Fall 2019

CE 443-103: Foundation Design

Vatsal Shah

JOHN A. REIF, JR. DEPARTMENT OF
CIVIL AND ENVIRONMENTAL ENGINEERING

NJIT New Jersey Institute of Technology

CE 443 Foundation Design **Fall 2019**
Section: 103

Instructor: Dr. Vatsal A. Shah, PE
Class Hours: Wed, 6pm – 9pm - FMH Room 305
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Office Hours: Wednesdays, 9pm – 10pm (following class) and by appointment

Text: Principles of Foundation Engineering 9th Ed. Das, 2014 Cengage Learning
ISBN: 978-133778

Prerequisites: CE 341, CE 341A. Site investigation, selection of foundation types and basis for design, allowable loads, and permissible settlements of shallow and deep foundations. Computations of earth pressure and design of retaining walls.

Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is you responsibility to protect your educational investment by knowing and following the academic code of integrity policy 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

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.

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:
10% - Weekly quizzes, 30% - Homework, 30% - Midterm, 30% - 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 from 6:00-6:10 PM. 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 70% 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: The NJIT Honor Code will be upheld, and that any violations will be brought to the immediate attention of the Dean of Students. Also, students will be consulted by the instructor and all must agree to any modifications or deviations from the syllabus throughout the course of the semester.

Department of Civil and Environmental Engineering

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 Geotechnical Engineering, 6th Edition, Brooks/Cole, ISBN#: 053438742X

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

Prepared By: Prof. Meegoda **Date:** 10/08/16

CE 443 Foundation Design

Strategies, Actions, Assignments	Assessment Measures	ABET Student Outcomes (1-7)	Program Educational Objectives
Student Learning Outcome 1: Apply subsurface exploration techniques and laboratory tests in design of foundations and retaining walls.			
Develop a site report based on field and laboratory data	Technical report assessment rubric	1, 3, 6	1, 2
Student Learning Outcome 2: Apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity and settlement calculations			
Students will learn and apply analytical methods incorporating soil mechanics concepts in design of shallow and deep foundations.	Homework, quizzes and examinations.	1, 2	1
Students will learn the relationship between empirical methods, theoretical concepts and design requirements in codes.	Homework, quizzes and examinations.	2, 4	1, 2
Students will visualize, formulate, analyze and design foundations.	Class/group discussions, homework, quizzes, and examinations.	1, 2, 5	1, 2
Student Learning Outcome 3: Compute the lateral earth pressure, select size of retaining walls to ensure safety against external forces and moments as well as excessive settlements.			
Students will learn and use engineering mechanics and soil mechanics concepts in design of retaining walls.	Homework, quizzes and examinations.	1, 2	1
Students will learn the relationship between empirical methods, theoretical concepts and design requirements in codes.	Homework, quizzes and examinations.	2, 4	1, 2
Students visualize, formulate, analyze and retaining walls.	Class/group discussion, homework, quizzes, and examinations.	1, 2, 5	1

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 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 skills through professional growth and development activities such as 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

Revised: 2/13/18