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

NJIT New Jersey Institute of Technology

CE 495-001 Course Title: Capstone-Geotechnical Fall 2025

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 site 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 design a support of excavation (SOE) system, plus develop a site monitoring program. Computer Program DeepEx will be taught and used by the students (CE Computer Lab) for the SOE design.

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

Canvas: All course work will be submitted and 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

Date 2025	**Lecture No. CE 495-001** Capstone	Subject	Homework Assignment
	Mondays and Thursdays, 1130 am to 1250 pm. (Classroom or Computer Lab)		

9/4	1	**Professor (Prof):** Introduction to Class Syllabus Review, Textbooks/Documents & Class Teaming **Course Reports** #1-Geot. Data Report #2-Fdn. Design Report #3-SOE Design Report #4-Final Design Report & 4 Memo's. CE Computer Lab	**HW**: Download & Review initial site information from Canvas Module Download FHWA and NAVFAC Documents **Each Student –** Submit Memo #1: "What are the Most Significant Geotechnical Project Challenges for the Site" by **9/11/2025** (1 page)

9/8	2	**Prof. Discussion** 1) The Site 2) Building Design 3) Existing Site Conditions **Group Classwork-** Review data	**HW** Review Site Survey Review Building Design Information on Canvas **Each Student -** Submit for Class: Memo#1: "What are the Most Significant Geotechnical Project Challenges for the Site" by **9/11/2025** (1 page)
9/11	3	**Each Student**: Present Memo #1: Significant Project Challenges **Prof**: NYC Building Code Review **Group 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 Review data on Canvas **GROUP -** Submit for Class: Subsurface Investigation Program by **9/15/2025** (1-page summary and attached site plan)
9/15 (CE Computer Lab?)	4	**Group**: Present Subsurface Investigation Program **Prof-** Provide Actual Subsurface Investigation data to class	GROUP- Commence Planning/Drawing site plan and subsurface cross-sections via Cadd. **Due 9/25/2025** Review Site and Boring Data Read NYC Code

9/18 (CE Computer Lab?)	5	**Prof:** Introduce Soil Lab Data **Group Classwork-** preparing site plan and subsurface crosssections via **Cadd** CE Computer Lab	Continue drawing site plan and commence subsurface crosssections via **Cadd, due 9/25/2025** Review Soil Lab Data
9/22 (CE Computer Lab?)	6	Group: Classwork- preparing site plan and subsurface crosssections via **Cadd** CE Computer Lab	Work on Subsurface Plan and Cross Sections via **Cadd, Due 9/25/2025** Identify adjacent structures, tunnels, utilities, etc. Review Lab Data
9/25 (CE Computer Lab?)	7	**Group**: Present Site Plan and Subsurface Cross Sections Group Classwork-Start Planning Data Report #1 CE Computer Lab	**HW**: Review Lab Data Prepare Outline of GROUP Geotechnical data report #1, Due **10/9/2025**
9/29	8	Prof: Discuss Outline of Data Report **Group Classwork-** Data Report #1	HW: **GROUP** Prepare geotechnical data report #1, **Due 10/9/2025**

10/2	**No Class Wellness Day**		
10/6	9	**Prof**: Review outline of data report and discussion **Prof:** Introduce Structural Plan and Loadings	HW**: GROUP** Complete and Submit Data Report #1 by **10/9/2025**
10/9	10	**Group**: Present Data Report #1 **Prof:** Discuss Geotechnical Analyses of Foundation Design	HW**: Memo #2; Each Student -** Prepare and Submit 1-page OUTLINE of Foundation Design Issues **(Due 10/13/25)** Review Your Shallow and Deep Foundation Class Notes from "Foundation Engineering" by Das

10/13	11	**Each Student**: Memo #2: Present OUTLINE of Foundation Design Issues **Prof**: Foundation Design Analyses, and Selections of Foundation Types Classwork	HW: Analyze Feasible Foundation Systems **Each Student- Memo #3:** Prepare/Submit a 1 page list of Foundation Options and issues due by **10/20/25**
10/16	12	**Prof** : Foundation System Discussion and Groundwater Conditions	HW: Analyses of Foundation types, Capacities and Settlement. **Each Student**: Memo #3: Foundation Options/Issues list due **10/20/25**
10/20	13	**Each Student**: Memo #3: Present Foundation Design Options (Loadings, Types, Sizes, Details, etc.) and Issues	HW: Foundation Design (Loadings, Types, Details, Etc.) **GROUP-** Finalize Foundation Design (Loadings, Types, Sizes, Details, etc.) and Submit Design Report #2 by **10/27/25**
10/23	14	**Prof**: Foundation Design **Report #2** Discussions and Foundation Design Selection	HW: **Group**: Complete Foundation Group Design with summary of subsurface data, Foundation Options, and Calculations, Due **10/27/2025**
10/27	15	**Group**: Present Design Report #2 **Prof**: Foundation Wall Lateral Loadings (Soil and Surcharge)	HW: Review At-Rest, Active and Passive Soil Pressure Theories, Foundation wall loadings, including surcharge

10/30	17	**Prof**: Lateral Soil Loadings Introduction to DeepEx Program	HW: View/Study DeepEx YouTube assignments and DeepEx Manual
11/3 (CE COMPUTER LAB)	18	**Prof**: Support of Excavation Systems (SOE) **Group**: DeepEx Classwork. CE Computer Lab	HW: Review DeepEx You-Tube assignments and DeepEx Manual

11/6 (CE COMPUTER LAB)	19	**Group**: DeepEx Classwork. **CE Computer Lab** Support of Excavation Systems (SOE)	HW: Selection/Analyses of Support of Excavation System (SOE) and design requirements. SOE Design and Report #3 due **12/4**
11/10 (CE COMPUTER LAB)	20	**Group:** DeepEx Class Work. CE Computer Lab Support of Excavation Systems (SOE)	HW: Selection/Analyses of Support of Excavation System (SOE) and design requirements. Group SOE Design and Report #3 due **12/4**
11/13 (CE COMPUTER LAB)	21	**Group:** DeepEx Class Work. Support of Excavation Systems (SOE)	HW : Support of Excavation System (SOE) and design.
11/17 (CE COMPUTER LAB)	22	**Group**: DeepEx Class Work. Support of Excavation Systems (SOE)	HW: Commence **Group** SOE Design Report #3 (**due 12/4**) and Plans
11/20 (CE COMPUTER LAB)	23	**Group**: DeepEx Class Work. Support of Excavation Systems (SOE)	HW: **Group** SOE Design Report #3 and Plans Due **12/4**
11/24 (CE COMPUTER LAB)	24	**Group**: DeepEx Class Work. Support of Excavation Systems (SOE)	HW: **Group** SOE Design Report #3 and Plans Due **12/4**
11/25 (Make-Up Class) (CE COMPUTER LAB)	25	**Group**: DeepEx Class Work. Support of Excavation Systems (SOE)	HW: **Group:** Continue Group SOE Design Report #3 and Plans. Submit Report #3 by **12/4**
No Class 11/27 Thanksgiving			

12/1	26	**Group**: SOE Design Review **Prof**: Monitoring of Adjacent Structures and Properties, Criteria and Specifications	HW: Continue Group SOE Design Report #3 and Plans, Develop Monitoring Program. **Group** SOE Report #3 by **12/4**
12/4	27	**Group**: Present SOE Design #3 Report **Prof:** Specifications Classwork	HW: Outline of Specifications **Group:** Commence Compiling Final Report #4, including Plans and Specifications, by **12/15**
12/8	28	**Group**: Discuss and work on Final Group Report #4, Plans and Specifications Classwork	HW: Prepare Final Design Report #4, including Plans and Specifications**, by 12/15**
12/11	29	**Group:** Discuss and work on Final Report #4 Plans and Specifications Classwork, and 12/15 Presentation	**HW**- Prepare for Final Presentation, Report #4 on **12/15**
12/15	30	**Group Final Presentation (Report #4)**	

Grading Policy:

Late Reports will not be accepted. Reports will be posted on Canvas and discussed during class.

Exams: No exams.

Calculation of Course Grade: A weighted average grade will be calculated as follows. **Each Student must identify sections of Reports #1 through #4 that they have prepared.**

Memo #1 (9/11) and Report #1 (10/9) - 20 %
Memos #2 (10/13) & #3 (10/20), and Report #2 (10/27) - 25 %
Report #3(12/4) - 25 %
Report #4 and Final Presentation (12/15) - 30 %
SUM - 100%

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 less than 60.0%
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.

- **Memos and Reports are due on specified due dates. Late submittals will incur grade deduction.**
- 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/academicintegrity-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".*

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.

AI statement: The use of artificial intelligence (AI) is permitted in this course only when explicitly stated in assignments. If students use AI for any course-related work, they must cite it according to the guidelines provided on the **NJIT Library AI Citation page**. If you have any questions about AI use in this course, please contact the course instructor before submitting any assignments. In cases where AI use is not allowed, students are expected to complete work without AI assistance to develop their skills in this subject area.

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)

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 memos and reports 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 CE 495 - 001

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.	1, 2	1, 2	Prepare site investigation program as per building size and basement depth, NYC Code requirements, and site conditions.

Identify Site and Subsurface Conditions and Evaluate Surrounding Site Constraints.	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	1, 2, 5 and 6	1, 2, 5 and 6	Based on engineering analyses, site constraints, structural loads,
foundation system, basement slab support, perimeter foundation walls, and support of excavation systems. Learn DeepEx Software			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, with use of DeepEx Software	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 scholarships among our faculty and students
- to promote service to the engineering profession and society

Program Educational Objectives

Our **Program Educational Objectives** are reflected in the achievements of our recent alumni:

1. **Engineering Practice:** Alumni will successfully engage in the ethical practice of civil engineering within industry, government, and private practice, working towards safe, practical, resilient and 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 as graduate study in engineering, research and development, professional registration and continuing education; some graduates will transition into other professional fields such as academia, 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.

Student Outcomes

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 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 conclusion
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies