Fall 2020

CE 443-001: Foundation Design

Andrew Ciancia

NJIT New Jersey's Science & Technology University

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CE 443-001
Course Title: Foundation Design Fall 2020

Course Description:

Geotechnical review, site Investigations, selection of foundation types, and basis for design, allowable loads, and permissible settlements of shallow and deep foundations.
Computations of earth, hydrostatic and surcharge pressures for the design of retaining walls and temporary retaining walls (sheeting).

Co-requisite or Pre-requisite

CE 341 – Soil Mechanics and CE 341A – Soil Laboratory

Canvas: All course work, class power-point slides, homework, tests, assignments, etc. will be posted on Canvas

Instructor:

Andrew J. Ciancia, PE, LEED AP
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Office Hours: By appointment via e mail

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Text: Das and Sivakugan, 9th Edition, "Foundation Engineering", 2019

Course Section: 001

Date 2020 WEEK	Lecture No. Foundation Design (CE 443-001)	Subject	Homework Assignment
	ONE SESSION PER WEEK Tuesdays 1230 pm to 320 pm		Re: Das and Nagaratnam, 9th Edition, "Foundation Engineering", 2019
	Prior to Class		Read Chapter 3 , exclude 3.22-3.25 Read Chapter 2.1-2.11 and PPt Slides

9/1	1	Review of Geotechnical Investigations (Chapter 3)	Lecture 1: Chapter 3, exclude 3.22-3.25
9/1	2	Review of Soil Mechanics (Index Properties, Classifications and Seepage) (Chapter 2)	Lecture 2/Chapter 2.1-2.11 **HW**: See Canvas Read Chapter 2.12 -2.24, Read Chapter 6.1-6.2 and PPt Slides
9/15* (miss one week)	3	Review of Soil Mechanics (Effective Stress, Consolidation and Shear Strength) (Chapter 2)	Lecture 3/Chapter 2.12-2.24
9/15*	4	Introduction to Foundation Types and Performance (Chapter 6)	Lecture 4/Chapter 6.1 – 6.2 **HW:** See Canvas Read Chapter 6.3 – 6.4 Read Chapter 6.5- 6.6, 7.1- 7.4 and PPt Slides
9/22	5	Introduction to Bearing Capacity Theory #1 (Chapter 6)	Lecture 5/Chapter 6.3-6.4
9/22	6	Introduction to Bearing Capacity #2 In-Situ Tests, Water Table Variations, Layered Soil, Other Solutions (Chapter 6)	Lecture 6.5- 6,7/7.1- 7.4 **HW:** See Canvas Read Chapter 7.11, 6.10 - 6.11 Read Chapter 8.1- 8.14 and PPt Slides
9/29	7	Bearing Capacity #3 Rock Bearing, Inclined Loadings (Chapter 7)	Lecture 7/Chapters 7.11, 6.10 - 6.11

9/29	8	Stress Distribution (Chapter 8)	Lecture 8/Chapter 8.1-8.14 **HW**: See Canvas Read Chapter 9.11 – 9.13 Read Chapter 9.1 to 9.6 (exclude 9.5) and PPt Slides
10/6	9	Introduction to Settlement, and Consolidation Settlement (Chapter 9)	Lecture 9/9.11 – 9.13
10/6	10	Settlement Analyses of Granular Soils (Chapter 9)	Lecture 10/9.1-9.6 (exclude 9.5) **HW:** See Canvas Read Chapter 9.5 (Review) 9.15-9.17 and Schmertmann Analysis and PPt Slides
10/13	11	Review Schmertmann, Settlement Criteria And Presumptive Bearing Values (Chapter 9)	Lecture 11/9.5, 9.15 - 9.17
10/13	12	Summary of Bearing Capacity and Settlement Analyses Shallow Foundation Design	Lecture 12/ Review 9 (especially 9.5) **HW**: Study for Exam #1 Read Chapter 12.1-12.3
10/20		EXAM #1 (Shallow Foundations, Chapters 2, 3, 6, 7, 8 and 9)	Exam #1
10/20	13	Introduction to Deep Foundations (Chapter 12)	Lecture 13/12.1-12.3 Read Chapter12.1 to 12.6, 12.20-12.22, and Read Chapter 12.7-12.9 and PPt Slides
10/27	14	Pile Foundations Types and Installations (Chapter 12)	Review Exam #1 Lecture 14 /12.4-12.6, 12.20-12.22

10/27	15	Pile Design (Chapter 12)	Lecture 15/ 12.7-12.10 **HW***:* See Canvas Read Chapter 12.11-12.16 (exclude 12.15) and Read Chapters 12.18-12.19 and PPt Slides
11/3	16	Pile Capacity (Chapter 12)	Lecture 16/12.11-12.16 (exclude 12.15)
11/3	17	Pile Settlement (Chapter 12)	Lecture 17, Chapter 12.18-12.19 **HW:** See Canvas Read 12.17 and Read 12.24-12.27 and PPt Slides
11/10	18	Pile Load Tests (Chapter 12)	Lecture 18, Chapter 12.17
11/10	19	Design/Construction of Pile Groups (Chapter 12)	Lecture 19 , Chapter12.24-12.27 **HW** – See Canvas Read Chapter 13.1-13.14 and Read Chapter 12.13 (review), 12.15 and PPt Slides
11/17	20	Design/Construction of Drilled Shafts Chapter 13	Lecture 20 , Chapter 13.1-13.14
11/17	21	Other Drilled Piles Chapter 12	Lecture 21, Chapter 12.13, 12.15 **HW** – Study for Exam #2 (Chapters 12 and 13) Read Chapter 16.1-16.2
11/24		EXAM #2 (Deep Foundations, Chapters 12 and 13)	Exam #2
11/24	22	Introduction to Earth Retaining Systems and Lateral Earth Pressures (At Rest) (Chapter 16)	Lecture 22, Chapter 16.1 - 16.2 **HW** See Canvas Read Chapter 16.3-16.8 Read Chapter 16.11 -16.15, and PPt Slides
12/1	23	Lateral Earth Pressure (Active) (Chapter 16)	Lecture 23, Chapter 16.3-16.8
12/1	24	Lateral Earth Pressure (Passive) (Chapter16)	Lecture 24, Chapter 16.11 to 16.15 **HW** See Canvas Read Chapter 17.1-17.8, 18.1-18.4, and 19.1-19.3, and PPt Slides

12/8	25	Design of Retaining Walls (Chapter 17)	Lecture 25, Chapter 17.1-17.8
12/8	26	Design of Sheet-Pile Walls and Braced Cuts (Chapters 18 and 19)	Lecture 26, 18.1-18.4, 19.1-19.3, and PPt Slides **HW**- Study for Final
TBD		EXAM #3 (Lateral Earth Pressures, Retaining Walls, Sheet Pile Walls, and Braced Cuts, Chapters 16-19)	Exam , Chapters 16-19

Grading Policy:

Attendance, Class Participation, and Quizzes 15%
Homework Problems 10% (Late HW submittals are not accepted, see below)
Exam 1 - 25%, Exam #2- 25%
Final Exam 25%

Exams are open book. However, only your book, class notes, HW problems, and a stand-alone calculator maybe used for exams. No solutions manuals, cell phones or computers are permitted. Homework is due no later than 1 hour before the beginning of each class. Late homework will incur a 50% deduction if handed in late the same day and 100% deduction after that. Online submissions are via Canvas

Quizzes (expect at least 3 to 4)

2 Exams	50 points
Final Exam	25 points
Homework	10 points
Quizzes, Class Participation.	15 points
Total	100 points

Grading Scale:

A: 100-90
B+: 89-85
B: 84-80
C+: 79-75
C: 74-70
D: 69-60
F: Below 60

Attendance Policy:

• The NJIT Honor Code will be upheld and any violations will be brought to the immediate attention of Dean of Students.
• Students will be notified by the instructor to any modifications or deviations from the syllabus throughout the semester.

• **Absence from 4 or more classed may result in a failing grade for the course.**
• Make sure that your email address stated in Canvas is correct and you are using it regularly. Communication

from the instructor will be sent only to the NJIT (Canvas) e-mail address.
• Always bring your textbook, a calculator and writing paper to WebEx.
• All material handed out, posted, or discussed in class by the instructor will be part of course material and students will be responsible for studying them in addition to the prescribed sections of the text book.
• Homework/projects must be done on 8 ½" × 11" engineering calculation paper, in a manner consistent with professional engineering calculation in practice.
• Please keep a copy of all your work until you received a final grade.
• Please save a copy of your homework before submitting it to the instructor, since it may not be always possible for the instructor to return the corrected homework back in time for you to study for quizzes and examinations.
• All work should be done in a professional manner.
• **Homework is due no later than 1 hour before the beginning of each class. Late homework will incur a 50% deduction if handed in late the same day and 100% deduction after that. Online submissions are via Canvas**
• The instructor may photocopy and save your assignments and tests, as part of the effort necessary to renew accreditation of our educational programs. The copies, which will be accessible only to faculty, administration, and external reviewers, will be destroyed afterwards.
• No make-up examination will be administered.
• Switch off laptops and cell phones during quizzes and examinations. Plan on bringing a watch to keep time during examinations.
• No recording devices shall be used during class or examinations. Take notes.

Withdrawals:

In order to insure consistency and fairness in application of the NJIT policy on withdrawals, student requests for withdrawals after the deadline will not be permitted unless extenuating circumstances (e.g., major family emergency or substantial medical difficulty) are documented. The course Professors and the Dean of Students are the principal points of contact for students considering withdrawals.

NJIT Academic Intergrity:

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf.

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. ***Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.*** *If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*

Assignment Policy:

Exams and quizzes are open book. However, only your book, class notes, HW problems, and a stand-alone calculator maybe used for exams. No solutions manuals, cell phones or computers are permitted.

There will be no extra credit available for this course.

HOMEWORK: Written assignments are to be submitted in class via Canvas ON OR BEFORE the due date. Late homework on the due date will incur a 50% deduction, after the due date a 100% deduction will apply. All homework assignments shall be submitted via Canvas with accompanying figures, tables, drawings, calculations, etc. The following information shall be included:
1. Your name
2. Date
3. Course Title and Number
4. Person to whom it is being submitted.
5. A brief statement of the assignment purpose (what was requested, who authorized it and what you did).
6. Reference to any drawings, figures, charts etc. – identify and important information that they contain.
7. Description of what information was obtained and used to solve the problem.

8. Important results clearly identified.
9. Appropriate conclusions and recommendations, if required.
10. All sources cited
11. If you assume soil property value you need provide a justification and cite your source.
12. Homework/projects must be done on 8 ½" × 11" engineering calculation paper, in a manner consistent with professional engineering calculation in practice.

Syllabus Information:

The dates and topics of the syllabus are subject to change; however, students will be consulted with and must agree to any modifications or deviations from the syllabus throughout the course of the semester.

Email Policy: all e-mails via Canvas

Items Required for this Course:

A. Bring your textbook, writing paper, and a calculator to each WebEx class.
B. Students should read the chapter and power point slides related to the topic that will be covered in the class before the class
C. Students are encourage to ask questions about the material covered in the class. This will be used as feedback and can be on a topic that was not clearly comprehended.
D. Zero points if engineering and graph papers are not used for your homework and exam.

Outcomes Course Matrix

Strategies, Actions and Assignments	ABET Student Outcomes (1-7)	Program Educational Objectives	Assessment Measures
Student Learning Outcome 1: Review properties of soils and the basic principles of soil mechanics. Review the ability to apply these principles to solving geotechnical design problems in civil engineering.			
Review index properties of soils and subsurface investigations.	1	1	Homework, quizzes and exams.
Present principals of shallow and deep foundation design, capacity, settlement and testing	1	1, 2	Homework, quizzes, and problem solving in class.
Introduce professional geotechnical design practice for retaining walls and sheeted excavations	2, 7	1, 2	Class discussions and problem solving. Quizzes and exams.
Student Learning Outcome 2: Apply principles of effective and total stress, stress distribution, and soil and hydrostatic properties to shallow and deep foundation design			
Apply basic concepts of effective stress, stress distribution, and soil and hydrostatic properties	1	1	Homework, quizzes and exams.
Apply these principles to shallow and deep foundation design analyses.	1, 2	1	Homework, quizzes, and problem solving in class.

Discuss application of these principles to geotechnical foundation problems.	2	1	Class discussions and problem solving. Quizzes and exams.
Student Learning Outcome 3: Apply geotechnical principles to compute and evaluate forces on, and stability of, retaining walls and sheeting			
Apply basic concepts of total/effective stress, stress distribution, and soil and hydrostatic properties to identify lateral and vertical loadings on walls	1	1	Homework, quizzes, and exams.
Discuss analytical methods to compute soil/hydrostatic/surcharge forces on retaining walls and sheeting	2	1	Homework, quizzes, and problem solving in class.
Discuss professional design practices to address soil/hydrostatic/surcharge loadings to design retaining wall systems and sheeting.	2, 4	1, 2	Class discussions, problem analyses, and problem solving.

CEE Mission, Program Educational Objectives and Student Outcomes

The mission of the Department of Civil and Environmental Engineering is:

- to educate a diverse student body to be employed in the engineering profession
- to encourage research and scholarship among our faculty and students
- to promote service to the engineering profession and society

Our Program Educational Objectives are reflected in the achievements of our recent alumni:

1. Engineering Practice: Alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working toward safe, practical, sustainable solutions in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.
2. Professional Growth: Alumni will advance their technical and interpersonal skills through professional growth and development activities such a graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as business and law through further education.
3. Service: Alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, educational institutions, civic organizations, charitable giving and other humanitarian endeavors.

Our Student Outcomes are what students are expected to know and be able to do by the time of their graduation:

1. an ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety and welfare, as well as global, cultural, social, environmental and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies