

Spring 2020

## **CE 443-102: Foundation Design**

Matthew Riegel

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DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

**CE 443-141 Foundation Design - Spring 2020**

**General Course Information**

**Instructors:** **Matthew Riegel, PE, D GE**  
 Office - 261 Thursday, 3pm to 6pm and 9pm – 10pm (following class) and by appointment  
**e-mail: mdriegel@hntb.com** 973-632-7541 (Cell)  
 Outside office hours please contact me via e-mail or cell phone.

**Text:** Principles of Foundation Engineering 8<sup>th</sup> ed; Das, 2014  
 Cengage Learning ISBN: 9781305081550

**Spring 2020:6:00 pm – 8:50 pm CKB 313 Thu. January 23, 2020- May 14, 2020 Prerequisites: CE 341, CE 341A.**

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.

Week	Date	Topic
1	1-23	Review –Shear Strength and Consolidation; Geotechnical Investigations
2	1-30	Shear Strength and Bearing Capacity Theory
3	2-6	Application of Bearing Capacity Theory
4	2-13	Bearing Stresses and Elastic Settlement
5	2-20	Consolidation Settlement
6	2-27	Design of Shallow Foundations
7	3-5	Midterm Examination
8	3-12	Pile Foundations- Types and Installations
	<b>3-19</b>	<b>No Class – Spring Break</b>
9	3-26	Pile Capacity and Settlements
10	4-2	Design/Construction of Pile Groups
11	4-9	Design/Construction of Drilled Shafts
12	4-16	Lateral Earth Pressure
13	4-23	Lateral Earth Pressure and Retaining Wall Design
14	4-30	Design of Retaining Walls
	<b>5-7</b>	<b>No Class – Reading Day</b>
15	5-14	Final Examination



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**Attendance:** Attendance: Attendance and class participation are mandatory. If you are unable to attend instructor should be informed prior to the class. It is your responsibility to obtain the materials presented and submit homework as assigned on the date due. It is suggested you contact a fellow student to provide you with the materials missed.

January 20 Monday Martin Luther King, Jr. Day  
January 21 Tuesday First Day of Classes  
January 25 Saturday Saturday Classes Begin  
January 31 Friday Last Day to Add/Drop a Class  
January 31 Friday Last Day for 100% Refund, Full or Partial Withdrawal  
February 1 Saturday W Grades Posted for Course Withdrawals  
February 3 Monday Last Day for 90% Refund, Full or Partial Withdrawal - No Refund for Partial Withdrawal after this date  
February 17 Monday Last Day for 50% Refund, Full Withdrawal  
March 9 Monday Last Day for 25% Refund, Full Withdrawal  
March 15 Sunday Spring Recess Begins - No Classes Scheduled - University Open  
March 22 Sunday Spring Recess Ends  
April 6 Monday Last Day to Withdraw  
April 10 Friday Good Friday - No Classes Scheduled - University Closed  
May 5 Tuesday Friday Classes Meet  
May 5 Tuesday Last Day of Classes  
May 6 Wednesday Reading Day 1  
May 7 Thursday Reading Day 2  
May 8 Friday Final Exams Begin  
May 14 Thursday Final Exams End

**Objectives:** Students will be provided insights into the following foundation design topics –

- Soil strength, consolidation, and site investigation
- Selection of foundation types and basis for design
- Foundation loading
- Permissible settlements (service state) of shallow and deep foundations
- Stability (strength state) of shallow and deep foundations
- Slope stability



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- Computations of earth pressure and design of retaining walls.

**Grading:** Your overall grade will be based on the following:

- 10% Quizzes
- 30% Written Homework Assignments
- 30% Midterm Grade
- 30% Final Grade

The final grade will be as follows:

A	90-100
B+	86-89
B	80-85
C+	74-79
C	70-73
D	60-69
F	<59

**Policy:** All assignments will be collected on the due date prescribed; if you are absent it is your responsibility to submit the assignment on that date. Late homework will be subjected to a 50% reduction in grade for the week following its due date assignments submitted later than one week beyond the date due will not receive credit.

Mobile Phones must be turned off during class. **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 must bring your textbook and a calculator to the class. Students should read the chapter related to the topic that will be covered before the class.

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)

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.

Written assignments are to be submitted in class on paper ON OR BEFORE the due date. All examinations open book, open notes.

The Honors Code applies to this course, as it does to every NJIT course. See <http://www.njit.edu/academics/honorcode.php> . Students will be consulted with and must agree to any



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modifications or deviations from the syllabus throughout the course of the semester..

*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](mailto:dos@njit.edu)*



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**HOMEWORK**

All homework assignments shall be submitted with a short Memorandum, generally of one to two (maximum) pages of text with accompanying figures, tables, drawings, calculations, etc. The memorandum should be typed (hand written submittals will not be accepted; however, handwritten calculations are acceptable). 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.
10. All sources cited

Also include any list of symbols, figures or tables that you think are appropriate but do not obscure the important results with excessive computer output or calculation worksheets.

All calculations are to be included, all work shown and presented on engineering graph paper, hand



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**CE 443 Foundation Design**

Strategies, Actions, Assignments	Assessment Measures	ABET Student Outcomes (1-7)	Program Educational Objectives
<b>Student Learning Outcome 1:</b> 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
<b>Student Learning Outcome 2:</b> 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
<b>Student Learning Outcome 3:</b> 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



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Students visualize, formulate, analyze and retaining walls.	Class/group discussion, homework, quizzes, and examinations.	1, 2, 5	1
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## DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

### CE 443-141 Foundation Design - Spring 2020

#### General Course Information

##### **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