

Spring 2019

# CE 443-002: Foundation Design

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## Recommended Citation

Goncalves da Silva, Bruno, "CE 443-002: Foundation Design" (2019). *Civil and Environmental Engineering Syllabi*. 147.  
<https://digitalcommons.njit.edu/ce-syllabi/147>

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



**CE 443 - 002 Foundation Design – Spring 2019**

**Instructor** Dr. Bruno Gonçalves da Silva, Ph.D. Office Hours: Tuesdays, Thursdays: 10.30am-12pm  
Colton 233  
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**Prerequisite** CE 341 and CE 341A

**Required Textbook**

Das, B.M., Principles of Foundation Engineering, 8th Edition, Cengage Learning, ISBN#: 10: 1-305-08155-2

**Other Recommended Texts & Reading**

Navfac Dm7 02 Foundations and Earth Structures.pdf

**Course Description** (*from NJIT's course catalog*)

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.  
<http://catalog.njit.edu/undergraduate/newark-college-engineering/civil-environmental/#coursestext>

**Course Objectives (General)**

By the end of this course, the student will be able to:

**Site Investigation Reports:** Develop a site investigation report based on field and laboratory test. Obtain soil parameters needed for foundation design from a site investigation report

**Design of Shallow Footing:** Compute the size and depth of a footing based on allowable loads, and permissible settlements for a shallow foundation with given structural loads and site information.

**Design of Deep Foundations:** Compute the number, size and length of a pile group or drilled shaft based on allowable loads, and permissible settlements for a deep foundation with given structural loads and site information.

**Design of Retaining Walls:** Compute earth pressures and design of retaining walls based on depth of a cut and side information.

## POLICIES & PROCEDURES

**Academic Integrity:** It is expected that NJIT's University Code on Academic Integrity will be followed in all matters related to this course. Refer to NJIT's Dean of Students website to become familiar with the Code on Academic Integrity and how to avoid Code violations.

<https://www.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>

**Communication:** All communications by the instructor will be during the class and via e-mail. It is your responsibility to check your e-mail regularly. If you prefer to use a private e-mail account, please inform the instructor.

**Lectures/Class:** Attendance to all lecture/class periods is expected. Absence of 4 or more classes will result in a failing grade for the course. During the class instructor will often ask you to work on a problem or brainstorm ideas with the people next to you and you will be called on to provide one or more of your answers. The goal of this in-class work is to get you started on a problem (not necessarily finish) that will then be discussed. Please turn off your cell phones during class.

**Quizzes:** Seven quizzes will be given based on each material covered in the previous class. There will be four questions: two will be conceptual to evaluate theory of the material covered in the previous week; the other two will be practical to apply theory and test comprehension. Each question will be worth 25% of the total grade of the quiz. These quizzes will be given either at the beginning or at the end of the class. A grade of zero will be assigned to a missed quiz (due to absence or tardiness to class). A minimum of 4 quizzes with grade >50% are required to pass the class.

**Handouts:** Copies of presentations will be e-mailed throughout the semester at least one day before the lecture.

**Homework:** It is expected that all homework be presented in an organized manner; use green, yellow or white engineering paper, one side of each page (clear side, not grid side); begin each problem on a new page and number all pages; staple all homework pages together and have your name written clearly on the front page.

**Homework Format:** Homework questions will be graded in terms of a ten point scheme based on three categories of format, concept, and execution. All homework questions will be equally weighted in determining your final homework grade.

### *Format*

One (1) point will be awarded if the solution is formatted with a problem statement and a statement on what is required in the solution

One (1) additional point will be awarded if the engineering solution is presented in an organized and neat fashion that is easy to follow along.

One (1) additional point will be awarded if the solution is completed with a boxed-in answer, including a properly formatted drawing if it is requested in the problem statement.

### *Concept*

One (1) point will be awarded if the solution has major errors in the conceptual basis of the solution.

Two (2) points will be awarded if the solution has minor errors in the conceptual basis of the solution.

Three (3) points will be awarded if the solution has no errors in the conceptual basis of the solution.

### *Execution*

One (1) point will be awarded if the solution has two or more math or execution errors.

Three (3) points will be awarded if the solution has one math or execution error.

Four (4) points will be awarded if the solution has zero math or execution errors.

**Late Homework:** Homework will be due at the beginning of class on the date it is due. Late Homework will be accepted up to two day after the due date with a 10% reduction for each day that it is late. After that time they will not be accepted. Turn in late homework to the Instructor by 5pm the day after the due date- be sure to hand it in by

**Homework Solutions:** Homework solutions will be posted two days after the homework is due. It is your responsibility to make sure you understand how to solve the problems by attending office hours with the instructor and/or asking questions in class. As with many engineering problems, multiple solutions may be possible. This means that all rational solutions to the assignments will be accepted.

**Exams:** There will be one midterm exam held during class time and one comprehensive final exam as scheduled by the University Registrar.

**Calculation of Course Grade:** A weighted average grade will be calculated as follows:

- 20% - Quizzes a total of 7
- 10% - Homework
- 10% - Class Participation
- 30% - Midterm
- 30% - Final

The minimum requirements for final letter grades are as follows:

A = 90.0%, B+ = 85.0%, B = 80.0%, C+ = 75.0%, C = 70.0%, D = 65.0%, F < 60.0%

Grades are not curved in computing the final grade.

**Instructor Commitment:** You can expect the Instructor to be courteous, punctual, organized, and prepared for lecture and other class activities; to answer questions clearly; to be available during office hours or to notify you beforehand if office hours are moved; to provide a suitable guest lecturer or pre-recorded lecture when they are traveling or unavailable; and to grade uniformly and consistently.

**Students with Documented Disabilities:** NJIT is committed to providing students with documented disabilities equal access to programs and activities. If you have, or believe that you may have, a physical, medical, psychological, or learning disability that may require accommodations, please contact the Coordinator of Student Disability Services located in the Center for Counseling and Psychological Services, in Campbell Hall, Room 205, (973) 596-3414. Further information on disability services related to the self-identification, documentation and accommodation processes can be found on the webpage. at: (<http://www.njit.edu/counseling/services/disabilities.php>)

**Course Schedule:**

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	Lateral Earth Pressure
9	Lateral Earth Pressure and Design of Retaining Walls
10	Design of Retaining Walls
11	Pile Foundations- Types and Installations
12	Pile Capacity and Settlements
13	Design/Construction of Pile Groups
14	Design/Construction of Drilled Shafts
15	Final Exam

### CE 443 - 002 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
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