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

NJIT New Jersey Institute of Technology

DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

CE 495-001 Course Title: Capstone-Geotechnical Fall 2024

Course Description: Provides students with the type of design experience they would receive if engaged in a geotechnical engineering design practice including incorporating engineering standards and multiple constraints. Understand the workflow of a geotechnical engineering design practice to be engaged during the foundation design for a 12 story multi-purpose educational building project with a 50-foot-deep basement in New York City. Students will learn to interpret applicable portions of the NYC building code and associated geotechnical design provisions including design loads such as dead and live loads. They will learn to investigate an urban site, analyze subsurface conditions, design a foundation system, and also design a support of excavation system, plus develop a site monitoring program.

Co-requisite or Pre-requisite: CE-341, CE-443

Canvas: All course work will be posted on Canvas.

Instructor: Andrew J. Ciancia, PE, LEED AP
Colton Room 209
Office Hours: Mondays and Thursdays, 10 to 11 am, or by appointment.
Email: ciancia@njit.edu

Required Text: Earth Retention Systems Handbook (ERSH) by Alan Macnab Suggested Text: NAVDOC DM-7, and **Foundation Engineering by Das**

Date 2024	**Lecture No. CE 495-001** Capstone	Subject	Homework Assignment
	Mondays and Thursdays, 1130 am to 1250 pm.		

9/5	1	Introduction to Class Syllabus Review Expected End Products NJIT Student Team Formations/Team Building	**HW**: Review initial information from Canvas Module Read Chapter 2 of ERSH **Submit in Class: "What are the project challenges" to discuss 9/9 (List in Bullet Points)**

9/9	2	Discuss 1) Chapter 2 of ERSH 2) Challenges 3) Building Design 4) Existing Site Conditions, (Dimensions & Constraints)	**HW** Review Site Survey Review Building Design Read 3.1 to 3.3 of ERSH **Submit for Class: Updated list of project challenges to discuss 9/12 (List in Bullet Points)**
9/12 **9/16**	3 4	Chapter 3.1 to 3.3 of ERSH Discuss Updated List of Project Challenges NYC Building Code Introduction Chapter 7 of ERSH Classwork- Develop Subsurface Investigation Program 1) Existing Site Conditions 2) Site footprint 3) Constraints 4) Building Code **5) Cadd Set-Up**	Review NYC Building Code Review Site Survey/Elevations Read Chapter 7 of ERSH **Submit for Class: Outline of Subsurface Investigation Plan to discuss 9/16** Commence Planning/Drawing site plan and cross-sections via **Cadd**. Due 9/30 Read Chapter 8 of ERSH
9/19	5	Chapter 8 of ERSH Discuss Plans **Provide Actual Subsurface Investigation data to class** Introduce Lab Data	Review Boring Data Continue drawing site plan and commence subsurface cross-sections via **Cadd, due 9/30** Review Lab Data

9/23	6	Classwork- preparing site plan and subsurface cross-sections via **Cadd**	Work on Subsurface Plan and Cross Sections via **Cadd, Due 9/30** Identify adjacent structures, tunnels, utilities, etc.

			Review Lab Data
9/26	7	Classwork- Work on Site Plan and Subsurface Cross Sections	**HW**: Review Lab Data and **Complete/Submit Site Plan and Subsurface Cross Sections by 9/30**
9/30	8	Discuss Completed Site Plan and Subsurface Cross Sections (to be used as part of Data Report #1)	**HW: Prepare/Submit OUTLINE of geotechnical data report #1**
10/3	9	Discuss Data Report Requirements Classwork- Data Report	**HW:** Commence Preparing Data Report #1 with summary of investigation, subsurface sections, and lab data. (Data Report due 10/10)

10/7 10 Data Report Discussion/Classwork Plan and Loadings

Introduce Structural **HW: Complete and Submit Data Report #1 by 10/10/2024**

10/10 (ZOOM Class)	11	Discuss Data Report #1 Geotechnical Analyses **(ZOOM Class)**	**HW: Prepare and Submit OUTLINE of Foundation Design Issues and Requirements** Review Your Shallow and Deep Foundation Class Notes from "Foundation Engineering" by Das
10/14	12	Discuss **Outline** of Foundation Design Issues, Analyses, and Selections of Foundation Types Classwork	HW: Analyze Feasible Foundation Systems **Prepare/Submit list of Options. Design due 10/31** Review Your Shallow and Deep Foundation Class Notes from "Foundation Engineering" by Das

10/17	13	Foundation System Options Discussion Groundwater Conditions	HW: Analyses of Foundation types, Capacities and Settlement Review Your Shallow and Deep Foundation Class Notes from "Foundation Engineering" by Das
10/21	14	Foundation Design Classwork	HW: Foundation Design (Loadings, Types, Details, Etc.) Review Your Shallow and Deep Foundation Class Notes from "Foundation Engineering" by Das
10/24	15	Foundation Design Classwork	**HW: Foundation Design (Loadings, Types, Sizes, Details, etc.) and Submit Evaluation**

10/28	16	Discuss Foundation Design (Loadings, Types, Sizes, Details, etc.)	**HW: Finalize Foundation Design (Loadings, Types, Sizes, Details, etc.) and Submit 10/31**
10/31	17	Foundation Design Selected Foundation Wall Lateral Loadings (Soil and Surcharge) Class work	**HW:** Commence Foundation Design Report #2 with summary of subsurface data, Foundation Options, Calculations and Recommendations. **Due 11/7**
11/4	18	Foundation Design Report Class work	Continue Design Report #2 **HW: Complete and Submit Foundation Design Report #2 by 11/7**
11/7	19	Discuss Design Report #2 Introduce Foundation Wall Lateral Loadings (Soil and Surcharge)	HW: Review At-Rest, Active and Passive Soil Pressure Theories, Foundation wall loadings, including surcharge Read Chapters 3.5 and 9 of ERSH
11/11	20	Chapters 3.5 and 9 of ERSH Support of Excavation System (SOE) Class work	HW: Selection/Analyses of Support of Excavation System (SOE) and design requirements. SOE Design and Report #3 due 12/2 Read Chapters 9 and 10 of ERSH

11/14	21	Chapters 9 and 10 of ERSH SOE Design Class work	**HW** : Support of Excavation System (SOE) and design. Read Chapters 10 and 11 of ERSH
11/18	22	SOE Design Class work	**HW:** Commence SOE Design Report #3 (due 12/2) and Plans
11/21 **11/25**	23 24	SOE Design Class work SOE Design Monitoring of Adjacent Structures and Properties and	HW: SOE Design Report #3 and Plans Due 12/2 Read Chapters 13-15 of ERSH HW: Continue SOE Design Report #3 and Plans, and Monitoring Program. Submit Report by 12/2 Read Chapters 13-15 of ERSH by 12/2
		Criteria Class work	
11/26* **No Class 11/28 Thanksgiving**	25	SOE Design Monitoring of Adjacent Structures and Properties and Criteria Specifications	HW: Continue SOE Design Report #3 and Plans, and Monitoring Program. **Submit Report #3 by 12/2** Read Chapters 13-15 of ERSH by 12/2
12/2 **12/5** **12/9**	26 27 28	Chapters 13-15 of ERSH Discuss SOE Design #3 Report Specifications Final Report, Plans and Specifications Class work Discuss Final Report #4 Plans and Specifications	HW: Outline of Specifications Commence Compiling Final Report #4 including Plans and Specifications (due 12/9) **HW: Submit Final Design Report #4, including Plans and Specifications by 12/9** **HW**- Prepare for **Final Presentation**
TBD		**Final Presentation**	

Grading Policy:

Late Reports will not be accepted.

Reports will be discussed during the class.
Exams: No exams.

Calculation of Course Grade: A weighted average grade will be calculated as follows:
Describe how homework, project participation, presentation, and report, etc. are weighted.

Report #1 - 20 %
Report #2 - 20 %
Report #3 - 25 %
Report #4 and Final Presentation – 35%

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 = 60.0%, F < 50.0%
Grading will be judged based on weights of various assignments, in-class participation, and attendance and reports.

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.

• **Unexcused absences from more than 4 classes 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 data to Class
• 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.
• Please keep a copy of all your work until you received a final grade.
• Please save a copy of your reports before submitting it to the instructor.
• All work should be done in a professional manner.
• **Reports are due on specified due dates. Late reports will incur deduction if handed in late.**
• The instructor may photocopy and save your assignments, 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 extra credit.
• No recording devices shall be used during class. Take notes.

Withdrawals:

In order to ensure 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.

Academic Integrity

"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:

Class work is open book, with access to Cadd, and computer programs.

There will be no extra credit available for this course.

HOMEWORK: Written reports #1 to #4 and Final Design Plans/Presentation are to be submitted in class via Canvas ON OR BEFORE 1 hour before the designated dates on the syllabus. For late reports submitted after the due time (1 hour before the class) a 100% deduction will apply. All assignments shall be submitted via Canvas with accompanying figures, tables, drawings, plans, calculations, etc. The following information shall be included:

1. Your group name
2. Date
3. Course Title and Number
4. Group names 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 values, you need to provide a justification and cite your source. 12. Reports shall include 8 ½" × 11" engineering calculation paper, plus large-scale design plans 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. **All class questions addressed to Mr.**

Ciancia. Items Required for this Course:

A. Bring your notes, writing and engineering/grid paper, and a calculator to each class. B. Students should read the data provided and power point slides related to the topic that will be covered in the class before the class.

C. Students are encouraged 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. Seven ABET outcomes are:

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.

Outcomes Course Matrix

Strategies, Actions and Assignments	ABET Student Outcomes	Program Educational Outcomes	Assessment Measures
Course Objective 1: Understand the workflow of a geotechnical engineering design practice, where engaged as a team for a professional firm during the design phase for a 12 story educational mixed-use building project in New York City.			
Introduce design objectives	1	1	Summarize Objectives
Explore subsurface methods of investigation during initial design phase.		and basement depth, NYC Code requirements, and site conditions.	
Identify Site and Subsurface Conditions and Evaluate Surrounding Site Constraints. 1, 2 1, 2 Prepare site investigation program as per building size		1, 2 1, 2 Prepare Data Report with summary of geotechnical investigation, subsurface sections, and lab data.	
Course Objective 2: Learn to interpret applicable building code requirements and associated geotechnical design provisions to address design loads such as soil loads, hydrostatic loads, dead loads, and live loads.			
Analyze Subsurface Cross Sections and Lab Data	1, 2, 5 and 6	1, 2, 5 and 6	Summarize geotechnical data in a logical approach to address project and Code requirements
Perform geotechnical analyses for design of foundation system, basement slab support, perimeter foundation walls, and support of excavation systems.	1, 2, 5 and 6	1, 2, 5 and 6	Based on engineering analyses, site constraints, structural loads, and NYC Code requirements, evaluate and select feasible foundation systems and perimeter support.

Discuss Data Report and Foundation Analyses	1 to 7	1 to 7	Complete Foundation Design Report with summary of subsurface data, Foundation Options, Calculations and Recommendations.
Course Objective 3: **Understand** planning and system aligning with client's objectives and architectural vision, and design and learn finite element software for foundation analysis and design while understanding live and dead loads and lateral load path.			
Develop Outline of Geotechnical Contract Documents (Plans and Specifications)	1, 2, 5 and 6	1, 2, 5 and 6	.Geotechnical Contract Documents (Plans and Specifications)
Support of Excavation System (SOE) and Monitoring Program	1, 2, 5 and 6	1, 2, 5 and 6	Complete Design Report #3 and Foundation Contract Documents
Finalize Contract Documents	1 to 7	1 to 7	Final Presentation

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, resilient, 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 & 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: 08/12/2024