CE 443 Foundation Design

Text: Principles of Foundation Engineering 10th ed; Das, 2014
Cengage Learning ISBN: 978-1337705028

Prerequisites: CE 341, CE 341A.

Objectives: Students will be provided insights into the following foundation design topics - site investigation, selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations, and computations of earth pressure and design of retaining walls.

Instructor: Dr. Vatsal A. Shah, PE
Class Hours: Wednesdays, 10am to 1pm
Office: via e-mail at Vatsal.Shah@ansgeo.com OR vas9@njit.edu
Phone: (908) 754-8800
Office Hours: Wednesday, 1pm to 2pm (following class) and by appointment

Week	Topic
1	Review of Soil Mechanics and Geotechnical Investigations
2	Shear Strength and Bearing Capacity Theory
3	Application of Bearing Capacity Theory
4	Bearing Stresses and Elastic Settlement
5	Consolidation Settlement
6	Design of Shallow Foundations
7	Midterm Examination
8	Pile Foundations- Types and Installations
9	Pile Capacity and Settlements
10	Design/Construction of Pile Groups
11	Design/Construction of Drilled Shafts
12	Lateral Earth Pressure
13	Lateral Earth Pressure and Design of Retaining Walls
14	Design of Retaining Walls
15	Final Exam

Attendance: Attendance and class participation are mandatory. It is your responsibility to obtain the materials presented and submit homework as assigned on the date due. It is suggested you contact your group to obtain the materials you missed or send homework to a group member BEFORE it is due.

Your overall grade will be based on the following:
20% - Weekly quizzes, 10% - Homework, 35% - Midterm, 35% - Final

Grading structure:
100 – 90: A 89 – 86 : B+ 85 – 80: B 79 – 74: C+ 73 – 70 : C 69 – 60: D 59 – 0 : F

A quiz will be given each class based on each material covered in the previous class. There will be two questions: the first will be conceptual to evaluate theory of the material covered in the previous week; the second will practical to apply theory and test comprehension. A missed quiz (due to absence or tardiness to class) will be assigned a grade of zero. A minimum passing grade of 50% for quizzes will be required to pass the course. Absence from 4 or more quizzes will result in a failing grade for the course.

All examinations will be open book, open notes. Bring your own paper to exams.

5 full points from your final grade will be deducted if a cellphone is used during class; please step out to use phone if it is an emergency. You would not start using your phone in the middle of an important meeting at work- only one warning will be given.

3 optional “practice problems”, will be available during the course as extra credit. One problem can be completed which will be worth up to 5 full points added to your final grade. Problems are based on actual design problems encountered in practice by the instructor. Topics available include:

1. Shallow footing design (sonotube, ringwall, or conventional spread footing)
2. Pile design for marine structure, airport terminal, or warehouse building
3. Design of reinforced segmental block retaining wall (internal and global stability)

*Field visits throughout the duration of the class may be organized by the instructor to a “real-world” construction site or investigation area to put theory to practice. Attendance may be limited to 5-7 individuals and will be on a first-come basis. Appropriate safety gear (steel-toed boots) and appropriate field clothing will be required to attend. Hard hats, safety vest, safety glasses, noise protection will likely be provided.

HOMEWORK: Written assignments are to be submitted in class on paper ON OR BEFORE the due date. Electronic submission will not be accepted. 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 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.

Additional requirements and notices:

A. Bring your textbook and a calculator to each class.
B. Students should read the chapter 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 exams.

Note: 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 ”

USE OF AI:

Student use of artificial intelligence (AI) is permitted in this course for certain assignments and activities. It is not permitted to be used in assignments which require calculations, or during the use of examinations and quizzes as doing so would undermine student learning and achievement of course learning outcomes.

If and when AI is used by the student in this course, the AI must be cited as is shown within the NJIT Library AI citation page for AI.

CE 443 – Foundation Design

Description:

Site Investigations, selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations. Computations of earth pressures and design of retaining walls.

Prerequisites: CE 341 – Soil Mechanics
CE 341A – Soil Laboratory

Textbook(s)/Materials Required:

Das, B.M., Principles of Foundation Engineering, 10th Edition
ISBN#: 978-0495668107

Course Objectives:

1. Learn subsurface exploration techniques and apply them to design of foundations and retaining walls.
2. Apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity and settlement calculations
3. Compute the lateral earth pressure, select size of retaining walls and ensure safety against external forces and moments.

Topics:

Review of Soil Mechanics and Subsurface investigation
Bearing Capacity
Settlement Calculations
Pile Foundations
Pile Groups, Caissons and Drilled Piers
Lateral Earth Pressure Theory
Design of Retaining Walls

Schedule: Lecture Recitation 3 hour class, once a week
Laboratory - none

Professional Component: Engineering Topics (Design)

Program Objectives Addressed: 1, 2

Course Objective Matrix – CE 443 Foundation Design

Strategies and Actions	Student Learning Outcomes	Outcomes (a-n)	Program Objectives	Assessment Methods/Metrics
Course Objective 1: Learn subsurface exploration techniques and apply them to design of foundations and retaining walls				
Present subsurface exploration methods and their applications to engineering designs.	Students will understand and apply subsurface exploration methods in design of foundations.	b, e, k	1	Field visits, homework, quizzes and examinations.
Course Objective 2: Apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity and settlement calculations				
Present analytical methods to determine bearing capacity of foundations and their settlements.	Students will understand and apply analytical methods in design of shallow and deep foundations.	c, i, k	1	Homework, quizzes, examinations and design projects.
Show empirical methods and those found in codes in design of foundation.	Students will learn the relationship between empirical methods, theoretical concepts and design requirements in codes.	e, k	1, 2	Homework, quizzes, Examinations and design projects.
Help students understand as to what to look for in professional design practice.	Students will develop ability to visualize, formulate, analyze and solve problems in specialty sub-disciplines within civil engineering.	b, c, h, i, o	1, 2	Class/group discussion, homework, quizzes, and examinations.
Course Objective 3: Compute the lateral earth pressure, select size of retaining walls and ensure safety against external forces and moments.				
Present the theory of lateral earth pressure and equilibrium of rigid bodies	Students will understand and use engineering mechanics and soil mechanics concepts in design of retaining walls.	a, c	1	Homework, Quizzes, examinations and design projects.
Help students understand as to what to look for in professional design practice.	Students will develop ability to visualize, formulate, analyze and solve problems in specialty sub-disciplines within civil engineering.	b, c, h, i, o	1, 2	Class/group discussion, homework, quizzes, and examinations.

CEE Mission, Program Objectives and Program 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 objectives are reflected in the achievements of our recent alumni.

1 – Engineering Practice: Recent alumni will successfully engage in the practice of civil engineering within industry, government, and private practice, working in a wide array of technical specialties including construction, environmental, geotechnical, structural, transportation, and water resources.

2 – Professional Growth: Recent alumni will advance their skills through professional growth and development activities such as graduate study in engineering, professional registration, and continuing education; some graduates will transition into other professional fields such as business and law through further education.

3 – Service: Recent alumni will perform service to society and the engineering profession through membership and participation in professional societies, government, civic organizations, and humanitarian endeavors.

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

(a) ability to apply knowledge of math, science, and engineering
(b) ability to design and conduct experiments, as well as interpret data
(c) ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of ethical and professional responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) ability to use techniques, skills and modern engineering tools necessary for engineering practice
(l) an understanding of management and leadership principles and techniques
(m) take the FE examination as the first step toward professional licensure
(n) an ability to find professional level employment or pursue an advanced degree