2, Lab. 1) In alternate years, next offered fall 1976. Kennett

**651 Cenozoic Marine Stratigraphy (I, 2)** Extensive reading and class discussion of concepts and methods

of biostratigraphy, chronostratigraphy and lithostratigraphy as applied to the Cenozoic. Stratigraphic nomenclature. Problems and advances in correlation and dating of marine sediments from distinct oceanographic regimes including type European sections. (Lec. 2) In alternate years, next offered 1977. Kennett and Moore

**660 Ecological Concepts in Marine Research (I, 3)** Advanced course in ecology, emphasis on marine environment. Ecological theory pertaining to stability and diversity of natural communities and perturbed systems. Field work in Narragansett Bay on zooplankton, benthos, nekton. (Lec. 1, Lab. 4) Jeffries

**661 (or BOT 661) Phytoplankton Taxonomy (I, 3)** Classical and modern systems and techniques for the identification, nomenclature, and classification of planktonic algae, with emphasis on marine forms. Phylogeny will be briefly considered. (Lec. 1, Lab. 4) Pre: permission of instructor. In alternate years, next offered fall 1976. Hargraves

**663 (or BOT 663) Phytoplankton Physiology (I, 3)** Metabolic processes and methods of their investigation in phytoplankton with primary emphasis on functions pertinent to their ecology. Includes adaptation, uptake of nutrients, excretion, rhythms, pigments, and photosynthesis. (Lec. 3) Pre: permission of instructor. Swift

**664 (or BOT 664) Phytoplankton Ecology (I, 4)** Biology, ecology, methods of investigation and introductory systematics of the pelagic marine microscopic plants; stress on their adaptations, physiological ecology, distribution, succession, production, and regional and seasonal dynamics. (Lec. 3, Lab. 3) Pre: permission of instructor. Smayda

**666 Zooplankton (II, 3)** Biology of marine zooplankton, dealing with morphology, adaptation, distribution, physiology, production and interrelationships with other members of the marine biota. (Lec. 1, Lab. 4) Pre: permission of instructor. Napora

**667, 668, 669 (or BOT 667, 668, 669) Advanced Phytoplankton Seminars (II, 2 each)** Specialized and advanced areas of phytoplankton biology and research, including systematics, physiology and ecology. (Sem. 3) Pre: permission of instructor. Hargraves, Smayda and Swift

**672 Marine Invertebrates and Environment (I, 3)** Physiological responses of marine invertebrates to seasonal and geographical changes in the environment. Survival, metabolism, reproduction and larval development of the populations. Mechanisms in adaptation during stages in life cycle examined in relation to changes of certain environmental factors. Physiological variation of populations related to speciation process. Lectures, reading and discussion. Research project. (Lec. 3) Pre: 561 and permission of instructor. Sastry

**679 (or ZOO 679) Animal Communication (I, 2)** Visual, chemical and auditory communication in animals, including receptor systems, feedback and redundancy. Functional aspects and organization of communication. Discussion of readings. Research problem can be taken under 691 or ZOO 693. (Lec. 2) Pre: ZOO 467 or equivalent and permission of instructor. In alternate years, next offered 1976-77. Winn

**691, 692 Individual Study (I and II, 1-6 each)** Individual study of assigned topics or special problems, involving literature search and/or original investigation under one or more members of the staff. (Lec., Lab. TBA) Staff

**693, 694 Special Studies (I and II, 1-4 each)** Studies of specialized topics in the marine sciences. (Lec., Lab. TBA) Staff

**695 Seminar in Oceanography (I and II, 1)** Students to give seminar reports on problems and current research in various areas of oceanography. Attendance and registration are required of all students in graduate residence but no more than 4 hours are allowed for a program of study. (Lec. 1) Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

Note: graduate students in oceanography choose from supporting courses in other departments.

## ORGANIZATIONAL MANAGEMENT AND INDUSTRIAL RELATIONS (OMR)

**407 Organization and Management Theory (I and II, 3)**

**408 Organization Development and Change (I or II, 3)**

**410 Business Policy (I and II, 3)**

**422 Labor Law and Legislation (II, 3)**

**423 Labor Relations (II, 3)**

**431 Advanced Management Seminar (I or II, 3)**

**480 Small Business Management (I and II, 3)**

**491, 492 Special Problems (I and II, 3 each)**

**504 Business Policy (II, 3)** Determination of objectives and planning programs of action, creating an organization and launching a program; controlling execution of plans; reappraising objectives. Studies of administrative situations. (Lec. 3) Pre: permission of department. Staff

**530 Management Theory and Practice (I and II, 2)** Management applied to business; objectives, policies, organization staffing and control; production; personnel; behavioral science applications; the role of quantitative methods. (Lec. 2) Staff

**626 Organizational Behavior (I and II, 3)** Incorporates the insights gleaned from the disciplines of psychology, sociology, anthropology and the social sciences of politics, economics and history in the study of the behavior of organizations and of their principal actors. (Lec. 3) Pre: 530 or equivalent. Staff

**627 Advanced Organization Theory and Behavior (I and II, 3)** Previous knowledge of classical and traditional management thought used to provide concepts, analytical approaches, and skills for understanding how behavioral sciences influence complex organizational systems. (Lec. 3) Pre: 626. Staff

**631 Human Resources Management (I and II, 3)** Role of human resources management, its functional relationship within an organization with emphasis on behavioral concepts and their application. Text, cases and research. (Lec. 3) Pre: 530. Staff

**638, 639 Seminar in Industrial Management (I and II, 3 each)** Class discussion of typical cases, original research work in the field of industry with discussion of data collected and analyzed by individual students. (Lec. 3) Pre: permission of department. Staff

**655 International Business Management (I, 3)** Examines the problems and characteristics of international management by focusing on the role of the multi-national corporation in a cross-cultural setting. (Lec. 3) Pre: 530 or equivalent. Staff

**670 Business Environmental Analysis (II, 3)** Advanced analysis of increasingly complex interrelationships between the business organization and its environment. Emphasis on conceptual foundations of business and the impact of contemporary socio-political issues on management decision-making. (Lec. 3) Pre: 530 or equivalent. Staff

**681 Administrative Policy and Decision-making (I and II, 3)** Review of the functional areas of marketing, production, finance, economics, accounting, quantitative methods, organizational theory, interpersonal relationships, control and motivation systems, and communications. Includes the M.B.A. written comprehensive examination according to Graduate School requirements. (Lec. 3) Pre: all M.B.A. foundation courses or undergraduate equivalents and a minimum of 21 M.B.A. credits at the 600 level which must include MMG 651, FIN 641, ACC 611. Staff

#### PHARMACOGNOSY (PCG)

**445, 446 General Pharmacognosy (I and II, 3 each)**

**447 General Pharmacognosy Laboratory (I and II, 1)**

**459 Public Health (I and II, 3)**

**497, 498 Special Problems (I and II, 1-3 each)**

**521, 522 Seminar (I and II, 1 each)** Seminar discussions including presentation of papers on selected topics in pharmacognosy. (Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed. No more than 3 credits for entire period. Staff

**533 Medicinal Plants (I, 2)** Problems in drug plant chemotaxonomy with field work in the drug plant gardens. Emphasis is placed on certain alkaloid, glycoside and oil-yielding plants. Weedicides and insecticides as related to measures for control. (Lec. 1, Lab. 3) Pre: 446 or permission of department. Staff

**536 Antibiotics (II, 3)** Advanced course on concept of antibiosis, biosynthesis pathways of antibiotic production, testing, chemistry, mechanism of action, medicinal and pharmaceutical uses of antibiotics. Phenomena of sensitivity and resistance; emphasis on entities of importance in pharmaceutical research and production. (Lec. 3) Pre: permission of department. In alternate years. Worthen

**548 Physical Methods of Identification**  
See Medicinal Chemistry 548.

**551, 552 Chemistry of Natural Products (I and II, 3 each)** Introduction to chemistry of certain groups of natural products especially in relation to their chemotaxonomic position in plant classification. Topics limited to secondary metabolites: e.g. terpenoids, phenolic compounds, aromatic compounds, phyosterols, alkaloids. (Lec. 3) Pre: CHM 228 and 230. In alternate years, next offered 1977-78. Shimizu and Lyon

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**633, 634 Biosynthesis (I and II, 3 each)** Biogenesis of medicinally active principles of biological origin. Emphasis given to organic acids, polysaccharides, glycosides, steroids and certain nitrogenous compounds. (Lec. 3) In alternate years, next offered 1976-77. Staff

**635, 636 Pharmacognosy Techniques (I and II, 3-4 each)** Physical and chemical factors influencing growth and development of active principles of drug plants. Certain biological analysis of results are performed. (Lec. 1, Lab. 6-9) Staff

**697, 698 Research in Pharmacognosy (I and II, 1-3 each)** Literature survey, laboratory work and a detailed research report on one or more assigned topics. (Lab. TBA) Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

#### PHARMACOLOGY AND TOXICOLOGY (PCL)

**436 (or PSY 436) Psychotropic Drugs and Therapy (II, 3)**

**438 (or PSY 438) Psychotropic Drugs and Behavior (I or II, 3)**

**441, 442 General Pharmacology (I and II, 4 each)**

**443, 444 General Pharmacology Laboratory (I and II, 1 each)**

**453 Clinical Pharmacology and Toxicology (I, 3)**

**455 (or PHC 455) Clinical Pharmacy/Pharmacology (I, 3)**

**497, 498 Special Problems (I and II, 1-3 each)**

**521, 522 Seminar (I and II, 1 each)** Seminar discussions and presentation of papers on selected topics in pharmacology. (Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed, no more than 3 credits for entire period. Staff

**542 Evaluation of Drug Effects (II, 5)** Theory, methods and techniques involved in the determination of qualitative and quantitative activity and relative toxicity of drugs. (Lec. 2, Lab. 9) Pre: 441 and 442, MGS 501, or equivalent and permission of department. In alternate years. DeFanti and DeFao

**544 Forensic Toxicology (II, 3)** Theoretical and practical aspects of poisoning including the isolation and identification of toxic materials from pharmaceuticals, body fluids and tissues. Isolation and identification of physiological fluids from stains, hairs, and tissue with application to forensic medicine. (Lec. 2, Lab. 3) Pre: 441, 442 and permission of department. In alternate years, next offered 1977-78. DeFanti

**546 Advanced Toxicology (II, 4)** Toxic effects of selected drugs and other xenobiotics on physiological and biochemical processes. (Lec. 3, Lab. 4) Pre: 441, 442 or equivalent, and permission of department. In alternate years, next offered 1977-78. Staff

**550 Operant Analysis of Behavior**  
See Psychology 550.

**562 Psychopharmacology (II, 3)** Effects of drugs on animal and human behavior and on related biochemical processes. (Lec. 3) Pre: 441 or equivalent and/or permission of department. In alternate years. Lal



**564 Psychopharmacology Laboratory (II, 1-3)** Laboratory exercises to demonstrate effects of drugs on animal and human behavior. To earn more than one credit, the student will engage in original work of limited scope. (Lab. 3-9) Pre: 441 or equivalent and/or permission of department. Lal

**572 Neural Bases of Drug Action (II, 3)** Review of neuroanatomy, neurochemistry, and neurophysiology as they are related to drug action. (Lec. 3) Pre: 441 or equivalent and/or permission of department. In alternate years. Lal

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**641 Biochemical Pharmacology (I, 4)** Theory and application of pharmacological studies at the cellular and subcellular levels and their significance to drug action in the intact organism. (Lec. 3, Lab. 3) Pre: 441 and 442 and permission of department. In alternate years. Fuller

**643 Advanced Pharmacology and Techniques (I, 4)** Mechanism of action of drugs on living tissues, organs and organisms with particular emphasis on cellular physiology as a basis of explanation of tissue response. Advanced laboratory techniques as employed for pharmacological testing. (Lec. 2, Lab. TBA) Pre: 442, and permission of department. In alternate years. DeFeo

**697, 698 Research in Pharmacology (I and II, 1-5 each)** Literature survey, laboratory work and a detailed research report on one or more assigned topics. (Lab. TBA) Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## PHARMACY (PHC)

**425 History of Pharmacy (I and II, 3)**

**450 Pharmacotherapeutics (II, 3)**

**451 Clinical Pharmacy (I, 3)**

**455 (or PCL 455) Clinical Pharmacy/Pharmacology (I, 3)**

**497, 498 Special Problems (I and II, 1-3 each)**

**501 Drug Information Pertaining to Institutional Pharmacy Practice (I, 3)** Discussion and evaluation of drug information sources, and how to use these sources. Includes the methodology of establishing and maintaining drug information services. (Lec. 2, Pract. 3) Jeffrey and Staff

**521, 522 Seminar (I and II, 1 each)** Seminar discussions including presentation of papers on selected topics in pharmacy. (Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed, not more than 3 credits for entire period. Staff

**552 Advanced Clinical Pharmacy (II, 3)** In-depth study of clinical pharmaceutical methods and the applications of these methods in the clinical environment on rounds and in conferences. (Lec. 1, Lab. 6) Pre: 451 or equivalent, and/or permission of department. Cooper

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**611, 612 Residency in Hospital Pharmacy (I and II, 6 each)** Residency consists of 2,000 hours of training and practice, under supervision, in the hospital pharmacy as prescribed and accredited by the American Society of Hospital Pharmacists: Rhode Island Hospital (accredited), Roger Williams Hospital (accreditation pending). Jeffrey

**621, 622 Manufacturing Pharmacy (I and II, 2-5 each)** Theory of and practice in the manufacture of pharmaceuticals and the principles of operation of the equipment used for their production. (Lec. 2, Lab. 0-9) Paruta

**631 Advanced Physical Pharmacy (I, 3-5)** Application of physical-chemical principles to problems in pharmaceutical research, with emphasis on methods by which properties of new medicinal and pharmaceutical agents are determined. (Lec. 3, Lab. 3-6) Pre: CHM 432 or permission of department. Paruta

**632 Advanced Physical Pharmacy (II, 2-4)** Application of physical-chemical principles to problems in pharmaceutical research, with emphasis on methods by which properties of new medicinal and pharmaceutical agents are determined. (Lec. 2, Lab. 0-6) Pre: 631. Paruta

**641 Pharmaceutical Formulations (I, 2-4)** Methods of solving problems in pharmaceutical formulations to obtain therapeutically active, stable, and esthetically acceptable dose forms. (Lec. 2, Lab. 3-6) Pre: 632. Paruta

**642 Pharmaceutical Formulations (II, 2-5)** Methods of solving problems in pharmaceutical formulations to obtain therapeutically active, stable, and esthetically acceptable dose forms. (Lec. 2, Lab. 3-9) Pre: 632. Paruta

**662 Biopharmaceutics (I, 3)** Pharmacokinetic principles as applied to absorption, metabolism, and excretion of drugs from finished dosage forms. Includes oral, parenteral, topical and sustained release forms. (Lec. 3) Pre: 384. In alternate years, next offered 1977-78. Rhodes

**697, 698 Research in Pharmacy (I and II, 1-3 each)** Literature survey, laboratory work and a detailed research report on one or more assigned topics in pharmacy. (Lab. TBA) Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## PHARMACY ADMINISTRATION (PAD)

**405 Pharmacy Personnel Administration (I, 2)**

**406 Pharmacy Retailing (II, 4)**

**453 Drug Marketing Principles (II, 2)**

**480 (580) Prepaid Drug Plans (I, 3)**

**497, 498 Special Problems (I and II, 1-3 each)**

**570 Case Studies in Pharmacy Law (II, 3)** Case studies and a detailed analysis of the FDC, Controlled Substances Act, health insurance laws. (Lec. 3) Pre: 351. In alternate years. Campbell and Jacoff

**580 Prepaid Drug Plans** (I, 3) Institutional relationships involved in the prescribing, dispensing and prepayment of drugs. Problems of interference with pharmaceutical or medical practice arising from different types of prepayment plans. Actual experience, laws and court decisions, abuse and controls. (Lec. 3) Pre: 451 and 453 or equivalent. Campbell and Jacoff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee. Staff

**621, 622 Seminar** (I and II, 1 each) Seminar discussions and presentation of papers on selected topics in pharmacy administration. (Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed, no more than 3 credits for entire program. Staff

**625, 626 Hospital Pharmacy Administration** (I and II, 2 each) Hospital organizations, including intra- and inter-department relationships, the medical and service staff problems, the administrator, personnel management, pharmaceutical service with relation to patient care, medical and pharmaceutical research. In alternate years. (Lec. 3) Staff

**651, 652 Health Care Systems I and II** (I and II, 3 each) Arrangements for utilizing pharmaceutical resources in public and private systems of health care in the U.S. and other countries. Variations in quality and distribution of care among socio-economic groups. (Lec. 3) Pre: 580 and EST 408 or 409, or equivalent. Jacoff

**697, 698 Research in Pharmacy Administration** (I and II, 1-3 each) Literature survey, laboratory work and a detailed research report on one or more assigned topics in pharmacy administration. (Lab. TBA) Staff

## PHILOSOPHY (PHL)

**401, 402 Special Problems** (I and II, 3 each)

**414 Advanced Studies in Ethics** (I or II, 3)

**440 Philosophy of Language** (I or II, 3)

**441 Metaphysics** (I or II, 3)

**442 Epistemology** (I or II, 3)

**443 The Nature of an Academic Discipline** (I or II, 3)

**451 Symbolic Logic** (I or II, 3)

**452 (552) Philosophy of Science** (I or II, 3)

**455 (404) Aesthetics** (I or II, 3)

**502, 503, 504, 505 Tutorial in Philosophy** (I and II, 3 each) Discussion by the staff and advanced students of research problems in philosophy. Presentation and criticism of original papers. (Lec. 3) Pre: graduate standing or permission of instructor. Staff

**513 General Axiology** (I or II, 3) Intensive historical and systematic study of issues such as nature and kinds of values, their ontological status, their relation to culture, their relation to emotions, relation of axiology to other disciplines. (Lec. 3) Pre: graduate standing or permission of instructor. Wenisch or Staff

**530 Philosophy of Plato** (I or II, 3) Selected dialogues from the later period. Particular attention will be given to the areas of metaphysics, epistemology, cosmology, and ethics. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Zeyl

**531 Philosophy of Aristotle** (I or II, 3) Selected texts

with emphasis on the major concepts of Aristotle's metaphysics, theory of knowledge, and ethics. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Zeyl

**542 Advanced Studies in Patristic and Scholastic Philosophy** (I or II, 3) Intensive studies of one or more thinkers belonging to the Patristic or Scholastic tradition. The specific subject may change from year to year. (Lec. 3) Pre: graduate standing or permission of instructor. Young or Peterson

**551 Philosophical Logic** (I or II, 3) Intensive consideration of such issues as the nature, structure and function of propositions, predication, analysis of the "is" relation. Relation between propositions and facts. Nature of logic and criterion of the logical, relation of logic to language, psychology and ontology. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Young

**555 Philosophy of the Arts and of Literature** (I or II, 3) An intensive study of one or more thinkers concerned with philosophical problems arising from our experience of the arts and of literature. The phenomenological tradition will be stressed. (Lec. 3) Pre: graduate standing or permission of instructor. Hanke

**562 Advanced Studies in Empiricism and Rationalism** (I or II, 3) Intensive study of one or more thinkers belonging to the empiricist or rationalist tradition. The specific subject may change from year to year. (Lec. 3) Pre: graduate standing or permission of instructor. Young or Staff

**570 Philosophy of Immanuel Kant** (I or II, 3) Intensive analysis of major texts. Special attention will be given to *The Critique of Pure Reason*. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years. Peterson or Staff

**580 Nineteenth-Century Philosophy** (I or II, 3) Intensive analysis of the work of a major philosopher or philosophical movement. Attention will be given to such major figures as Hegel, Kierkegaard, C.S. Peirce, or James. The specific subject changes from year to year. (Lec. 3) Pre: graduate standing or permission of the instructor. In alternate years. Young or Staff

**582 Advanced Studies in Contemporary Philosophy** (I or II, 3) Intensive studies of one or more thinkers of philosophical movements of the twentieth century. The specific subject may change from year to year. (Lec. 3) Pre: graduate standing or permission of instructor. Young or Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**966 Student Teaching in Philosophy** (I or II, 3) Discussion of purpose of teaching philosophy in various types of institutions, of alternative syllabi for various philosophy courses, actual classroom teaching under supervision, critical evaluation of teaching performance. Restricted to graduate students in philosophy. For non-program credit only. Staff

## PHYSICAL EDUCATION (PED)

**410 Corrective and Adapted Physical Education** (I, 3)

**495 Directed Study** (I and II, 3)

**510 Current Problems in Physical Education, Health and Recreation (I or II, 3)** Designed to acquaint the students with conditions that give rise to problems and various techniques used in finding solutions to them. (Lec. 3) Pre: permission of instructor. Bloomquist and O'Donnell

**520 Curriculum Construction in Physical Education (I or II, 3)** Analysis of criteria and procedures for curriculum construction in physical education. Standards for the evaluation and revision of elementary and secondary school physical education courses. (Lec. 3) Pre: permission of instructor. Polidoro

**530 Research Methods and Design in Health and Physical Education (I or II, 3)** Introduction to methodology in experimental, laboratory, curriculum, action, and historical research. (Lec. 3) Pre: competence in basic statistics and permission of instructor. Sonstroem

**540 Principles of Recreation Leadership (I or II, 3)** Modern concepts of responsibilities involved in program planning in schools and community agencies. Leadership of committees and board relations as well as practical program promotional techniques. (Lec. 3) Pre: permission of instructor. Leathers and Mandell

**543 Outdoor Recreation and Education (I or II, 3)** Investigation of the present scope and significance of the present-day outdoor recreation and education movements and an examination of current ideas and practices. (Lec. 3) Pre: permission of instructor. Leathers and Mandell

**550 Administration of Physical Education (I or II, 3)** Problems and procedures for administering a physical education program studied from the viewpoint of the physical education administrator, the school administrator and the faculty. Emphasis is placed upon the study of administrative cases. (Lec. 3) Pre: 380 or permission of instructor. Polidoro and Nedwitek

**560 Seminar in Health, Physical Education and Recreation (I or II, 3)** Selected topics within the three areas, depending on availability of specialized instruction including visiting professorships. (Lec. 3) Pre: permission of instructor. Staff

**570 Major Health Problems and Curriculum Planning in Health Education (I or II, 3)** Major health problems related to personal and community health with emphasis on health education, curriculum planning and evaluation. (Lec. 3) Pre: permission of instructor. DelSanto

**575 Perceptual-motor Education (I or II, 3)** Role of motor activity in enhancing perceptual development. How the physical educator can become involved with other school personnel in the implementation and continuing development of perceptual-motor programs. For teachers in elementary schools and in special education who wish to incorporate motor activities into their programs. (Lec. 3) Pre: PSY 113, 232 and permission of instructor. Staff

**580 Physical Education for the Mentally Retarded (I, 3)** Introduction to the contributions of physical education to the growth and development of mentally retarded. Basic movement, rhythms, games, sports, stunts, tumbling, gymnastics, apparatus, etc. for both educable and trainable mentally retarded. (Lec. 3) Pre: permission of instructor. McCormick

**581 Psychological Aspects of Physical Activity (II, 3)** Scientific principles and research from psychology related to physical activity. Educational program situations amenable to research and application of psychological principles are isolated. Recommendations for improvements in physical education methodology. (Lec. 3) Pre: PSY 113, 232 and permission of instructor. Sonstroem

**585 Physical Education for the Atypical Child (I, 3)** Limitations, needs, learning characteristics of the physically and mentally handicapped child which apply to verbal response, body control, kinesthesia and neuromuscular acceptance. Research reviewed and synthesized for a practical problem. (Lec. 3) Pre: ZOO 121, 242, and kinesiology recommended. Staff

**591 Special Problems (I or II, 3)** Written paper reporting an in-depth investigation of a pertinent problem in the field, including a review of relevant literature, analysis and solution of the problem based on scientific methodology, with recommendations for improved practices. Limited to and required of all master's degree candidates in physical education who elect the non-thesis option. Staff

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee. Staff

## PHYSICS (PHY)

**401, 402 Seminar in Physics (I and II, 1 each)**

**406 Introduction to Atmospheric Physics (I, 3)**

**420 Introduction to Thermodynamics and Statistical Mechanics (I, 3)**

**421 Introduction to Theoretical Physics (I, 3)**

**425 Acoustics (I, 3)**

**431 Introduction to Theoretical Physics (II, 3)**

**451 Atomic and Nuclear Physics (I, 3)**

**452 Nuclear Physics (II, 3)**

**455 Introduction to Solid State Physics (II, 3)**

**483, 484 Laboratory and Research Problems in Physics (I and II, 3 each)**

**491, 492 Special Problems (I and II, 1-6 each)**

**510, 511 Mathematical Methods of Physics (I and II, 3 each)** Definition of a vector, vector algebra and calculus, scalar and vector fields, linear vector operators, coordinate transformations, vector operations in curvilinear coordinates, dyadics, tensors, simple applications of the theory of finite groups. Partial differential equations of physics and their solutions; diffusion equation, wave equation, Schrodinger equation, Klein-Gordon equation, elements of the theory of probability. (Lec. 3) Pre: permission of department. Staff

**520 Classical Dynamical Theory I (I, 3)** Lagrange's equations, holonomic and non-holonomic constraints, applications to dynamical systems, non-inertial systems, alternate formulations of mechanics, theory of small vibrations, variational principles, Hamiltonian formulation of dynamics, canonical transformations. (Lec. 3) Pre: 421, 510. Staff

**522 Topics in the Physics of the Earth (II, 3)** Physics of the earth. Topics chosen from: elasticity, seismology, and the structure of the earth; terrestrial electricity,

gravity, heat flow, magnetism, radioactivity, and tides; physics of the upper atmosphere. (Lec. 3) Pre: permission of department. In alternate years, next offered 1977-78. Dietz

**530 Electromagnetic Theory I** (I, 3) Coulomb's law, Gauss' law, scalar potential, boundary value problems, multipole expansion, dielectrics, magnetic field due to stationary currents, scalar and vector potential, magnetic materials, Faraday's law, Lorentz force, conservation laws, Maxwell's equations. (Lec. 3) Pre: 431, 510. Staff

**531 Electromagnetic Theory II** (I, 3) Scalar and vector wave equations and their solutions, retarded and advanced potentials. Lienard-Wiechert potentials, radiation from an arbitrarily moving charge, multipole radiation, wave guides, cavity resonators, plasma oscillations, theory of relativity. (Lec. 3) Pre: 511, 530. Staff

**550 Physical Acoustics** (I, 3) Physical properties of gases, liquids and solids as revealed by the propagation of acoustic waves. Ultrasonic generation and measurement techniques, irreversible thermodynamics, mechanisms for absorption and dispersion of acoustic waves. (Lec. 3) Pre: permission of department. Letcher

**570 Quantum Mechanics I** (I, 3) Wave packets, Schrodinger equation, one-dimensional problems, hydrogen atom, harmonic oscillator, WKB approximation, operator formalism and matrix mechanics, angular momentum, perturbation theory, scattering and partial wave analysis, semiclassical treatment of the radiation field. (Lec. 3) Pre: permission of department. Staff

**571 Quantum Mechanics II** (II, 3) Dirac equation, spin orbit energy, theory of positrons, Feynman diagrams, Compton scattering, pair production and bremsstrahlung. Second quantization and application to selected topics. (Lec. 3) Pre: 570. Staff

**580 Graduate Laboratory** (I and II, 3) Laboratory experiments, designed to be performed by beginning graduate students, consist of a limited number of classic experiments to be completed with precision and thoroughness. Experiments selected primarily from the areas of atomic, nuclear and solid state physics. (Lab. 6) Pre: permission of department. Quirk

**585 Acoustic Measurements** (II, 1-2) Techniques for the measurement and analysis of sound in fluids and solids. (Lab. 3-6) Pre: permission of department. Staff

**590, 591 Special Problems** (I and II, 1-6 each) Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. (Lec. or Lab. according to nature of problem) Credits not to exceed 12. Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**620 Statistical Mechanics** (I and II, 3) Kinetic theory of matter, Maxwell-Boltzmann distribution, collision and mean free path, the H-theorem, Ergodic theorem, entropy, Nernst heat theorem, fluctuations and distributions, quantum statistics, ensemble theory, applications in nuclear physics, fluidity, condensa-

tion, electron theory of metals and relativistic gas. (Lec. 3) Pre: 511, 570. Staff

**630 Electromagnetic Theory III** (I, 3) After developing the covariant formulation of electrodynamics, selected topics of current interest in electromagnetic theory such as accelerator design, etc., will be discussed. (Lec. 3) Pre: 531. Staff

**650, 651 Solid State Physics** (I and II, 3 each) Quantum theory of electrons, phonons and other elementary excitations, Hartree-Fock approximation, many body problem, super conductivity, band theory and Fermi surface. (Lec. 3) Pre: 455, 570. Staff

**660, 661 Nuclear Physics** (I and II, 3 each) General properties of the nucleus. Two body problem at low, intermediate and high energy. Three and four body problems, nuclear forces, special models, nuclear spectroscopy and reactions, decay of nuclei, many body problem, structure of nucleons. (Lec. 3) Pre: 511, 571. Staff

**670, 671 Advanced Quantum Theory** (I and II, 3 each) Relativistic quantum field theory, free and interacting fields, the S-matrix and the perturbation expansion, quantum electrodynamics, dispersion relations, symmetry operations and invariance properties. (Lec. 3) Pre: 571. Staff

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

## PLANT AND SOIL SCIENCE (PLS)

**401, 402 Plant and Soil Science Seminar** (I and II, 1 each)

**405 Propagation of Plant Materials** (II, 3)

**411 (or FRC 411) Soil Biochemistry and Fertilizers** (I, 3)

**412 (or FRC 412) Soil Biochemistry** (II, 3)

**420 Crop Ecology** (I, 3)

**432 Commercial Floriculture** (II, 3)

**442 Professional Turfgrass Management** (II, 3)

**444 Environmental Aspects of Landscape Design** (II, 3)

**450 Soil Conservation and Land Use** (I, 3)

**454 Identification of Basic Ornamental Plants** (II, 3)

**461 Weed Science** (II, 3)

**468 Soil Genesis and Classification** (I, 4)

**472 Plant Improvement** (II, 3)

**475 Plant Nutrition and Soil Fertility** (II, 3)

**491, 492 Special Projects and Independent Study** (I and II, 1-3 each)

**500 Growth and Development of Economic Plants** (II, 3) Factors affecting vegetative and reproductive growth and development of plants. Topics include growth regulators, auxins, environmental factors, dormancy, juvenility, vernalization and flowering. Term paper required. (Lec. 3) Pre: BOT 445. In alternate years, next offered 1976-77. Shutak

**501 to 504 Graduate Seminar in Plant and Soil Science** (I and II, 1 each) Presentation of technical reports and discussion of current research papers in soil science, landscape ecology, growth and development of economic crops and production and management of economic crops. (Lec. 1) Pre: permission of instructor.

**568 Recent Advances in Soil Science** (II, 3) Critical analysis and presentation of technical reports of recent advances in soil science. Topics will vary according to background of students enrolled. With departmental permission can be taken more than once. (Lec. 3) Pre: six credits in soil science or permission of instructor. In alternate years, next offered 1977-78. Wright

**573 Post-Harvest Physiology of Economic Crops** (I, 3) Factors affecting post-harvest physiology of fruits, vegetables, flowers, ornamentals and sod. Influence of preharvest factors on post-harvest condition. Principles of preservation and storage. Individual or group projects. (Lec. 3) Pre: BOT 445 or equivalent. In alternate years, next offered 1976-77. Shutak and Staff

**576 Physiology of Plant Productivity** (I, 3) Critical analysis of contemporary views on energy conversion and transformation in primary plant production. Topics include photosynthesis, phosphorylation, photorespiration, transport mechanisms, carbohydrate and lipid metabolism, nitrogen assimilation and symbiosis. (Lec. 3) Pre: organic chemistry, plant physiology, biochemistry or with permission of instructor. In alternate years, next offered 1977-78. Hull

**591, 592 Non-Thesis Research in Plant and Soil Science** (I and II, 1-3 each) Advanced work under supervision of research staff to expand research experience into areas other than those related to thesis research. Arranged to suit individual requirements. (Lab. 3-9) Pre: permission of department. Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

#### PLANT PATHOLOGY-ENTOMOLOGY (PLP)

**422 (or MIC 422) Industrial Microbiology** (II, 3)

**442 Diseases of Turfgrasses, Trees and Ornamental Shrubs** (II, 3)

**443 Plant Disease Laboratory** (I, 1)

**482 Nematology** (II, 3)

**511 The Nature of Plant Disease** (I, 3) Analysis of the nature of plant disease, the processes of infection and pathogenesis, and the structural and physiological responses that determine resistance to disease. (Lec. 3) Pre: BOT 332 or equivalent. In alternate years, next offered 1976-77. Beckman and Mueller

**561 Plant Virology** (I, 3) Nature and properties of plant viruses, survey of plant diseases caused by viruses and experience in basic techniques. (Lec. 3) Pre: BOT 332 or equivalent. In alternate years, next offered 1977-78. Mueller

**591, 592 Research Problems** (I and II, 1-3 each) Individual or group study supervised by a faculty member in fields of plant virology, nematology and disease mechanisms, economic entomology or plant pathology, agricultural and industrial mycology and related subjects. Written reports. (Lec. 1-3, Lab. 2-6) Staff

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

Note: for other related courses see BOT 332, 432 and ZOO 381, 482, 581, 586.

#### POLITICAL SCIENCE (PSC)

**403 Government and Society of India and Pakistan** (I, 3)

**407 The Soviet Union: Politics and Society** (II, 3)

**408 African Government and Politics** (I, 3)

**411 The United States and China** (II, 3)

**420 Dissent, Non-Violence and Change** (I, 3)

**421 State and Local Government** (I, 3)

**422 Comparative American State Politics** (II, 3)

**431 International Relations** (I, 3)

**432 International Government** (II, 3)

**434 American Foreign Policy** (II, 3)

**443 Twentieth-Century Political Theory** (I, 3)

**455, 456 Directed Study or Research** (I and II, 3 each)

**460 Urban Politics** (I and II, 3)

**461 The American Presidency** (I, 3)

**464 International Law** (II, 3)

**466 Urban Problems** (II, 3)

**470 Problems and Principles in the American Political Process** (II, 3)

**471 Constitutional Law** (I, 3)

**472 Civil Liberties** (II, 3)

**481, 482 Political Science Seminar** (I and II, 3 each)

**483 Political Process: Policy Formulation and Execution** (I or II, 3)

**486 Intentional Communities** (II, 3)

**491 Principles of Public Administration** (I, 3)

**495 Comparative Urban Politics** (I, 3)

**498 Public Administration and Policy Formulation** (II, 3)

**501 Administrative Theory** (I and II, 3) Theoretical constructs and models in fields of public administration; theories of Weber, Riggs, Dorsey, Simon, Presthus. Lower-level models in subfields of organization, communications and decision-making. Task-oriented subject matter such as personnel, budget and program administration related to theoretical formulations which seek to explain them. (Lec. 3) Pre: 491 or permission of department. Grossbard

**502 Techniques of Public Management** (I and II, 3) Principles and techniques employed in the administration of staff activities of the public service such as administrative planning, project scheduling and budgeting. (Lec. 3) Pre: 491 or permission of department. Staff

**503 Problems in Public Personnel Administration** (I or II, 3) Development of personnel administration, including problems of recruitment, examination, promotion and staffing within public service. Emphasis on evaluation of employee performance and collective bargaining in public service. (Lec. 3) Pre: graduate standing or permission of department. Grossbard

**504 Politics of Developing Areas: Asia (II, 3)** Analysis of developments in newly independent, "third world" nations, particularly of Asia. Emerging political structures in relation to the processes of social, economic, and psychological change. (Lec. 3) *In alternate years, next offered 1977-78.* Stein

**506 Seminar in Budgetary Politics (I, 3)** Examination of federal, state and local fiscal and budgetary processes, focusing on the politics of the budgetary process and models of budgeting with emphasis on contemporary issues. (Lec. 3) Wirth

**507 The U.S.S.R. and China in World Affairs (II, 3)** Seminar of Russian and Chinese world outlook and study of their foreign policies—how they deal with each other, the West, other communist nations and developing nations. (Lec. 3) *Pre: 407 or department approval.* Stein

**510 Developing Nation State: Africa (II, 3)** Analysis of developmental policy formation with emphasis upon the governmental processes in the new nations with major focus on African countries. (Lec. 3) *Pre: permission of instructor.* Milburn

**512 Seminar in Marine Science Policy and Public Law (II, 3)** Multi-disciplinary teams of faculty and selected graduate students tackle unresolved problems in creating rules or institutions to cope with new uses of the marine environment, e.g., freedom of the seas, fisheries regulation, deep-sea mining, or weather modification. Team meetings at team convenience; plenary sessions; backup studies for team meetings plus final report. *Pre: permission of department.* Staff

**522 Comparative American Local Politics (I, 3)** Comparative study of American local government and politics. Emphasis on the determinants of local public policy. (Lec. 3) *Pre: 221 or urban related course, EST 408.* Leduc

**523 Seminar in Comparative Public Administration (I, 3)** Theory, practice, organization and operation of English and French administrative systems and their influence on newly established systems. Use of models, structure-function analysis and ecological analyses. (Lec. 3) *Pre: 491, 501 or permission of department.* Milburn

**524 Seminar in Public Policy Problems (I and II, 3)** Exploration in depth of selected problems of policy formulation—intergovernmental relations, regionalization, citizen participation and control, priority setting for public sector programs. (Lec. 3) *Pre: 491, 501 or permission of department.* Grossbard

**544 Democracy and Its Critics (I, 3)** Seminar examining the roots of modern democracy in the social contract theorists and analyzing the quality and limits of self-determination in these theories in the light of contemporary politics. (Lec. 3) *Pre: 341, 342, or permission of department.* Killilea

**553 Scope and Methods of Political Science (I, 3)** Development of political science in relation to other social sciences. Political concepts, theories, and analytic systems surveyed in relation to the methodology. Latest trends and interests in the discipline. Research papers and reports explore individual problems. Required for graduate students. (Lec. 3) Tyler

**554 Advanced Research in Political Science (II, 3)** Fundamental concepts and techniques in political science with emphasis on advanced quantitative and qualitative analysis and the application of these methods to individual research projects. (Lec. 3) *Pre: 553 or permission of department.* Staff

**555, 556 Directed Study or Research (I and II, 3 each)** Special work arranged to meet the individual needs of graduate students in political science. (Lec. 3) *Pre: permission of department.* Staff

**566 American Political Thought (II, 3)** Origins and development of American political thought. Intensive study, including European influences, of the growth of ideas about democracy in America. Locke, DeTocqueville, Jefferson, Lincoln, and other representative theorists. (Lec. 3) *Pre: 341, 342 or permission of instructor. In alternate years.* Wood

**568 Jurisprudence (II, 3)** Introduction to the philosophy of law, treating the sources, the nature, and the consequences of major systems of legal thought. Emphasis on the relationship between legal reasoning and judicial decision-making in the United States. (Lec. 3) *Pre: 471, 472, or permission of instructor. In alternate years, next offered 1977-78.* Wood

**572 Problems in International Relations (I, 3)** Examination of such major current problems in international relations as control of atomic energy, the flowering of nationalism in Asia, the role of the United Nations, western European problems, the problem of Germany and the role of ideologies in international relations. (Lec. 3) *Pre: 431 or permission of department.* Staff

**578 International Law and Politics of the Oceans (II, 3)** Chronological view of interaction between political processes and resulting international law of the oceans. Special emphasis on international conferences on law of the sea. Open to graduate students in Master of Marine Affairs Program and Department of Political Science, other graduate students with permission of instructor. (Lec. 3) Gamble

**590 Internship in Public Administration (I and II, 3-6)** Participation at an administrative agency under supervision of agency head and a member of the faculty. Planning, personnel management, research organization, budgeting, interdepartmental relations, informal liaisons that are the hallmark of effective administration. *May be taken as one 6-credit unit or two 3-credit units. Pre: permission of Bureau of Government Research.* Staff

**595 Problems of Modernization in Developing Nations** See Resource Economics 595.

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## PSYCHOLOGY (PSY)

**410 Quantitative Methods in Psychology II (I, 3)**  
**432 Advanced Development Psychology (II, 3)**  
**434 Introduction to Psychological Testing (I and II, 3)**  
**435 The Psychology of Social Behavior (I and II, 3)**  
**436 (or PCL 436) Psychotropic Drugs and Therapy (II, 3)**

**438 (or PCL 438) Psychotropic Drugs and Behavior** (I or II, 3)

**445 Group Processes and Individual Behavior** (I and II, 3)

**450 Cognitive and Behavioral Analysis of Communication** (II, 3)

**460 The Psychology of Violence and Aggression** (I and II, 3)

**461 Social and Psychological Aspects of Alcoholism** (I and II, 3)

**464 Humanistic Psychology** (II, 3)

**479 Contemporary Problems for Modern Psychology** (I and II, 3-12)

**480 The Female Experience** (II, 3)

**482 Psychobiology** (II, 3)

**489, 499 Problems in Psychology** (I and II, 3 each)

**510 Intermediate Quantitative Methods** (II, 3)

Complex statistical techniques useful in practical psychological research including multiple correlation and regression analysis, multiple correction for restriction in range, and introductory multivariate analysis methods. (Lec. 3) Pre: permission of department. Merenda and Cain

**520 Psychometric Methods** (I or II, 3) Techniques for investigating areas of attitude and opinion research, morale and leadership, personality and perception. Includes techniques of test construction. Q-methodology, and psychometric scaling. (Lec. 3) Pre: 434, 510. In alternate years. Merenda and Staff

**532 Experimental Design**

See Experimental Statistics 532.

**534 Clinical Interpretation of Standardized Psychological Tests** (II, 3) Clinical use of standardized assessment techniques such as MMPI. Critical review of theory and research underlying objective, group assessment of human characteristics. Development and interpretation of individualized evaluations based on profile analysis. (Lec. 3) Pre: 434. Staff

**542 The Exceptional Child** (I or II, 3) Definition and proper classification of types of exceptional children; social, psychological, and physical factors involved. Problems of rehabilitation and psychological treatment. Types of exceptional children; e.g. superior, retarded, physically handicapped, those suffering from developmental aberrations. (Lec. 3) Pre: 232, 254 and permission of department. Weiner

**550 (or PCL 550) Operant Analysis of Behavior** (I or II, 3) Introduction to the principles of operant conditioning with emphasis on the use of these principles in the analysis of behavior. (Lec. 3) Pre: permission of department. Smith

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**600 Advanced General Psychology** (I or II, 3-15) Series to provide incoming graduate students with intensive preparation in major areas of general psychology: (a) psychophysiology, (b) learning, (c) cognition and perceptual processes, (d) developmental, (e) social. (Lec. 3) May be repeated up to five times. Pre: permission of department. Staff

**610 (or EST 610) Factor Analysis** (II, 3) Comparison among various procedures of factor analysis including tetrad differences, bi-factor, group centroid, principal

components, canonical methods. Interpretation of factors. Estimation of factor loadings and specific variances. Methods for factor rotation. Estimation of factor scores. (Lec. 3) Pre: EST 541. In alternate years, next offered 1977-78. Merenda and Staff

**611 Methods of Psychological Research and Experimental Design** (I or II, 3) Provides the student of psychology with a knowledge of research methodology and the techniques of experimental designs. It prepares for the development of thesis problems of graduate students in psychology and related disciplines. (Lec. 3) Pre: 510, 532. In alternate years, next offered 1977-78. Merenda and Staff

**616 Methodology and Design in Research in School Psychology** (I or II, 3) Models of research design and methodology particularly applicable to the school situation are explored. (Lec. 3) Pre: 510, 532, permission of department. Staff

**617 Methodology and Design in Research in Clinical Psychology** (I or II, 3) Models of research design and methodology particularly pertinent to the area of clinical psychology with emphasis on mental designs appropriate to research problems, using specific experiments and original research. (Lec. 3) Pre: 510, 532, permission of department. Biller

**620 Seminar: Classical Conditioning** (I and II, 3) History and nature of the conditional reflex, with emphasis placed on understanding the role of the conditional reflex and contemporary behavioral research and theory. (Lec. 3) Pre: permission of department. Smith

**621 Seminar: Human Learning and Memory** (I or II, 3) Experimental analysis of major problem topics of learning and retention studies in humans. Emphasis on systematic studies of verbal habits, dimensional analysis of the critical variables influencing these habits, and the interference theory of forgetting. (Lec. 3) Pre: permission of department. Silverstein

**640 Personality Dynamics I (Advanced Personality)** (II, 3) Readings from the original sources of the major contemporary personality theorists. Emphasis on the possible integration of these theories, and the development of syncretic theory according to individual preferences. (Lec. 3) Pre: permission of department. In alternate years. Cain

**660 Personality Dynamics II (Advanced Psychopathology)** (I or II, 3) Empirical literature with regard to etiological factors involved in the formation of pathological character trends and deviations. Evaluation of clinical theory and classification systems as related to the psychotherapeutic process. (Lec. 3) Pre: permission of department. Prochaska

**661 Psychological Services I (Administration and Interpretation of Cognitive Tests)** (I, 3) Instruction and practice in administration and interpretation of cognitive tests; individual intelligence tests of both general and specific abilities. Rationale, research evidence, clinical application of Stanford-Binet, Wechsler, Leiter International. (Lec. 3) Pre: permission of department. Berman

**662 Psychological Services II (Administration and Interpretation of Personality Tests)** (II, 3) Instruction and practice in the administration and interpretation of instruments used in the assessment of personality. Emphasis upon projective tests such as Rorschach,

TAT. Rationale, research evidence and clinical application. (Lec. 3) Pre: permission of department. Staff

**663 Seminar to Accompany Field Experience in Psychological Services (I and II, 3)** All students meet in seminar to discuss and investigate specific diagnostic, therapeutic, research problems emerging in connection with internship experience. (Lec. 3) Pre: 670. Staff

**664 Advanced Diagnostic Problems (I or II, 3)** Use and interpretation of cognitive, projective, and neural psychological tests. Focus on integrated data into meaningful description of total personality functioning. Use of the diagnostic interview. (Lec. 3) Pre: 661, 662 and permission of instructor. In alternate years. Berman

**665 Seminar: Behavior Disorders in Childhood (I or II, 3)** Emphasis on etiological factors, diagnostic and treatment consideration, and experimental research findings related to the psychological maladjustments in infancy and childhood; treatment procedures, resources and methods used in dealing with behavior and personality problems. Lectures, discussions, and case demonstrations. (Lec. 3) Pre: 660. In alternate years, next offered 1977-78. Berman

**666 Seminar: The Professional Psychologist in the Community (I and II, 3)** Ethical and professional standards related to the practice of psychological services. Discussion and guest lectures by members of related disciplines. Special emphasis upon the role of the professional psychologist in the community: (a) clinical psychology, (b) school psychology. (Lec. 3) Pre: permission of department. Staff

**670 Field Experience in Psychological Service (I and II, 6-12)** Training placements and internships are available in a variety of institutional agencies and school settings under supervision which must be acceptable to the department. Pre: equivalent of 1 year full-time graduate work, clinical practices sequence, permission of department. Staff

**671 Clinical Practices I (Diagnostic) (I or II, 3)** Supervised practice in the assessment of problem behavior. Emphasis on the integration of data from psychological tests, case histories, and other sources in the assessment of personality. Practicum facilities available in several agencies. (Lec. 2, Lab. 2) Pre: 661, 662, and permission of department. In alternate years, next offered 1977-78. Berger

**672 Individual Clinical Practicum (I or II, 3-9)** Introductory experience in dealing with clinical problems in a variety of clinical settings. Individual supervision to be arranged. (Lec. 3) May be repeated up to three times. Pre: 661, 662 and permission of department. Staff

**673 Seminar: Introduction to Clinical Psychotherapy (I, 3)** Theories and techniques of psychotherapeutic procedures involving directive and nondirective and play therapies. Theoretical rationale and empirical research with special emphasis on the child area. (Lec. 3) Pre: permission of department. Willoughby and Staff

**674 Clinical Practices II (Therapy) (I or II, 3-21)** Specialized techniques of clinical interviewing, counseling, and psychotherapy. Critical discussions of the student's own supervised therapy sessions: (a) in-

dividual, (b) behavior, (c) group, (d) sensitivity, (e) family, (f) childplay, (g) specialized techniques. (Lec. 3) May be repeated up to seven times. Pre: 640, 660, 673, and permission of department. Staff

**675 Experimental Psychopathology (I or II, 3)** Relates recent experimental methodology and findings to prevalent theoretical positions. Emphasis on reviewing experimental literature in specialized clinical areas. (Lec. 3) Pre: permission of department. Prochaska

**676 Neurological Correlates of Psychopathology (I and II, 3)** Functioning and physiology of central nervous system with particular attention to determining how neurological disruption and injury are manifested in behavioral disorder. Techniques used to evaluate and interpret neuropsychological functioning. (Lec. 3) Pre: permission of instructor. In alternate years, next offered 1977-78. Berman

**678 Seminar: Physiology of Learning and Memory (II, 3)** Examination of theories of learning and memory in terms of biochemical changes and neurological processes. Neuroanatomy and function of higher brain systems are reviewed and related to learning and memory processes. (Lec. 3) Pre: 381 or permission of instructor. In alternate years, next offered 1977-78. Staff

**680 School Practices I (Diagnostic) (I and II, 3-9)** Testing procedures and devices in the diagnosis of organicity, personality problems and devices in the diagnosis of organicity, personality problems, special learning problems, visual, auditory, and memory problems; includes administration, interpretation, and special adaptation of tests in the school situation. (Lec. 3) May be repeated up to three times. Pre: 434, 661 and permission of department. Staff

**681 Special Problems in School Psychology (I or II, 3-9)** Role of the psychologist in the school setting. Several theoretical and practical issues concerned with the value of psychological theory, administrative philosophy, and school organization are explored. (Lec. 3) May be repeated up to three times. Pre: 680 and permission of department. Vosburgh, Staff

**682 Individual Practicum in School Psychology (I or II, 3-9)** Accompanies student's internship in the school setting. Techniques for adapting psychological services to function within the school system. Individual supervision to be arranged. (Lec. 3) May be repeated up to three times. Pre: permission of department. Vosburgh

**683 Psychology of the Exceptional Child (I, 3)** Social, psychological and educational factors that constitute the matrix of concerns with the exceptional individual in the school and community. Recent innovations in public and private education and habilitation. Research issues and legislation discussed evolve into student studies. (Lec. 3) Pre: permission of department. Staff

**684 Learning Disabilities (I, 3)** Introduction to developments in the field of disorders of learning in the school-age child, stressing recent conceptualizations of underlying psychological parameters essential to basic processes involved in learning. Interdisciplinary approaches to diagnosis; innovation of prescriptive teaching introduced. (Lec. 3) Pre: 683 and/or permission of instructor. Gross



**685 Psychology of Mental Retardation (II, 3)** Etiological factors, including biogenetic, physiological and social origins of mental retardation. The epidemiology and ecological aspects considered as they interact with social and cultural forces. Historical and current philosophy of habilitation and education of school-age children and adults. (Lec. 3) Pre: permission of instructor. Staff

**686 Psychology and Education of the Emotionally Disturbed (I, 3)** Current thinking on treatment and education of residential and day-care programs for the emotionally disturbed. Meaning of the various concepts of schizophrenia, autism and hyperkinetic impulse disorder for treatment. Application of operant techniques for shaping socially appropriate behavior. Overview of origins of current operant methods in hospitals and schools. (Lec. 3) Pre: permission of instructor. Gross

**690 Seminar: Contemporary Issues in Psychology (I and II, 3-12)** Recent developments and current issues. Rigorous exploration of experimental and theoretical literature. Study limited each semester to one of the following areas: developmental, clinical, motivation, perception, psychophysics, and scaling problem solving and thinking. A maximum of 4 seminars may be taken. (Lec. 3) Pre: permission of department. Staff

**691 Individual Practicum in Teaching Psychology (I or II, 3-6)** Seminar and supervised experience in the teaching of psychology primarily at the undergraduate level. Students will be involved in laboratory and discussion groups under supervision. (Lec. 3) May be repeated up to two times. Pre: permission of department. Camp and Staff

**692, 693 Directed Readings and Research Problems (I or II, 3-6 each)** Directed readings and advanced research work under the supervision of a member of the staff arranged to suit the individual requirements of the students. Pre: permission of department. Staff

**694 Special Problems in Clinical Psychology (I or II, 3-12)** Instruction and clinical practicum training in unique problem areas of clinical psychology. Development of specialized evaluation instruments and procedures. (Lec. 3) May be repeated up to four times. Pre: permission of department. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

#### RESOURCE DEVELOPMENT EDUCATION (RDE)

**444 (or EDC 444) Teaching Agribusiness and Natural Resources (I, 3)**

**486 Internship in Agribusiness and Natural Resources (I and II, 3)**

#### RESOURCE ECONOMICS (REN)

**430 International Resource Development (II, 3)**

**440 Development and Evaluation of Natural Resource Projects (I, 3)**

**455 Economics of Land, Forestry and Recreation Resources (II, 3)**

**460 Economics of Ocean Management (II, 3)**

**491, 492 Special Projects (I and II, 1-3 each)**

**514 Economics of Marine Resources (I, 3)** Role of economics in development of marine resources. Particular attention to problems of multiple use of resources and to the conflicts between private and public goals. (Lec. 3) Pre: M.M.A. students or permission of instructor. Rorholm

**527 Macroeconomic Theory**

See Economics 527.

**528 Microeconomic Theory**

See Economics 528.

**532 Land Resource Economics**

See Community Planning 521.

**534 Economics of Resource Development I (II, 3)**

Economic theory applied to the development of human and natural resources with topics drawn from current resource use problems. Analytical techniques treated are simulation techniques, cost-benefit analysis, input-output models, growth models, Cobb-Douglas functions, and Markov chains. (Lec. 3) Pre: 532 and ECN 528 or equivalent, or permission of instructor. Gates

**543 Economic Structure of the Fishing Industry (I, 3)**

Analysis of U.S. and world fishing industries from standpoint of activity and efficiency. Problems related to common property resources, government policy, labor, and legal and institutional factors. (Lec. 3) Pre: ECN 427 and 428 or permission of instructor. Holmsen

**550 The Economics of Exhaustible Marine Resources (II, 3)**

Theory and application of natural resource analysis specifically applied to such marine resources as petroleum, sand and gravel, manganese, and other minerals. (Lec. 3) Pre: ECN 328 or permission of instructor. Grigalunas

**576 Econometrics I (I, 3)**

See Economics 576.

**577 (or EST 577) Econometrics II (II, 3)** Continuation of Econometrics I. (Lec. 3) Pre: 576. Lampe

**595 (or ECN 595, GEG 595, PSC 595 or SOC 595) Problems of Modernization in Developing Nations (II, 3)**

Selected regional problems in the environmental complex, agricultural systems, population dynamics, distribution systems, political integration, urbanization-industrialization, popular participation, integrated theories of modernization. (Lec. 3) Pre: permission of instructors. Brand (Geography), Weaver (Resource Economics), Poggie (Sociology and Anthropology), Milburn (Political Science), and Suzawa (Economics)

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**602 Research Methodology (I and II, 3)** Evaluation of alternative research methods and techniques. Development of specific research projects. (Lec. 3) Hueth

**610 Advanced Studies (I and II, 3)** Advanced topics in resource economics. Mathematical models in resource management. May be repeated for different topics. (Lec. 3) Staff

**621 The Estuary and Coastal Zone**

See Oceanography 621.

**634 Economics of Resource Development II** (I, 3) Concepts of economic efficiency applied to natural resources with emphasis on marine resources. Application of welfare and institutional economics to resource development; analysis of optimum allocation among users. (Lec. 3) Pre: 534. Cummings

**635 Marine Resources Policy** (I, 3) Analysis of public policy problems relating to the development and management of marine resources, including fisheries, minerals, petroleum, water and recreation. (Lec. 3) Pre: 534. Norton

**699 Doctoral Dissertation Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**RESOURCE MECHANICS (REM)**

**451 Soil Conservation Technology** (I, 3)

**484 Structures** (II, 3)

**RUSSIAN (RUS)**

**460, 461 The Russian Novel** (I and II, 3 each)

**497, 498 Directed Study** (I and II, 3 each)

**901, 902 Reading Course in Russian for Graduate Students** (I and II, 0 each) 901: Fundamentals of grammar and syntax necessary to develop reading knowledge. Assumes no prior knowledge of Russian. 902: Exercises in translating scholarly and scientific texts. Staff

**SOCIOLOGY (SOC)**

**408 Industrial Sociology** (I or II, 3)

**410 Complex Organizations in Modern Society** (I or II, 3)

**412 Occupations, Professions, and Social Structure** (I or II, 3)

**414 Demography** (I or II, 3)

**416 Deviant Behavior** (II, 3)

**420 Sociology of the Environment** (II, 3)

**422 The Sociology of the Arts** (I or II, 3)

**430 Social Pathology and Social Change** (I or II, 3)

**432 Ecology of the Community** (I or II, 3)

**434 Urban Sociology** (I or II, 3)

**436 Sociology of Politics** (I or II, 3)

**440 Sociology of Mental Disorder** (I or II, 3)

**442 Sociology of Education** (I or II, 3)

**444 Sociology of Religion** (I or II, 3)

**446 Sociology of Knowledge** (I or II, 3)

**448 Sociology of Science** (I or II, 3)

**492 History of Sociological Thought** (I or II, 3)

**502 Contemporary Sociological Theory** (I or II, 3) Critical examination of the theories and systems of contemporary sociologists. (Lec. 3) Pre: 12 credits of sociology or permission of instructor. Gardner

**505 Methods of Sociological Research** (I, 3) The logic of sociological inquiry with particular emphasis on the interrelationship between theory and fact through an examination of a variety of methodological procedures. (Lec. 3) Pre: graduate standing or permission of instructor. Bassis

**506 Methods of Sociological Research** (II, 3) Practical application of the issues discussed in 505. Experience in the art of empirical investigation culminating in the completion of a research project. (Lec. 3) Pre: 505 or permission of instructor. Bassis

**508 Individual and Social Organization** (I or II, 3) Sociology of the individual as the creator, preserver and participant in society. Emphasis upon symbolic interaction in the growth of personal idiom, the development of social structure, and of the content of social change. (Lec. 3) Pre: permission of department. Staff

**510 Seminar in Deviance** (I or II, 3) Deviation from social expectations analyzed as a social phenomenon. Emphasis on deviation theories and research pertaining to individuals, subcultures, and social systems. Discussions, oral and written reports. (Lec. 3) Pre: permission of department. England

**512 Concepts of Social Structure** (I or II, 3) Examination of key spheres in social organization such as stratification, institutions, communities from a variety of perspectives including consensus and coercion models, pluralist versus elitist images of power structure, and the pros and cons of functionalism. (Lec. 3) Pre: permission of department. Staff

**514 Issues and Problems of Bureaucracy** (I or II, 3) Classical and modern theory, research and current problems in the sociology of bureaucratic organizations. Analysis of case studies, field research, and critiques. (Lec. 3) Pre: graduate standing and/or permission of instructor. Rosengren

**516 Seminar in Law and Society** (II, 3) Social forces in the creation and function of law in American society. Roles of law enforcers. Influences of social classes and interest groups on law as an instrument of social control and change. (Lec. 3) Pre: 314 or 330 or permission of instructor. England

**520 Seminar in Sociological Topics** (I or II, 3) Advanced study of selected topics in sociology. (Lec. 3) Pre: graduate or senior standing, and permission of department. Staff

**571, 572 Directed Study or Research** (I and II, 3 each) Designed to cover areas of special research interests of graduate students not covered in other courses. (Lec. 3) Pre: permission of department. Staff

**595 Problems of Modernization in Developing Nations** See Resource Economics 595.

**599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**SPANISH (SPA)**

**409 History of the Spanish Language** (II, 3)

**430 Castilian Literature of the Sixteenth and Seventeenth Centuries** (II, 3)

- 451 The Spanish Novel of the Nineteenth Century** (I, 3)
- 461 The Generation of 1898** (I, 3)
- 470 Topics in Spanish-American Literature and Culture** (I and II, 3)
- 481 Don Quijote** (I, 3)
- 483 The Origins of the Novel in Spain** (I, 3)
- 485 The Modern Spanish Novel** (II, 3)
- 488 The Drama of the Golden Age** (II, 3)
- 495 Hispanic Civilization** (II, 3)
- 497, 498 Directed Study** (I and II, 3 each)
- 512 Spanish Literature of the Fifteenth Century** (II, 3) Folk ballads and courtly poetry as well as prose writings reflecting the rise of new cultural currents. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1977-78. Navascués
- 573 Modern Spanish-American Poetry and Drama** (I, 3) Selected poets and dramatists since the end of the nineteenth century. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1976-77. Navascués
- 574 Spanish-American Narrative** (II, 3) Selected narrative works, with emphasis on the modern novel and short story. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1976-77. Navascués
- 582 Cervantes: Theater and Novels** (II, 3) Reading and critical interpretation of selections from *Comedias and Entremeses, Las novelas ejemplares, La Galatea, Persiles y Sigismunda*. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1976-77. Hutton
- 583 The Spanish Baroque** (I, 3) Analysis of Culteranismo and Conceptismo in Gongora, Quevedo and Gracián. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1977-78. Kossoff
- 584 Spanish Problematic Literature** (II, 3) Development of Spanish thought particularly with respect to sociological and cultural problems from the eighteenth century to the contemporary period as seen through the writings of significant essayists. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1977-78. Hutton
- 591 Introduction to Research and Criticism** (I, 3) Introduction to scholarly research and literary criticism. Required as the first course for all candidates for the M.A. in Spanish. (Lec. 3) Pre: graduate status or permission of instructor. Kossoff
- 592 Religious Sources of Hispanic Literature** (II, 3) Significance of religion in Iberian culture and its reflection in major literary works. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered 1977-78. Hutton
- 594 Seminar in Spanish Literature** (I and II, 3) Research and analysis of a particular author or problem of Spanish or Hispanic-American literature. (Lec. 3) Pre: graduate status or permission of instructor. Staff
- 599 Masters Thesis Research** (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**SPEECH COMMUNICATION (SPE)**

- 400 Rhetoric** (I, 3)
- 410 Semantics** (II, 3)
- 415 The Ethics of Persuasion** (II, 3)
- 417 Speech in the Elementary School** (I and II, 3)
- 420 Seminar in American Public Address and Criticism** (II, 3)
- 430 Political Communication** (I, 3)
- 431 Readers Theatre** (II, 3)
- 433 Chamber Theatre** (I, 3)
- 437 Intercultural Communication** (II, 3)
- 471, 472 Internship in Speech Communication** (I and II, 3 each)
- 491, 492 Special Problems** (I and II, 1-3 each)
- 504 Speech and Hearing Research** (I, 3) Types of research in speech pathology, audiology, and communication science; critiques of representative models with special emphasis on experimental research; individual pilot projects or master's thesis. (Lec. 3) Pre: admission to graduate programs in speech, or permission of instructor. Grubman
- 551 Measurement of Hearing** (I, 2) History of hearing evaluation techniques; methods and practicum in basic audiological assessment; types of hearing losses and their implications for rehabilitation. (Lec. 2) Staff
- 552 Advanced Measurement of Hearing** (II, 2) Speech audiometry; recruitment phenomena; functional hearing losses; education and rehabilitation problems associated with electronically assisted hearing. (Lec. 2) Pre: 551 or equivalent. Staff
- 553 Pedaudiology** (I, 2) Hearing evaluation problems associated with infants and preschool children; instrumentation and procedures; behavioral characteristics of hearing-impaired children. (Lec. 2) Staff
- 554 Auditory Training and Speechreading** (II, 2) Rationale and techniques for auditory training programs; speechreading as a communication system; evaluation of methodologies for developing speechreading skills; practicum with children and adults. (Lec. 2) Pre: 551 or permission of instructor. Staff
- 555 Electronically Assisted Hearing** (I, 2) Principles of selective amplification and acoustical control; evaluation of various devices including wearable hearing aids; methods of instruction in the use of acoustical instruments. (Lec. 2) Pre: 552 or permission of instructor. Staff
- 556 Automatic Audiometry** (II, 2) Bekey principle; continuous, discrete, and pulsetone measurements; diagnostic implications of various type tracings; research findings and current issues; practicum. (Lec. 2) Pre: 552 or permission of instructor. Regan
- 561 Disorders of Articulation** (I, 2) Types and causes of articulation disorders; rationale for case selection; S-R-L syndrome; special emphasis on rehabilitation procedures associated with individual involvements; practicum. (Lec. 2) Grubman
- 562 Disorders of Voice** (I, 2) Type and cause of voice disorders; rationale for case selection; medical implications; special emphasis on rehabilitation procedures associated with individual involvements; practicum. (Lec. 2) Beaupre

- 563 Disorders of Rate and Rhythm (II, 2)** Types and causes of rate, rhythm and stress disorders; rationale for case selection; survey of stuttering theories, special emphasis on rehabilitation procedures associated with individual involvements; practicum. (Lec. 2) Fitz-Simons
- 564 Disorders of Symbolization (II, 2)** Types and causes of language symbolization disorders; rationale for case selection; childhood aphasia and autism; special emphasis on rehabilitation procedures associated with individual involvements; practicum. (Lec. 2) Fitz-Simons
- 565 Diagnostic Procedures: Voice and Articulation (I, 2)** Instrumentation, tests, and procedures for evaluating individuals with voice and articulation disorders; practicum in speech and hearing centers; principles of differential diagnosis and report writing. (Lec. 2) Pre: permission of instructor. Grubman
- 566 Diagnostic Procedures: Rhythm and Symbolization (II, 2)** Instrumentation, tests, and procedures for evaluating individuals with disorders of rate, rhythm and symbolization; problems in differential diagnosis; practicum in speech and hearing centers. (Lec. 2) Pre: permission of instructor. Grubman
- 567 Clinical Practicum in Speech Pathology (I and II, 1-3)** Supervised diagnostic and therapeutic procedures with persons experiencing communicative disorders. Differential diagnosis, parent counseling, and cooperation with allied personnel. Practicum held on campus and within institutional and school settings. (Lab. 3-9) Pre: permission of adviser. Staff
- 568 Clinical Practicum in Audiology (I and II, 1-3)** Supervised clinical practicum concerned with audiological assessment of hearing disorders and auditory rehabilitation with the hearing impaired. Practicum held on campus and within institutional and school setting. (Lab. 3-9) Pre: permission of adviser. Staff
- 571 Audiometric Screening and Surveying Techniques (I, 3)** Rationale, instrumentation, and techniques for selecting and administering group and individual screening tests; records and interpretations; current research and professional issues. (Lec. 3) Pre: admission to graduate program in audiology. Staff
- 572 Medical Audiology (II, 3)** Diagnostic implications of audiometry for various organic disorders; supportive audiological information relevant to medical and surgical interventions; differential data associated with otosclerosis, Meniere's disease, VIIIth cranial nerve tumors, and malingering. (Lec. 3) Pre: admission to graduate program in audiology. Staff
- 573 Contemporary Problems in Audiology (I, 3)** Critical review of current research and controversial issues within the profession; student selects one topic for independent study. (Lec. 3) Pre: admission to graduate program in audiology and permission of instructor. Staff
- 574 Environmental Audiology (II, 3)** Hearing problems in industry, in the military, and other high noise level environments; medico-legal aspects of hearing loss; hearing conservation programs in public schools. (Lec. 3) Pre: admission to graduate program in audiology or permission of instructor. Staff
- 575 Speech and Language for Deaf or Hard of Hearing Child (I, 3)** The audiologist as hearing therapist in public school settings, medical clinics, and pre-school programs; responsibilities as part of the educational, psychological and medical team for active intervention with speech and language problems. (Lec. 3) Pre: admission to the graduate program in audiology or permission of instructor. Staff
- 576 Speech and Language for Deaf or Hard of Hearing Adult (II, 3)** The audiologist as hearing therapist and consultant for adults with agenerative or degenerative hearing deficits; responsibilities as part of the rehabilitation team for active intervention with speech and language problems. (Lec. 3) Pre: admission to graduate program in audiology or permission of instructor. Staff
- 581 Cerebral Palsy (I, 3)** Identification of types of cerebral palsy by location of lesion, motor symptomatology and additional handicaps; role of the speech clinician on the team; types of speech therapy with emphasis on the Bobath approach; current research and controversial issues. (Lec. 3) Pre: admission to graduate program in speech pathology. Grubman
- 582 Stuttering and Cluttering (II, 3)** Analysis of the various etiological theories of stuttering and tachyphemia; techniques and implications of the several therapies; developing a rationale for intervention and case selection. (Lec. 3) Pre: admission to graduate program in speech pathology. Fitz-Simons
- 583 Cleft Palate and Other Orofacial Deformities (I, 3)** Relationship of prosthetic, surgical, and orthodontic intervention to speech rehabilitation; role of speech clinician on the cleft palate team; assessment of therapeutic approaches; current research and controversial issues. (Lec. 3) Pre: admission to the graduate program in speech pathology or permission of instructor. Staff
- 584 Delayed Speech and Language (II, 3)** Problems in differential diagnosis for deafness, aphasia, autism, and learning disorders; demonstrations and critiques of clinical interventions with children who have speech and language learning deficits including dyslexia and acalculia. (Lec. 3) Pre: admission to the graduate program in speech pathology. Fitz-Simons
- 585 Aphasia and Allied Language Disorders (I, 3)** Types of adult aphasia; central and peripheral dysarthrias; role of speech clinician on the rehabilitation team; other degenerative disorders such as Parkinsonism and dystonia; current research and controversial issues. (Lec. 3) Pre: admission to graduate program in speech pathology or permission of instructor. Grubman
- 586 Alaryngeal Speech (II, 3)** Voice and speech rehabilitation for individual without a functional larynx; social, emotional and medical considerations; clinical procedures for esophageal, pharyngeal and buccal speech; implications for use of artificial larynx; current research. (Lec. 3) Pre: admission to graduate program in speech pathology. Beaupre
- 599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**STATISTICS****Economics**

- 576 Econometrics I  
577 Econometrics II

**Experimental Statistics**

- 408 or 409 Statistical Methods in Research I  
412 Statistical Methods in Research II  
413 Data Analysis  
491, 492 Problems in Experimental Statistics  
500 Nonparametric Statistical Methods  
511 Linear Statistical Models  
520 Fundamentals of Sampling and Applications  
532 Experimental Design  
541 Multivariate Statistical Methods  
550 Ecological Statistics  
591, 592 Problems in Experimental Statistics

**Industrial Engineering**

- 411 Engineering Statistics I  
412 Engineering Statistics II  
513 Statistical Quality Control  
533 Advanced Statistical Methods for Research and Industry  
634 Design and Analysis of Industrial Experiments  
635 Response Surfaces and Evolutionary Operations

**Management Science**

- 581 Fundamental Business Statistics  
601, 602 Advanced Business Statistics

**Mathematics**

- 451 Introduction to Probability and Statistics  
452 Mathematics Statistics  
456 Probability  
550 Advanced Probability  
551 Advanced Mathematical Statistics I  
552 Advanced Mathematical Statistics II

**Mechanical Engineering and Applied Mechanics**

- 521 Reliability Analysis and Prediction

**Psychology**

- 410 Quantitative Methods in Psychology II  
510 Intermediate Quantitative Methods in Psychology  
610 Factor Analysis

**TEXTILES AND CLOTHING (TXC)**

- 403 Textile Performance (II, 3)  
405 Advanced Clothing (I and II, 3)  
406 Housing Planning (I, 3)  
422 Field Experience in Fashion Merchandising (I and II, 5)  
433 Textiles and Clothing Industry (I and II, 3)  
440 Historic Textiles (I, 3)

502 Seminar in Textiles and Clothing (I and II, 3) Original investigations in the area of clothing problems. (Lec. 3) Pre: permission of department. Carpenter

503 Advanced Textiles (I and II, 3) Analysis of fabrics; methods and techniques of testing fabrics; evaluation of fabric data in relation to end-use performance and to existing quality standards. (Lec. 2, Lab. 2) Pre: 303. Darling

513 Detergency (II, 3) Study of chemical and mechanical interactions of textile fibers, fabrics, laundering products, equipment, and soils. Laboratory experience in evaluation of laundry products and fabric durability during laundering. (Lec. 2; Lab. 2) Pre: graduate standing, 303 or equivalent, and permission of instructor. In alternate years, next offered spring 1977. Darling

524 Social Psychological Aspects of Textiles and Clothing (II, 3) Seminar in social and psychological aspects of textiles and clothing. Theories and assumptions concerning relevance of clothing to individuals and groups. (Lec. 3) Pre: 224 or permission of instructor. Carpenter

533 Textile and Clothing Economics (I and II, 3) Economic development of production and distribution of textiles and clothing. (Lec. 3) Staff

540 Special Problems in Textiles and Clothing (I and II, 3) Supervised independent study in specific areas of textiles and clothing. Pre: permission of department. Staff

550 Seminar and Practicum (I and II, 3) Professional role of the textiles and clothing specialist. Pre: permission of department. Staff

560 Special Problems in Textiles and Clothing (I and II, 3) Supervised independent study in specific areas of textiles and clothing. Pre: permission of department. Staff

570 Seminar in Textiles and Clothing Research (I and II, 3) Critical study of research literature and research techniques. Pre: permission of department. Staff

580 Research Methods in Textiles and Clothing (I, 3) Development and execution of research in textiles and clothing following the historical, descriptive, and experimental methods. Analysis of current research in the field. (Lec. 3) Carpenter

599 Masters Thesis Research (I and II) Number of credits is determined each semester in consultation with the major professor or program committee.

**THEATRE (THE)**

- 405 Children's Theatre Laboratory (I and II, 2)  
410 Advanced Acting (I and II, 1-3)  
420 Advanced Directing Practice (I and II, 1-3)  
440 Advanced Stage Management (I and II, 1-3)  
450 Advanced Costuming (I and II, 1-3)  
460 Advanced Scene Design (I and II, 1-3)  
461 Advanced Theatre Technology (I and II, 1-3)  
470 Advanced Stage Lighting (I and II, 1-3)  
482 Contemporary Theatre (I, 3)

**ZOOLOGY (ZOO)**

- 408 (or MIC 408) Introduction to Protozoology (II, 4)  
421 Principles of Taxonomy (I, 3)  
427 (or MCE 427) Modeling and Analysis of Dynamic Systems (I, 3)  
441 General (Cellular) Physiology (I, 3)  
442 Mammalian Physiology (II, 3)

- 455 (or BOT 455) Marine Ecology (I, 3)**  
**457 (or BOT 457) Marine Ecology Laboratory (I, 1)**  
**463 Animal Ecology (II, 3)**  
**465 Limnology (I, 3)**  
**466 Vertebrate Biology (II, 3)**  
**467 Animal Behavior (II, 3)**  
**475 Causes of Evolution (II, 3)**  
**476 Human Genetics (II, 3)**  
**482 Systematic Entomology (II, 3)**  
**484 (or ELE 484) Modeling of Physiological Systems (II, 3)**
- 505 Biological Photography (I, 2)** Application of scientific photography to biological subjects living and prepared. Photomacrography and photomicrography. Principles of photography as applied to the specialized needs of biological research and publication. (Lab. 6) Pre: permission of instructor. Heppner
- 508 Seminar in Zoological Literature (II, 1)** Survey of zoological literature including traditional methods of bibliographic control, contemporary information retrieval services and the development of a personalized information system. (Lec. 1) Pre: graduate standing in zoology. J. F. Sieburth
- 512 Fine Structure (II, 4)** Experimental evidence correlating the fine structure and function of cell organelles, including especially the plasma membrane, endoplasmic reticulum, mitochondria, ribosomes, centrioles, lysosomes and cilia. Introduction to instrumental and to cytochemical methods for study of each cell. Emphasis on the examination of electron micrographs. (Lec. 3, Lab. 3) Pre: 323. In alternate years, next offered 1976-77. Goertemiller
- 518 Mechanisms of Development (I, 2)** Current concepts of mechanisms responsible for developmental changes. Morphological, chemical, and genetic aspects of development are treated in discussions of morphogenetic movements, cell differentiation, and organogenesis. (Lec. 2) Pre: 316 or 320 or equivalent; BOT 352 recommended. Bibb, Goertemiller, Surver
- 531 Advanced Parasitology Seminar (II, 2)** Advanced topics in the host-parasite relationships of protozoan and metazoan parasites. Reading knowledge of one foreign language assumed. Topics vary from year to year. (Lec. 2) Pre: 331 or equivalent. In alternate years, next offered 1976-77. Hyland
- 541, 542 Comparative Physiology (I and II, 3 each)** Comparison of physiological mechanisms by which animals maintain life, emphasis on marine invertebrates. (Lec. 2, Lab. 3) Pre: 345 and 354. 541 is not prerequisite for 542. 541: Responses to external environment mediated by receptors, nervous systems, effectors. Living control systems for muscular activity and circulation. Hill. 542: Processes related to maintenance of internal environment, including osmotic balance, gaseous exchange and transport, nutrition, intermediary metabolism, nitrogen excretion, shell formation. Hammen
- 543 Biology of Reproduction in Animals (I, 3)** Aspects of reproduction in animals of different phyla. Hormonal interrelationships, environmental control and adaptive mechanisms. (Lec. 2, Lab. 3) Pre: 345 and 545. In alternate years, next offered 1976-77. Chipman
- 545 Endocrinology (I, 3)** Comparative anatomy, histology, embryology, physiology of the endocrine glands of vertebrates. Lectures, demonstrations, student reports. (Lec. 3) Pre: 316 or 321 and 323 or equivalent. Chipman and Krueger
- 548 Neurophysiology (II, 4)** Fundamental processes occurring in the nervous systems of invertebrates and vertebrates. Structure and functions of nervous elements with emphasis on integration and coordination. (Lec. 3, Lab. 3) Pre: 345, MTH 141 or equivalent recommended and permission of instructor. Kass-Simon
- 554 Seminar in Morphogenetic Theory (II, 2)** Recent investigations in developmental physiology, and the control of differentiation and development. Reference to original papers. (Lec. 2) Pre: 323 or equivalent, and permission of instructor. In alternate years, next offered 1977-78. Goertemiller
- 562 Seminar in Behavioral Ecology (I, 1)** Special topics in the relationships between animal behavior and ecology, such as social organization of animals, evolution of behavior, competition and habitat selection. Discussion and presentation of individual reports. (Lec. 1) Cobb
- 563 Ichthyology (I, 3)** Fishes of the world. Their structure, evolution, classification, ecology and physiology. Emphasis on local marine and freshwater fauna. Several field trips. (Lec. 2, Lab. 3) Pre: 316 or 321 and 466. Krueger
- 564 Oceanic Ichthyology (II, 3)** Fishes of the great ocean basins. Their systematics, adaptations, vertical distribution and zoogeography. Emphasis on mesopelagic and bathypelagic forms in the North Atlantic. (Lec. 2, Lab. 3) Pre: 563 or permission of instructor. In alternate years, next offered 1976-77. Krueger
- 565 (468) Mammalogy (II, 3)** Characteristics and adaptive significance of mammals encompassing their evolution, classification, distribution, life-histories, population dynamics and behavior. Methods and techniques of identification, collection, and preparation of local mammals for study. Field work. (Lec. 2, Lab. 3) Pre: 466 or equivalent. In alternate years, next offered 1976-77. Chipman
- 566 Herpetology (II, 3)** Biology of recent orders of amphibians and reptiles; emphasis on adaptations and evolution, world faunal relationships past and present, current systematic problems. Selected herpetological material in laboratory, field trips, two week-end trips to the American Museum of Natural History. (Lec. 2, Lab. 3) Pre: 316 or 321 or permission of instructor. Dowling and Shoop
- 568 Ornithology (II, 2)** Biology of birds, with emphasis on the role of birds in biological research. Areas covered include systematics, evolution, physiology, ecology and behavior. Discussion of current topics in ornithology. (Lec. 2) Pre: 466 or permission of instructor. Heppner
- 573 Developmental Genetics (II, 3)** Genetic control of gametogenesis and fertilization. Survey of modern approaches to the problem of gene regulation during embryogenesis with animal systems. (Lec. 3) Pre: BOT 352 or ASC 352 or equivalent and permission of instructor. Surver
- 576 Ecological Genetics (II, 4)** Hereditary structure of populations, population strategy in heterogeneous environment, species area-diversity patterns, strategy of

colonization, stepping stones and biotic exchange. (Lec. 3, Lab. 3) Pre: one semester of genetics. Costantino

**579 (or BOT 579) Advanced Genetics Seminar (I and II, 1)** Current topics in genetics, including cytological, ecological, molecular, physiological, population, quantitative and radiation genetics. (Lec. 1) Pre: BOT 352 or ASC 352 and permission of instructor. Costantino and Mottinger

**581 General Acarology (I, 3)** Detailed study of mites and ticks, their structure, life histories, and classification. Free-living forms as well as plant and animal feeders. (Lab. 6) Pre: 331 or 481 or 586, and permission of instructor. In alternate years, next offered 1976-77. Hyland

**586 Medical and Veterinary Entomology (II, 3)** Life histories, classifications, habits and control of insects and other arthropods which affect the health of man and animals. Duties of the entomologist on public health team, including field practice in methods of insect surveys, control measures and subsequent surveys to determine success of control measures. (Lec. 1, Lab. 4) Pre: 331 or 381 or equivalent. In alternate years, next offered 1977-78. Hyland.

**595, 596 Graduate Seminar in Zoology (I and II, 1 each)** Consideration of philosophy and techniques of research and information presentation at the graduate level. Reports by students, critique and discussion by class. Required of entering graduate students in zoology. Pre: graduate standing, S/U credit. Chipman

**599 Masters Thesis Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

**640 to 645 Seminar in Physiology (I and II, 1-3 each)** Reports and discussions on topics of current research in physiology. Subject matter adapted to meet interests of staff and students. (Lec. 1-3) Pre: 345. Harrison and Hill

**646 Advanced Mammalian Physiology (II, 2)** Reports and discussions on topics of current research in mammalian physiology, coordinated with 442. Assigned research projects using advanced physiological techniques and instrumentation. (Lec. 1, Lab. 3) Pre: concurrent enrollment in 442 or permission of instructor. Hill

**648, 649 Seminar in Environmental Physiology (I and II, 2 each)** Reading, library research, special lectures on topics of current research interest in environmental physiology. (Lec. 2) Pre: one year of physiology, and at least one course in ecology or permission of department. Staff

**664 Seminar in Ichthyology (II, 2)** Reading, library research, reports and class discussion on problems of current research interest in the biology of fishes. (Lec. 2) Pre: 563 or permission of department. In alternate years, next offered 1977-78. Krueger

**666 Physiological Ecology (II, 3)** Comparative study of physiological adjustments which animals make in response to environmental factors, with emphasis on the physiological basis of animal distribution and evolution. (Lec. 3) Pre: one year of physiology and a course in ecology. Chipman

**670 to 675 Advanced Ecology Seminars (I and II, 2 each)** Specialized and advanced areas of ecological research and theory, including zoogeography, pleistocene ecology, population dynamics, energy flow in ecosystems and radiation ecology. Pre: 463 and permission of department. Shoop and Staff

**679 Animal Communication**  
See Oceanography 679.

**691, 692 Assigned Work (I and II, 1-3 each)** Subject matter adapted to meet needs of student. May be arranged with any member of the staff, with the permission of the head of the department. (Lec. 3 or Lab. 6) Staff

**693, 694 Zoological Problems (I and II, 1-3 each)** Special work to meet needs of individual students who are prepared to undertake special problems. (Lec. 1-3 or Lab. 2-6) Pre: permission of department chairman. Staff

**699 Doctoral Dissertation Research (I and II)** Number of credits is determined each semester in consultation with the major professor or program committee.

## Personnel

### Graduate School

Michel, Aloys A., *Dean*  
Cain, Leila S., *Associate Dean*  
Rose, Vincent C., *Associate Dean*

### The Graduate Council

Michel, Aloys A., *Chairman, ex officio*  
Beckman, Carl H., *Resource Development (1978)*  
Brown, Phyllis R., *Arts and Sciences (1977)*  
Cohen, Paul S., *Arts and Sciences (1979)*  
DeFeo, John J., *Pharmacy (1977)*  
Goos, Roger D., *Arts and Sciences (1977)*  
Greene, Helen F., *Home Economics (1977)*  
Grubman, Stephen D., *Arts and Sciences (1979)*  
Hynes, Martin D., *Graduate Student Association (1977)*  
James, Charles F., *Engineering (1977)*  
Kang, Hesook S., *Nursing (1979)*  
Leduc, Edgar C., *Arts and Sciences (1978)*  
Mayfield, Betty, *Graduate Student Association (1977)*  
Miksic, Joy, *Graduate Student Association (1977)*  
Rogers, Warren, *Business Administration (1979)*  
Schneider, Stewart P., *Library Science (1977)*  
Sennott, Roger, *Arts and Sciences (1978)*  
Yoder, James, *Graduate Student Association (1977)*

### Academic Administrators

Newman, Frank, M.S., *President*  
Ferrante, William R., Ph.D., *Vice President for Academic Affairs*  
Knauss, John A., Ph.D., *Provost for Marine Affairs and Dean of the Graduate School of Oceanography*  
Youngken, Heber W., Jr., Ph.D., *Provost for Health Science Affairs and Dean of the College of Pharmacy*  
Marks, Barry, Ph.D., *Dean of the College of Arts and Sciences*  
Weeks, Richard R., Ph.D., *Dean of the College of Business Administration*  
Conta, Lewis D., Ph.D., *Dean of the College of Engineering*  
Crandall, Elizabeth Walbert, Ed.D., *Acting Dean of the College of Home Economics*  
Tate, Barbara L., Ed.D., *Dean of the College of Nursing*  
Donovan, Gerald A., Ph.D., *Dean of the College of Resource Development*  
Lott, Bernice, Ph.D., *Dean of the University College*  
Potter, Nancy A., Ph.D., *Acting Dean of the Graduate Library School*  
Woods, Frank L., Ph.D., *Dean of the Summer Session*  
Dillavou, George J., Ph.D., *Dean of the Division of University Extension*  
Sage, Nathaniel M., Jr., Ph.D., *Coordinator of Research*  
Parks, George R., M.A.L.S., Ph.D., *Dean, University Libraries*



## Board of Regents

Carlotti, Albert E., *Chairman, Warwick*  
 Bonte, Andre R., *North Smithfield*  
 Boyle, Francis J., *Newport*  
 Buonanno, Bernard V., *Providence*  
 Capotosto, Augustine, Jr., *East Greenwich*  
 Gallogly, Raymond, *Warwick*  
 Kane, John J., *Warwick*  
 Lynch, John J., *Warwick*  
 Lyons, Mary P., *Providence*  
 Nardone, Henry J., *Westerly*  
 Peluso, Donna M., *Cranston*  
 Quattrocchi, Rocco, *Providence*  
 Van Leesten, Michael S., *Providence*  
 Willis, Norma B., *Saunderstown*  
 Zorabedian, Richard, *Saunderstown*  
 Schmidt, Thomas C., Ph.D., *Commissioner*

## Graduate Faculty

First date after title indicates appointment to present position; the second date, when the first fails to do so, indicates first appointment in the University.

- Abell, Paul Irving, *Professor of Chemistry, 1964, 1951*. B.S., 1948, University of New Hampshire; Ph.D., 1951, University of Wisconsin.
- Abushanab, Elie, *Associate Professor of Medicinal Chemistry, 1973, 1970*. B.S., 1960, American University of Beirut; M.S., 1962, Ph.D., 1965, University of Wisconsin.
- Ageloff, Roy, *Assistant Professor of Management Science, 1972*. B.S., 1965, University of New York at Buffalo; M.B.A., 1967, University of Connecticut.
- Albert, Luke S., *Professor of Botany, 1970, 1960*. B.S., 1950, Lebanon Valley College; M.S., 1952, Ph.D., 1958, Rutgers—The State University.
- Alexander, Lewis M., *Professor of Geography, 1960*. A.B., 1942, Middlebury College; M.A., 1948, Ph.D., 1949, Clark University.
- Allen, Anthony J., *Assistant Professor of Education, 1969*. B.S., 1960, Loyola University; M.Ed., 1967, Ph.D., 1970, Boston College.
- Allen, William R., *Assistant Professor of Organizational Management and Industrial Relations, 1973*. B.S., 1960, U.S. Coast Guard Academy; M.B.A., 1971, Ph.D., 1975, University of Florida.
- Allred, Hilda, *Assistant Professor of Business Education, 1974*. B.A., 1966, M.Ed., 1969, Southeastern Louisiana University; Ed.D., 1974, Louisiana State University.
- Alton, Aaron John, *Professor of Marketing Management, 1961*. A.B., 1942, Miami University, Ohio; M.B.A., 1947, Harvard Business School; Ph.D., 1956, Ohio State University.
- Anderson, Judith L., *Associate Professor of Speech, 1975, 1970*. B.A., 1962, M.A., 1963, University of Kansas; Ph.D., 1970, Indiana University.
- Arakelian, Paul G., *Assistant Professor of English, 1976*. B.A., 1969, California State University, Los Angeles; Ph.D., 1975, Indiana University.
- Armstrong, Charles P., *Associate Professor of Management Science, 1976, 1971*. B.S., 1961, M.B.A., 1965, University of Illinois; Ph.D., 1973, University of Arizona.
- Aronian, Sona, *Assistant Professor of Russian, 1970*. A.B., 1960, Boston University; Ph.D., 1971, Yale University.
- Avery, Carol E., *Assistant Professor of Textiles and Clothing, 1974, 1970*. B.S., 1951, M.S., 1967, University of Rhode Island.
- Bachelder, Alfred Clarence, *Associate Professor of Mechanical Drawing and Shopwork and Director of Engineering Instrument Shop, 1962, 1947*. B.S., 1943, Rhode Island School of Design; M.S., 1955, University of Rhode Island.
- Bailey, Richard E., *Associate Professor of Speech, 1972, 1967*. B.A., 1951, Otterbein College; M.A., 1954, United Theological Seminary; M.A., 1964, Ph.D., 1968, Ohio State University.
- Baker, Homer O'N., *Assistant Professor of Education, 1973*. B.S., 1962, Abilene Christian College; M.A., 1969, Ed.D., 1973, Arizona State University.
- Barker, Walter L., *Associate Professor of English, 1973, 1966*. B.A., 1960, M.A., 1962, University of Rhode Island; Ph.D., 1966, University of Connecticut.
- Barnett, Harold, *Assistant Professor of Economics, 1973, 1970*. B.A., 1965, Miami University, Ohio; Ph.D., 1973, Massachusetts Institute of Technology.
- Barnett, Stanley M., *Associate Professor of Chemical Engineering, 1975, 1969*. B.A., 1957, Columbia College; B.S., 1958, Columbia University; M.S., 1959, Lehigh University; Ph.D., 1963, University of Pennsylvania.
- Barron, Robert Alfred, *Assistant Professor of Mathematics, 1956*. A.B., 1951, Princeton University; M.A., 1955, Fordham University.
- Bass, Leonard J., *Associate Professor of Computer Science, 1975, 1970*. B.A., 1964, M.A., 1966, University of California, Riverside; Ph.D., 1970, Purdue University.
- Bassis, Michael S., *Assistant Professor of Sociology, 1974, 1971*. A.B., 1967, Brown University; M.A., 1968, Ph.D., 1974, University of Chicago.
- Beauregard, Raymond A., *Associate Professor of Mathematics, 1973, 1968*. A.B., 1964, Providence College; M.S., 1966, Ph.D., 1968, University of New Hampshire.
- Beckman, Carl Harry, *Professor of Plant Pathology-Entomology and Botany, 1969, 1963*. B.S., 1947, University of Rhode Island; Ph.D., 1953, University of Wisconsin.
- Bell, Robert G., *Associate Professor of Biochemistry, 1974, 1971*. A.B., 1959, Bradley University; Ph.D., 1964, St. Louis University, School of Medicine.
- Bender, Michael L., *Assistant Professor of Oceanography, 1972*. B.S., 1965, Carnegie Institute of Technology; Ph.D., 1970, Columbia University.
- Benson, Edward G., *Assistant Dean, College of Arts and Sciences, and Adjunct Assistant Professor of French, 1975, 1970*. A.B., 1963, Princeton University; M.A., 1968, Ph.D., 1971, Brown University.
- Bergan, James G., *Associate Professor of Food and Nutritional Science and Food Science and Technology, 1975, 1971*. B.S., 1966, Ph.D., 1970,

- University of Illinois.
- Bergen, Daniel P., *Professor of Library Science*, 1975, 1970. A.B., 1957, University of Notre Dame; A.M., 1961, University of Chicago; M.A., 1962, University of Notre Dame; M.A., 1968, Ph.D., 1970, University of Minnesota.
- Berger, Stanley I., *Professor of Psychology*, 1965, 1963. B.A., 1950, Brooklyn College; M.A., 1955, Ph.D., 1957, University of Kansas.
- Berman, Allan, *Professor of Psychology*, 1976, 1968. B.A., 1962, University of Massachusetts; M.Ed., 1963, Boston University; Ph.D., 1968, Louisiana State University.
- Bibb, Harold D., *Assistant Professor of Zoology*, 1972. B.A., 1962, Knox College; M.S., 1964, Ph.D., 1969, University of Iowa.
- Biller, Henry B., *Professor of Psychology*, 1975, 1970. A.B., 1962, Brown University; Ph.D., 1967, Duke University.
- Birk, John R., *Associate Professor of Electrical Engineering*, 1976, 1970. B.E., 1966, The Cooper Union; M.S., 1968, Ph.D., 1970, University of Connecticut.
- Bloomquist, Lorraine C., *Assistant Professor of Physical Education*, 1971, 1967. B.S., 1966, M.S., 1968, University of Rhode Island; Ed.D., 1974, Boston University.
- Bockstael, Nancy P., *Assistant Professor of Resource Economics*, 1976. B.A., 1971, Connecticut College; M.A., 1972, Brown University.
- Bohnert, Lea M., *Assistant Professor of Library Science*, 1970. B.A., 1942, M.A., 1947, University of Chicago.
- Bond, Howard W., Ph.D., *Emeritus Professor of Medicinal Chemistry*, 1976, 1966. B.S., 1936, University of Arkansas; M.S., 1938, Ph.D., 1941, University of Illinois.
- Booth, G. Geoffrey, *Director of Research Center in Business and Economics and Associate Professor of Finance*, 1974, 1970. B.B.A., 1964, M.B.A., 1966, Ohio University; Ph.D., 1971, University of Michigan.
- Boothroyd, Jon C., *Assistant Professor of Geology*, 1975. B.A., 1962, University of New Hampshire; M.S., 1972, University of Massachusetts; Ph.D., 1974, University of South Carolina.
- Bowman, Beverly Hosbrook, *Associate Professor of Marketing Management*, 1958, 1954. B.S., 1937, Northeastern State College; M.S., 1939, Oklahoma State College.
- Bracken, Robert M., *Assistant Professor of Accounting*, 1976. B.S., 1963, Waynesburg College; M.B.A., 1968, Pennsylvania State University.
- Bradbury, Donald, *Professor of Mechanical Engineering and Applied Mechanics*, 1953, 1950. B.S., 1939, Tufts College; M.S., 1940, S.D., 1950, Harvard University.
- Brainard, Calvin H., *Professor of Finance and Insurance*, 1961, 1953. A.B., 1935, Columbia University; M.B.A., 1948, Ph.D., 1951, New York University.
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- Suryanarayan, E. Ramnath, *Professor of Mathematics*, 1973, 1960. B.Sc., 1951, M.Sc., 1952, University of Mysore; Ph.D., 1961, University of Michigan.
- Sussman, Donald L., *Associate Professor of Civil Engineering*, 1976, 1967. B.S., 1958, City College of New York; Ph.D., 1966, Polytechnic Institute of Brooklyn.
- Sutinen, Jon G., *Assistant Professor of Resource Economics*, 1973. A.A., 1962, Lower Columbia College; B.S., 1964, San Francisco State College; Ph.D., 1973, University of Washington.
- Suzawa, Gilbert S., *Assistant Professor of Economics*, 1973, 1971. B.A., 1965, M.A., 1967, University of Hawaii; Ph.D., 1973, Brown University.
- Swanson, Edward P., *Assistant Professor of Accounting*, 1976. B.S., 1969, University of Rhode Island; M.B.A., 1974, Ph.D., 1976, University of Wisconsin.
- Swift, Elijah V., *Associate Professor of Oceanography and Botany*, 1974, 1969. B.A., 1960, Swarthmore College; M.A., 1964, Ph.D., 1967, The Johns Hopkins University.
- Swift, Judith M., *Assistant Professor of Theatre*, 1974, 1971. B.A., 1968, M.A., 1971, University of Rhode Island.
- Swonger, Alvin K., *Assistant Professor of Pharmacology and Toxicology*, 1971. B.A., 1967, Boston University; Ph.D., 1971, Dartmouth College.
- Tate, Barbara L., R.N., *Dean of the College of Nursing and Professor of Nursing*, 1969. Diploma, 1942, Mountainside Hospital School of Nursing; B.A., 1945, Elmira College; M.A., 1951, Ed.D., 1961, Teachers College, Columbia University.
- Test, Frederick Laurent, *Professor of Mechanical Engineering and Applied Mechanics*, 1962, 1949. B.S., 1945, M.S., 1947, Massachusetts Institute of Technology; Ph.D., 1956, Pennsylvania State University.
- Tetreault, David E., *Assistant Professor of Computer Science*, 1971, 1967. B.S., 1963, M.S., 1972, University of Rhode Island.
- Thompson, A. Ralph, *Director, Rhode Island Water Resources Center, and Professor of Chemical Engineering*, 1966, 1952. B.A.Sc., 1936, University of Toronto; Ph.D., 1945, University of Pennsylvania.
- Thurston, Gary, *Associate Professor of History*, 1976, 1966. B.A., 1962, Grinnell College; M.A., 1965, Ph.D., 1973, Columbia University.
- Toloudis, Constantin, *Assistant Professor of French*, 1968, 1966. B.A., 1963, University of British Columbia; Ph.D., 1969, Rice University.
- Towers, Tom H., *Associate Professor of English, Division of University Extension*, 1973, 1971. B.A., 1951, University of Chicago; B.A., 1958, M.A., 1959, University of New Mexico; Ph.D., 1971, Tulane University.
- Travisano, Richard Vito, *Assistant Professor of Sociology*, 1973, 1969. B.A., 1961, University of Connecticut; M.A., 1967, Ph.D., 1973, University of Minnesota.
- Traxler, Richard W., *Professor of Plant Pathology-Entomology and Microbiology*, 1973, 1971. B.A., 1951, M.S., 1955, Ph.D., 1958, University of Texas.
- Tremblay, George C., *Professor of Biochemistry*, 1975, 1966. B.S., 1960, Massachusetts College of Pharmacy; Ph.D., 1965, St. Louis University.
- Treybal, Robert E., *Professor of Chemical Engineering*, 1973. B.S., 1935, M.S., 1936, New York University; Ph.D., 1942, Columbia University.
- Tryon, Jonathan Stedman, *Assistant Professor of Library Science*, 1969. A.B., 1955, Brown University; M.S., 1963, Columbia University; M.A., 1970, University of Rhode Island; Certificate in Advanced Librarianship, 1974.
- Tufts, Donald W., *Professor of Electrical Engineering*, 1967. B.A., 1955, Williams College; S.M., 1958, Sc.D., 1960, Massachusetts Institute of Technology.
- Turcotte, Joseph George, *Associate Professor of Medicinal Chemistry*, 1972, 1967. B.S., 1958, M.S., 1960, Massachusetts College of Pharmacy; Ph.D., 1967, University of Minnesota.
- Turnbaugh, William A., *Assistant Professor of Anthropology*, 1974. A.B., 1970, Lycoming College; Ph.D., 1973, Harvard University.
- Tutt, Ralph M., *Associate Professor of English*, 1971, 1964. A.B., 1954, University of Florida; M.A., 1958, Kent State University; M.A., 1961, Ohio State University; Ph.D., 1966, Duke University.
- Tutt, Roberta-Marie Hard, *Associate Professor of English, and Secretary of Faculty*, 1976, 1962. B.A., 1956, M.A., 1959, University of Michigan.
- Tyler, Gerry Ruth Sack, *Assistant Dean of the College of Arts and Sciences and Assistant Professor of Political Science*, 1971, 1966. B.A., 1960, University of Pittsburgh; M.A., 1961, Ph.D., 1972, Yale University.
- Tynan, Eugene J., *Associate Professor of Geology*, 1968, 1959. B.A., 1954, University of Connecticut; M.S., 1956, University of Massachusetts; Ph.D., 1962, University of Oklahoma.
- Tyne, Thomas F., *Assistant Professor of Psychology*,



1975. B.A., 1969, University of Dayton; M.S., 1972, Hunter College; Ph.D., 1975, University of Connecticut.
- Valentino, Domenic, *Assistant Professor of Psychology*, 1973. B.A., 1963, California State University; M.A., 1966, Ph.D., 1971, University of California.
- Vangermeersch, Richard, *Associate Professor of Accounting*, 1973, 1971. B.S.A., 1959, Bryant College; L.A.C., 1962, M.S., 1964, University of Rhode Island; Ph.D., 1970, University of Florida; C.P.A., Rhode Island.
- Velicer, Wayne F., *Assistant Professor of Psychology*, 1973. B.S., 1966, University of Wisconsin; M.S., 1969, Ph.D., 1972, Purdue University.
- Verma, Ghasi Ram, *Associate Professor of Mathematics*, 1968, 1964. B.A., 1950, Birla College; M.A., 1954, Banaras Hindu University; Ph.D., 1957, Rajasthan University.
- Vittimberga, Bruno M., *Professor of Chemistry*, 1971, 1961. B.S., 1952, Massachusetts Institute of Technology; M.S., 1954, University of Rhode Island; Ph.D., 1957, University of Illinois.
- Vosburgh, William Thomas, *Professor of Psychology and Director, School Psychology Program*, 1973, 1965. B.A., 1951, University of Maine; M.A., 1958, Ph.D., 1965, Syracuse University.
- Votta, Ferdinand, Jr., *Professor of Chemical Engineering*, 1974, 1946. B.S., 1939, M.S., 1941, University of Rhode Island; D.Eng., 1958, Yale University.
- Wakefield, Robert C., *Professor of Plant and Soil Science*, 1965, 1954. B.S., 1950, University of Rhode Island; M.S., 1951, Ph.D., 1954, Rutgers—The State University.
- Wallace, William Henry, *Associate Extension Professor of Resource Economics*, 1961, 1953. B.S., 1948, M.S., 1951, University of New Hampshire.
- Warren, David Daniel, *Professor of Political Science*, 1967, 1953. A.B., 1948, Brown University; M.A., 1949; Ph.D., 1959, Fletcher School of Law and Diplomacy.
- Waters, Harold Arthur, *Professor of French*, 1969, 1962. A.B., 1949, Harvard College; M.A., 1954, Ph.D., 1956, University of Washington.
- Watkins, Norman D., *Professor of Oceanography*, 1970. J.B.Sc., 1956, B.Sc., 1957, University of London; M.Sc., 1958, University of Birmingham; M.Sc., 1961, University of Alberta; Ph.D., 1964, University of London.
- Watts, D. Randolph, *Assistant Professor of Oceanography*, 1974. B.A., 1966, University of California; Ph.D., 1973, Cornell University.
- Weaver, Thomas F., *Assistant Professor of Resource Economics*, 1971. B.S., 1958, Pennsylvania State University; M.S., 1962, Ph.D., 1966, Cornell University.
- Weeden, Patricia Joyce, *Assistant Professor of Textiles and Clothing*, 1965, 1961. B.S., 1948, M.S., 1961, University of Rhode Island.
- Weeks, Richard R., *Dean of the College of Business Administration and Professor of Marketing Management*, 1970. B.S., 1955, University of Illinois; M.B.A., 1960, D.B.A., 1966, Washington University.
- Weideman, Nelson H., *Assistant Professor of Computer Science and Director of Computer Laboratory*, 1973, 1971. B.A., 1967, M.S., 1969, Ph.D., 1971, Cornell University.
- Weisbord, Robert G., *Professor of History*, 1973, 1966. B.A., 1955, New York University; M.A., 1960, Ph.D., 1966, New York University Graduate School.
- Wenisch, Fritz, *Associate Professor of Philosophy*, 1974, 1971. L.B.A., 1964, Salzburg, Austria; Ph.D., 1968, University of Salzburg.
- Whitcomb, Charles L., *Assistant Professor of Education*, 1969. B.B., 1936, State College at Bridgewater; Ed.M., 1952, Harvard University; Ed.D., 1965, Boston University.
- White, Frank Mangrem, *Professor of Mechanical and Ocean Engineering*, 1967, 1964. B.M.E., 1954, Georgia Institute of Technology; S.M., 1956, Massachusetts Institute of Technology; Ph.D., 1959, Georgia Institute of Technology.
- White, Sidney Howard, *Professor of English, Division of University Extension*, 1973, 1966. B.S., 1950, Loyola University; M.A., 1951, Ph.D., 1962, University of Southern California.
- Wiener, Frank George, *Associate Professor of Marketing Management*, 1960, 1949. B.S., 1942, Rutgers—The State University; M.S., 1948, Columbia University.
- Wilde, Charles E., Jr., *Professor of Zoology*, 1975. A.B., 1940, Dartmouth College; M.A., 1947, Ph.D., 1949, Princeton University.
- Willis, George H., *Assistant Professor of Education*, 1971. A.B., 1964, Hamilton College; M.A.T., 1965, Harvard University; Ph.D., 1971, The Johns Hopkins University.
- Willoughby, Alan, *Professor of Psychology*, 1974, 1968. A.B., 1949, Brown University; M.A., 1955, Ph.D., 1959, University of Connecticut.
- Wilson, Mason P., Jr., *Professor of Mechanical Engineering and Applied Mechanics*, 1976, 1968. B.S., 1957, State University of New York; M.S., 1960, Ph.D., 1968, University of Connecticut.
- Wing, Richard A., *Instructor in Fisheries and Marine Technology*, 1973, 1969.
- Winn, Howard Elliott, *Professor of Oceanography and Zoology*, 1965. B.A., 1948, Bowdoin College; M.S., 1950, Ph.D., 1955, University of Michigan.
- Wirth, Clifford J., *Assistant Professor of Political Science*, 1975. B.S., 1969, Muhlenberg College; M.P.A., 1971, California State University; Ph.D., 1975, Southern Illinois University.
- Wolke, Richard E., *Associate Professor of Animal Pathology*, 1975, 1970. B.S., 1955, D.V.M., 1962, Cornell University; M.S., 1966, Ph.D., 1968, University of Connecticut.
- Wood, Norris P., *Professor of Microbiology*, 1972, 1963. B.S., 1949, Hartwick College; M.S., 1951, Cornell University; Ph.D., 1955, University of Pennsylvania.
- Wood, Porter Shelley, *Associate Professor of Accounting*, 1957, 1955. B.S., 1935, Tennessee Polytechnic Institute; M.A., 1950, University of Kentucky; C.P.A., Rhode Island.
- Wood, Richard Dawson, *Professor of Botany*, 1959, 1947. A.B., B.Sc., 1940, Ohio State University; M.S., 1942, Ph.D., 1947, Northwestern University.
- Wood, Stephen B., *Professor of Political Science*, 1970, 1967. Ph.B., 1948, M.A., 1954, Ph.D., 1964, University of Chicago.
- Woods, Frank Leslie, *Dean of the Summer Session and Professor of German and Linguistics*, 1968, 1956. A.B., 1937, Colgate University; M.A., 1948, Ph.D.,

- 1951, Yale University.
- Worthen, Leonard Robert, *Director of Environmental Health Sciences and Professor of Pharmacognosy*, 1970, 1957. B.S., 1950, Massachusetts College of Pharmacy; M.S., 1952, Temple University; Ph.D., 1957, University of Massachusetts.
- Wright, William Ray, *Assistant Professor of Plant and Soil Science*, 1972. B.S., 1966, Wisconsin State University, River Falls; M.S., 1969, Ph.D., 1972, University of Maryland.
- Yates, Vance Joseph, *Professor of Animal Pathology*, 1955, 1949. B.S., 1940, D.V.M., 1949, Ohio State University; Ph.D., 1960, University of Wisconsin.
- Youngken, Heber W., Jr., *Provost for Health Science Affairs, Dean of the College of Pharmacy, and Professor of Pharmacognosy*, 1969, 1957. A.B., 1935, Bucknell University; B.S., 1938, Massachusetts College of Pharmacy; M.S., 1940, Ph.D., 1942, University of Minnesota.
- Zartler, Robert L., *Assistant Professor of Management Science*, 1971. A.B., 1966, M.B.A., 1968, Dartmouth College; D.B.A., 1973, Harvard University.
- Zeyl, Donald J., *Assistant Professor of Philosophy*, 1971. B.A., 1966, University of Toronto; Ph.D., 1972, Harvard University.
- Zinn, Donald J., *Emeritus Professor of Zoology*, 1974, 1946. S.B., 1933, Harvard University; M.S., 1937, University of Rhode Island; Ph.D., 1942, Yale University.
- Zucker, Norman I., *Professor of Political Science*, 1969, 1966. B.A., 1954, M.A., 1956, Ph.D., 1960, Rutgers—The State University.
- ## Graduate Adjunct Faculty
- Barber, Brian K., *Adjunct Assistant Professor of Transportation Planning*, 1975, 1974. B.S., 1960, Florida State University; M.U.P., 1962, University of Washington.
- Bass, David E., *Adjunct Professor of Zoology*, 1965. A.B., 1932, Brown University; M.A., 1951, Ph.D., 1953, Boston University.
- Biberman, Lucien M., *Adjunct Professor of Electrical Engineering*, 1972. B.S., 1940, Rensselaer Polytechnic Institute.
- Burdo, Ronald Arnold, *Adjunct Assistant Professor of Chemistry*, 1975. B.S., 1967, Fordham University; M.S., 1969, Cornell University.
- Cabelli, Victor J., *Adjunct Professor of Microbiology*, 1965. A.B., 1948, Ph.D., 1951, University of California, Los Angeles.
- Cardinale, George J., *Adjunct Associate Professor of Pharmacology & Toxicology*, 1975. B.S., 1957, Fordham University; Ph.D., 1965, Ohio State University.
- Carlson, Gary P., *Adjunct Associate Professor of Pharmacology & Toxicology*, 1976. B.S., 1965, St. Bonaventure University; Ph.D., 1969, University of Chicago.
- Chapple, Paul J., *Adjunct Professor of Microbiology*, 1975. B.S., 1957, Ph.D., 1960, University of Bristol.
- Coduri, Richard J., Jr., *Adjunct Assistant Professor of Food and Resource Chemistry*, 1976, 1972. B.S., 1964, M.S., 1971, University of Rhode Island.
- Cooper, George N., *Adjunct Assistant Professor of Electrical Engineering*, 1974. B.A., 1957, St. Joseph's College; M.D., 1961, Seton Hall College of Medicine.
- Crenshaw, John W., Jr., *Adjunct Professor of Zoology*, 1972, 1967. B.A., 1948, Emory University; M.S., 1951, University of Georgia; Ph.D., 1955, University of Florida.
- Dardiri, Ahmed H., *Adjunct Professor of Animal Pathology*, 1968. B.V.S., 1939; M.V.S., 1945, Cairo Vet. College; M.S., 1939, Ph.D., 1950, Michigan State University.
- DeBoer, Jelle, *Adjunct Professor of Oceanography*, 1969. B.S., 1958, M.S., 1961, Ph.D., 1963, University of Utrecht.
- DiMeglio, A. Francis, *Adjunct Associate Professor of Nuclear Engineering*, 1965. B.S., 1952, Providence College.
- DiNapoli, Frederick R., *Adjunct Assistant Professor of Ocean Engineering*, 1970. B.S., 1962; M.A., 1965; Ph.D., 1969, University of Rhode Island.
- Douglas, William Henry James, *Adjunct Associate Professor of Biochemistry*, 1975. B.S., 1963, State University of New York at Plattsburgh; M.A.T., 1967, Ph.D., 1970, Brown University.
- Dowling, Herndon G., *Adjunct Professor of Zoology*, 1964. B.S., 1942, University of Alabama; M.S., 1948, University of Florida; Ph.D., 1951, University of Michigan.
- Doyle, Michael, *Adjunct Assistant Professor of Nuclear Engineering*, 1965. B.S., 1958, Scranton University.
- Eisler, Ronald, *Adjunct Professor of Oceanography*, 1970. B.A., 1952, New York University; M.S., 1957, Ph.D., 1961, University of Washington.
- Gibbs, Robert H., *Adjunct Professor of Zoology*, 1971. A.B., 1951, Ph.D., 1955, Cornell University.
- Hall, James A., *Adjunct Professor of Electrical Engineering*, 1973. B.S., 1942, Brown University; Ph.D., 1971, University of Rhode Island.
- Hammond, Rupert P., *Adjunct Professor of Biochemistry*, 1970. B.S., 1955, Northeastern State College; M.S., 1958, State University of Iowa; Ph.D., 1968, Brown University.
- Holt, Sidney J., *Adjunct Professor of Oceanography*, 1972. B.Sc., 1945, B.Sc. (Special), 1946, D.Sc., 1966, University of Reading.
- Hutchison, Victor H., *Adjunct Professor of Zoology*, 1970. B.S., 1952, North Georgia College; M.A., 1956, Ph.D., 1959, Duke University.
- Imbrie, John, *Adjunct Professor of Oceanography*, 1976. B.A., 1948, Princeton University; M.S., 1949, Ph.D., 1951, Yale University.
- Kaplan, Arthur M., *Adjunct Professor of Plant Pathology-Entomology*, 1969. B.S., 1939, Massachusetts State College; M.S., 1941, Washington State College; Ph.D., 1948, University of Massachusetts.
- Karkalas, Yani, *Adjunct Professor of Pharmacology-Toxicology and Psychology*, 1970, 1969. B.S., 1948, M.D., 1953, University of Istanbul.
- Karlson, Karl E., *Adjunct Professor of Electrical Engineering*, 1974. B.S., 1942, Bethel College; M.B., 1944, M.D., 1945, Ph.D., 1952, University of Minnesota.
- Krause, Dale Curtiss, *Adjunct Professor of Oceanography*, 1973, 1962. B.S., 1952, California Institute of Technology; M.S., 1957, Ph.D., 1961, University of California.
- LaMarche, Paul H., *Adjunct Professor of Zoology*,

1973. B.S., Boston College; M.D., Boston University School of Medicine.
- Levin, Morris A., *Adjunct Associate Professor of Civil and Environmental Engineering and Microbiology*, 1974. B.A., 1957, University of Chicago; Ph.D., 1970, University of Rhode Island.
- Liu, Oscar Chum, *Adjunct Professor of Animal Pathology*, 1965. M.D., 1943, Cheeloo University; D.M.Sc., 1952, University of Pennsylvania.
- Lundgren, Raymond G., Jr., *Adjunct Associate Professor of Pharmacology & Toxicology*, 1975. B.S., 1954; M.S., 1960, University of Rhode Island; Ph.D., 1963, University of Missouri.
- McCormick, Neil G., *Adjunct Professor of Microbiology*, 1975. B.S., 1951, M.S., 1957, Ph.D., 1960, University of Washington.
- Miller, Eugene, *Adjunct Assistant Professor of Pharmacology and Toxicology*, 1970. B.Sc., 1955, Butler University; Ph.D., 1967, University of Chicago.
- Modest, Edward J., *Adjunct Professor of Medicinal Chemistry*, 1971, 1968. A.B., 1943, Harvard College; A.M., 1947, Ph.D., 1949, Harvard University.
- Moffett, Mark B., *Adjunct Associate Professor of Ocean Engineering*, 1974, 1970. B.S., M.S., 1959, Massachusetts Institute of Technology; Ph.D., 1970, Brown University.
- Most, Albert S., *Adjunct Assistant Professor of Electrical Engineering*, 1974. B.S., 1958, Amherst College; M.D., 1962, The Johns Hopkins University.
- Nakanishi, Koji, *Adjunct Professor of Pharmacognosy*, 1974. B.S., 1947, Ph.D., 1954, Nagoya University.
- Phelps, Donald K., *Adjunct Assistant Professor of Oceanography*, 1969. B.A., 1951, M.S., 1958, Ph.D., 1964, University of Rhode Island.
- Pogacar, Srecko J., *Adjunct Assistant Professor of Pharmacology*, 1969. M.D., 1953, University of Ljubljana.
- Prager, Jan C., *Adjunct Associate Professor of Microbiology*, 1967. B.Sc., 1954, M.Sc., 1956, University of Cincinnati; Ph.D., 1961, New York University.
- Sahagian, Charles S., *Adjunct Assistant Professor of Chemical Engineering*, 1970. B.S., 1950, Boston College.
- Schaefer, Karl E., *Adjunct Professor of Zoology*, 1965. M.D., 1936, University of Kiel.
- Schneider, Eric, *Adjunct Professor of Oceanography*, 1974. B.A., 1962, University of Delaware; M.S., 1965, Ph.D., 1969, Columbia University.
- Sherman, Charles H., *Adjunct Associate Professor of Ocean Engineering*, 1974. B.A., 1950, Massachusetts Institute of Technology; M.S., 1957, Ph.D., 1962, University of Connecticut.
- Shonting, David H., *Adjunct Professor of Oceanography*, 1975. B.S., 1955, M.S., 1958, University of New Hampshire; Sc.D., 1966, Massachusetts Institute of Technology.
- Silverman, Gerald, *Adjunct Professor of Food and Nutritional Science*, 1969. B.S., 1950, M.S., 1952, Ph.D., 1954, Cornell University.
- Simmons, Emory G., *Adjunct Professor of Botany*, 1972. A.B., 1941, Wabash College; A.M., 1946, DePauw University; Ph.D., 1950, University of Michigan.
- Smart, Mollie S., *Adjunct Professor of Child Development and Family Relations*, 1973, 1954. B.A., 1936, University of Toronto; M.A., 1940, University of Michigan; Ph.D., 1970, University of Delhi.
- Smith, James R., *Adjunct Associate Professor of Pharmacology & Toxicology*, 1976. B.S., 1963, University of Missouri; M.Ph., 1968, Ph.D., 1970, Yale University.
- Spano, Leo A., *Adjunct Assistant Professor of Chemical Engineering*, 1967. B.S., 1943, M.S., 1948, University of Rhode Island.
- Sturges, Wilton III, *Adjunct Professor of Oceanography*, 1973, 1966. B.S., 1957, Alabama Polytechnic Institute; M.A., 1963, Ph.D., 1966, The Johns Hopkins University.
- Tarzwel, Clarence M., *Adjunct Professor of Plant Pathology-Entomology*, 1965. A.B., 1930, M.S., 1932, Ph.D., 1936, University of Michigan.
- Tenore, Kenneth R., *Adjunct Professor of Oceanography*, 1976. A.B., 1965, St. Anselm College; M.S., 1967, Ph.D., 1970, North Carolina State University.
- Thomas, Carol J., *Adjunct Professor of Community Planning and Area Development*, 1971. B.S., 1948, Syracuse University; M.S., 1948, University of Connecticut.
- Tilly, Lawrence J., *Adjunct Professor of Zoology*, 1974. B.S., 1952, Elmhurst College; M.S., 1953, University of Illinois; Ph.D., 1965, State University of Iowa.
- Yacowitz, Harold, *Adjunct Professor of Zoology*, 1973. B.S., 1947, M.N.S., 1948, Ph.D., 1950, Cornell University.
- Zaroogian, Gerald E., *Adjunct Associate Professor of Food and Resource Chemistry*, 1969. B.S., 1958, University of Rhode Island; M.S., 1960, Ph.D., 1963, Purdue University.
- Zirkind, Ralph, *Adjunct Professor of Electrical Engineering*, 1973. B.S., 1940, City College of New York; M.S., 1946, Illinois Institute of Technology.

## Graduate Clinical Appointments

- Gallina, Joseph N., *Clinical Associate Professor of Pharmacy*, 1970. B.S., 1960, Rutgers—The State University; Pharm.D., 1965, University of California.
- Jeffrey, Louis Paul, *Clinical Professor of Pharmacy*, 1969. B.S., 1953, M.S., 1955, Massachusetts College of Pharmacy.
- Mohrnhelm, Johanna E., *Clinical Professor of Psychology*, 1970. Cand. Med., 1944, M.D., 1949, University of Hamburg.
- Pinkus, Theodore F., *Clinical Assistant Professor of Pharmacy*, 1972. B.S., 1965, Massachusetts College of Pharmacy; Pharm.D., 1972, University of Cincinnati.
- Redmon, William C., *Clinical Professor of Psychology*, 1969. B.S., 1937, University of Kentucky; M.D., 1942, University of Cincinnati Medical School.



## Graduate School Calendar

**IMPORTANT NOTE:** Request for scheduling examinations must be submitted to the Graduate School Office at least 10 days prior to the date(s) requested. Oral and written examinations, including qualifying and comprehensive examinations and defenses of theses, will not be scheduled during periods when the University is in recess. During the winter intersession and summer session, such examinations will be scheduled only at the convenience of the faculty members involved and depending upon the availability of the candidate's program committee and additional qualified examiners. Students wishing to take any such examinations during these sessions should first check as to the availability and convenience of the faculty members. If they are not registered for course work or research during the summer session, students should register for Continuous Registration.

### Fall Semester 1976

August 10, Tuesday  
Final date for continuing students to pay fall semester bills without penalty.

September 7, Tuesday  
Graduate registration, 8:00 a.m. to 5:00 p.m., Tootell Gymnasium.  
Fees must be paid at time of registration. There is a late fee for continuing students who did not register in April, or who did not pay fall semester bills in August.

September 8, Wednesday  
Classes begin, 8:00 a.m.

September 22, Wednesday  
Final date for dropping courses without \$5 penalty fee.  
Final date for adding courses or for changing from audit to credit.  
Final date for pass/fail options.

October 4, Monday  
Final date for January master's degree candidates to submit thesis proposals.  
Final date for nominations for January graduation due.

October 9, Saturday  
ETS language examinations in French, German, Russian and Spanish.

October 11, Monday  
Holiday, Columbus Day.

October 22, Friday  
Final date for May doctoral degree candidates to submit thesis proposals.

October 25, Monday  
Holiday, Veterans Day.

October 26, Tuesday  
Monday classes meet.

October 26, Tuesday  
Final date for dropping courses without grading and to change from pass/fail option to grade.

November 1-8  
Graduate registration for 1977 spring semester, 9:00 a.m. to 4:00 p.m., Memorial Union.

November 2, Tuesday  
Holiday, Election Day.

November 25, Thursday  
Thanksgiving recess begins 8:00 a.m.

November 29, Monday  
Classes resume, 8:00 a.m.

December 10, Friday  
Final date for nominations from departments for tuition scholarships for spring semester. Nomination must be accompanied by a statement of financial need.

December 14, Tuesday  
Classes end.

December 17-23  
Final examinations.

December 22, Wednesday  
Final date for students admitted in September 1976 to submit programs of study.

December 29, Wednesday  
Last day for grades, 4:00 p.m.

January 4, Tuesday  
Final date for January candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes along with the request for oral defense of the thesis. **NO EXTENSION OF TIME WILL BE GRANTED.** Theses must be submitted at least ten days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below and note at beginning of this calendar regarding scheduling examinations during the winter intersession.

### Spring Semester 1977

January 17, Monday  
Graduate registration, 8:00 a.m. to 5:00 p.m., Tootell Gymnasium. Fees must be paid at the time of registration. There is a late fee for continuing students who did not register in November or who did not pay semester bills in December.

January 18, Tuesday  
Classes begin, 8:00 a.m.  
Final date for January degree candidates to submit master's and doctoral theses, which have been successfully defended in final form, 9:00 a.m. **NO EXTENSION OF TIME WILL BE GRANTED.**

January 21, Friday  
Final date for May master's degree candidates to submit thesis proposals.

January 21, Friday  
 Final date for nominations for May graduation.  
 Final date for submission of annual reviews of doctoral candidates.

February 1, Tuesday  
 Final date for dropping courses without \$5 penalty fee.  
 Final date for adding courses or for changing from audit to credit.  
 Final date for pass/fail options.

February 5, Saturday  
 ETS language examinations in French, German, Russian and Spanish.

March 11, Friday  
 Final date for August doctoral degree candidates to submit thesis proposals.  
 Final date for dropping courses without grading, and to change from pass/fail option to grade.  
 Final date for nominations from departments for URI Fellowships and Affirmative Action Assistantships.

March 28-April 1  
 Graduate registration for 1977 fall semester, 9:00 a.m. to 4:00 p.m., Memorial Union.

April 4, Monday  
 Spring recess begins, 8:00 a.m.

April 9, Saturday  
 ETS language examinations in French, German, Russian and Spanish.

April 11, Monday  
 Classes resume, 8:00 a.m.

April 25, Monday  
 Final date for May degree candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes, along with the request for oral defense of thesis, 9:00 a.m. NO EXTENSION OF TIME WILL BE GRANTED. Theses must be submitted at least ten days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below.  
 Final date for August master's degree and January doctoral degree candidates to submit thesis proposals.

April 29, Friday  
 Final date for nominations from departments for tuition scholarships for the 1977-78 academic year. Nominations must be accompanied by a statement of financial need.

May 6, Friday  
 Last day of classes.

May 9-14  
 Final examinations.

May 13, Friday  
 Final date for students admitted in January 1977 to submit programs of study.

May 17, Tuesday  
 Last day for grades, 4:00 p.m.

May 23, Monday  
 Final date for all May degree candidates to submit master's and doctoral theses, which have been

successfully defended in final form, 9:00 a.m. NO EXTENSION OF TIME WILL BE GRANTED.

May 29, Sunday  
 Commencement.

## Summer Session 1977

**NOTE:** All courses taken by graduate students during summer sessions are subject to the same regulations regarding inclusion in programs of study and calculation of overall academic average, etc., as are courses taken during the regular academic year. Students wishing to take directed studies or special problems courses during summer sessions must obtain individual approval for these courses from the Dean of the Summer Session unless the specific offering is listed in the *Summer Session Bulletin* for that year. Students wishing to enroll for thesis or dissertation research during summer sessions must ascertain first that their major professors and/or members of their thesis or dissertation committees will be available and are willing to provide the necessary supervision. See also the important note at the beginning of this calendar regarding scheduling of examinations, including defenses of theses, during summer sessions.

See *Summer Session Bulletin* available at Summer Session Office.

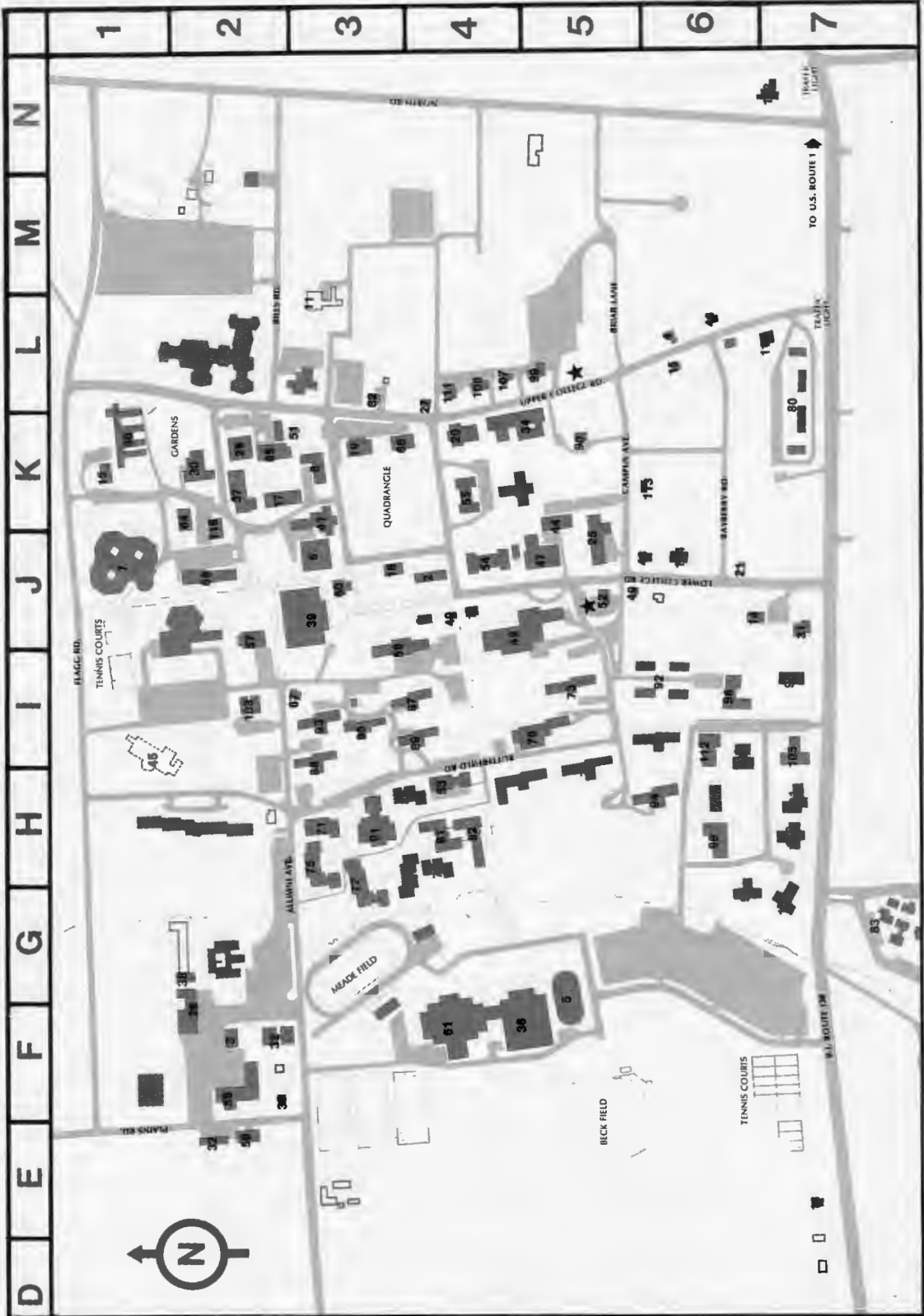
June 15, Wednesday  
 Final date for nomination for August graduation.

June 25, Saturday  
 ETS language examinations in French, German, Russian and Spanish.

August 1, Monday  
 Final date for all August degree candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes, along with the request for oral defense of the thesis. NO EXTENSION OF TIME WILL BE GRANTED. Theses must be submitted at least ten days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below.

August 8, Monday  
 Holiday, Victory Day.

August 22, Monday  
 Final date for all August degree candidates to submit master's and doctoral theses, which have been successfully defended in final form, 9:00 a.m. NO EXTENSION OF TIME WILL BE GRANTED.



# Campus Map

## Academic and Service Buildings

- |    |  |        |    |  |    |
|----|--|--------|----|--|----|
| 1  | Aquacultural Facility                                | G2     | 37 | Kelley Hall electrical engineering       | K2 |
| 2  | Administration Bldg.                                 | J4     | 38 | Lands and Grounds                        | G2 |
| 3  | Administration Services Ctr. campus mail F2          |        | 39 | Library                                  | J3 |
| 4  | Afro-American Ctr.                                   | L6     | 40 | Library School graduate                  | J3 |
| 5  | Athletic Bubble                                      | G5     | 41 | Lippitt Hall                             | K3 |
| 6  | Ballentine Hall business administration J3           |        | 42 | Memorial Union                           | J4 |
| 7  | Biological Sciences Bldg.                            | J1     | 43 | Memorial Union Annex                     | J6 |
| 8  | Bliss Hall engineering                               | K3     | 44 | Morrill Science Bldg. life sciences      | K5 |
| 9  | Business Office personnel and purchasing J4          |        | 45 | Nursing Building                         | I1 |
| 10 | Career Planning and Placement                        | J4     | 46 | Oceanography, Law of Sea                 | L6 |
| 11 | Catholic Ctr.  | L3     | 47 | Pastore Chemical Laboratory and Annex J5 |    |
| 12 | Central Receiving                                    | F1     | 49 | Pharmacy Annex                           | J5 |
| 13 | Chafee Social Science Ctr.                           | J2     | 51 | Planetarium                              | K3 |
| 14 | Child Development Ctr.                               | J6     | 52 | Police                                   | J5 |
| 15 | Community Planning                                   | L6, K1 | 53 | Potter Bldg. health services             | H4 |
| 16 | Commuters' Hostel                                    | E7     | 54 | Quinn Hall home economics                | J4 |
| 17 | Crawford Hall chemical engineering K2                |        | 55 | Ranger Hall biological sciences          | K4 |
| 18 | Davis Hall   | J3     | 56 | Rifle Range                              | E2 |
| 19 | East Hall physics                                    | K3     | 57 | Rodman Hall library annex                | J2 |
| 20 | Edwards Hall   | K4     | 58 | Roosevelt Hall                           | J3 |
| 21 | Episcopal Ctr.                                       | J6     | 59 | Sherman Bldg. maintenance                | F2 |
| 22 | Faculty Ctr.   | L3     | 60 | Taft Hall                                | J3 |
| 23 | Fine Arts Ctr.                                       | L2     | 61 | Tootell Physical Education Ctr.          | F4 |
| 24 | Fire Station   | M2     | 62 | Tucker House                             | L3 |
| 25 | Fogarty Health Science Bldg. nursing and pharmacy J5 |        | 64 | Tyler Hall computer laboratory           | K2 |
| 26 | Garage   | F2     | 65 | Wales Hall mechanical engineering K2     |    |
| 27 | Gerontology  | L4     | 66 | Washburn Hall                            | K3 |
| 28 | Gilbreth Hall industrial engineering K2              |        | 67 | Watson House                             | I3 |
| 29 | Green Hall   | K4     | 68 | Woodward Hall resource development J2    |    |
| 30 | Greenhouses  | K1, K2 |    |  |    |
| 31 | Home Management House                                | J7     |    |  |    |
| 32 | Warehouses   | F2, E2 |    |  |    |
| 34 | Independence Hall                                    | K4     |    |  |    |
| 35 | International House                                  | F2     |    |  |    |
| 36 | Keaney Gymnasium                                     | F5     |    |  |    |
| 78 | Dorr Hall  | H4     |    |  |    |
| 79 | Ellery Hall  | H4     |    |  |    |
| 80 | Faculty Apartments                                   | L7     |    |  |    |
| 81 | Fayerweather Hall                                    | H4     |    |  |    |
| 82 | Gorham Hall  | H4     |    |  |    |
| 83 | Graduate Housing                                     | G7     |    |  |    |
| 84 | Heathman Hall  | H2     |    |  |    |
| 85 | Hope Hall dining                                     | I3     |    |  |    |
| 86 | Hopkins Hall   | H4     |    |  |    |
| 87 | Hutchinson Hall                                      | I4     |    |  |    |
| 88 | Morrow Hall  | I3     |    |  |    |
| 89 | Peck Hall  | I4     |    |  |    |
| 90 | President's House                                    | K5     |    |  |    |
| 91 | Roger Williams Ctr. housing office and dining        | H3     |    |  |    |
| 92 | Student Apartments                                   | I6     |    |  |    |
| 93 | Tucker Hall  | I3     |    |  |    |
| 94 | Weldin Hall  | H6     |    |  |    |

## Fraternities and Sororities

- |     |                               |    |
|-----|-------------------------------|----|
| 95  | Alpha Chi Omega               | I7 |
| 96  | Alpha Delta Pi                | I6 |
| 97  | Alpha Xi Delta                | G6 |
| 98  | Chi Omega                     | H6 |
| 99  | Chi Phi                       | L5 |
| 101 | Delta Zeta                    | H7 |
| 102 | Lambda Chi Alpha              | N7 |
| 103 | Phi Gamma Delta               | I2 |
| 104 | Phi Kappa Psi                 | I6 |
| 105 | Phi Mu Delta                  | I7 |
| 106 | Phi Sigma Kappa               | L6 |
| 107 | Sigma Alpha Epsilon           | L4 |
| 108 | Sigma Chi                     | L4 |
| 109 | Sigma Delta Tau               | G7 |
| 110 | Sigma Kappa                   | H7 |
| 111 | Sigma Nu                      | L4 |
| 112 | Sigma Phi Epsilon             | I6 |
| 113 | Tau Epsilon Phi               | K6 |
| 114 | Tau Kappa Epsilon             | J6 |
| 115 | Theta Chi                     | L7 |
| 116 | Theta Delta Chi               | K2 |
| 117 | Zeta Beta Tau/Phi Sigma Sigma | H6 |

## ★ Information

## Residence and Dining Halls

- |    |  |    |
|----|--|----|
| 70 | Adams Hall                               | H5 |
| 71 | Aldrich Hall                             | H3 |
| 72 | Barlow Hall                              | I6 |
| 73 | Bressler Hall                            | I5 |
| 74 | Browning Hall                            | H4 |
| 75 | Burnside Hall                            | H3 |
| 76 | Butterfield Hall residence and dining I5 |    |
| 77 | Coddington Hall                          | H3 |



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