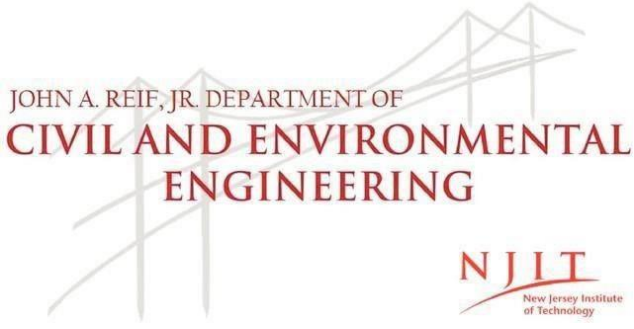
CE 662 – SPRING 2025 SYLLABUS



Section: 101

Instructor: Dr. Oladoyin Kolawole, Ph.D.
Colton RM 233
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Office Hours: Tuesdays 2:00-5:00pm
(In person)

Room: **TIER 107** Day and Time: **Tuesdays 6:00 - 8:50 pm**

Prerequisite: Permission of instructor. Approved undergraduate or graduate course in soil mechanics or geology or construction engineering within the last seven years or equivalent. Restriction: None.

Required Textbook

There is no required textbook for this course. A very detailed lecture notes/materials will be provided to the students.

Other Useful Textbooks & Reading Materials

- Wang Q., Jiang B., Li S. "High strength support for soft surrounding rock in deep underground engineering". Springer Singapore, 2020. ISBN: 978-981-15-3846-9. https://doi.org/10.1007/978-981-153844-5.
- Surampalli, R.Y., et al. "Carbon Capture and Storage: Physical, Chemical, and Biological Methods". Edited by Rao Y. Surampalli, TianC. Zhang, et al. American Society of Civil Engineers, 2015. ISBN (print): 9780784413678; ISBN (PDF): 978-0-78-447891-2. https://doi.org/10.1061/9780784413678.
- Alessio Ferrari and Lyesse Laloui. "Energy Geotechnics". Springer Nature Switzerland AG, 2019. ISBN978-3-030-07622-1. https://doi.org/10.1007/978-3-319-99670-7.2.

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

This course will provide students with fundamental and applied engineering knowledge critical for identifying, designing, managing, and harnessing various materials from deep underground using geotechnical principles so as to provide society with valuable resources and promote sustainability. This course will also explore the governing mechanisms controlling the excavation of underground geomaterials (rock and soil) to create optimum space for extraction or storage of economically valuable and sustainable materials/resources at varying deep underground conditions. This course covers essential geo-engineering and geotechnical concepts and topics related to advancing underground geo-infrastructure such as underground drilling; borehole/wellbore mechanics; vertical and directional drilling; wellbore cementing; foundations of sustainable (solar and wind) energy systems; underground carbon transport and sequestration; underground nuclear waste disposal; geothermal energy pile; and risk assessment of underground engineering. Case study applications are included to show students how to apply the learned techniques in various underground engineering practices.

Course Objectives (General)

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

- Identify and understand the various underground engineering techniques for drilling and extraction.
- Understand various engineering techniques to enhance transport and storage in deep underground.
- Design and engineer resilient underground engineering infrastructures against failure.
- Apply various engineering principles to advance the current underground engineering practices and resources.
- Understand the impact of underground resources on environment, sustainability, and climate change.

Course Schedule:

Week(s)	Topic(s)
1	Introduction to Underground Resources Energy Geotechnics Concept Renewable vs. Non-Renewable Underground Resources
2	Underground Drilling and Extraction Techniques & Technologies Underground Wellbore/Borehole Construction Underground Wellbore Mechanics Underground Directional Drilling
2	Underground Wellbore Cementing Deep underground engineering under extreme conditions (such as high ground stress, high ground temperature, high pore pressure, and strong disturbance)
3	Infrastructure & Underground Mining of Metallic & Non-Metallic Minerals Underground Critical Minerals Infrastructure & Underground Extraction of Coal Infrastructure & Underground Extraction of Oil Sands Engineering Challenges of Underground Extraction of Minerals, Coal, & Oil Sands
3	Nuclear Waste Materials (Uranium) Infrastructure & Underground Extraction of Nuclear Materials & Waste Disposal Engineering Challenges of Underground Nuclear Waste Disposal
4 & 5	Infrastructure & Underground Extraction of Geothermal Energy Geothermal Energy – Geothermal Systems & Underground Heat Flow Geothermal Energy – Enhanced Geothermal Systems (EGS) Underground Thermal Energy Storage (UTES) Geothermal Energy Piles (GEPs) Engineering Challenges of Geothermal Energy & Underground Thermal Energy Storage
6	Carbon Capture, Transport, & Underground Storage Concepts Current And Emerging Technologies for Carbon Capture, Transport, & Underground Storage Carbon Transport – Pipelines, Ships, Truck, & Rail. Geologic Carbon Sequestration
7	Modeling and Uncertainty Analysis of Underground Carbon Transport & Sequestration Direct air capture (DAC) for Carbon Sequestration Biomass Carbon Sequestration and Bio-Induced Sequestration of Carbon Dioxide Enhanced Soil Carbon Trapping Enhanced Carbon Sequestration in Oceans (Ocean CO_2 Sequestration) Benefits & Challenges of Carbon Capture, Underground Transport, & Underground Storage
8	Midterm Exam
9	Spring Break
10	Infrastructure & Underground Hydrates Extraction Engineering Challenges of Underground Hydrates Extraction Infrastructure & Underground Extraction & Storage of Hydrogen Underground Engineering of Hydrogen Extraction, Transport & Storage Engineering Challenges of Underground Hydrogen Extraction & Storage
11	Energy Geotechnics: Offshore Energy Infrastructure & Systems Energy Geotechnics: Solar Energy Systems Foundation Design & Geotechnical Investigations for Solar Energy Infrastructure Installations

12	Energy Geotechnics: Wind Energy Systems Foundation Design & Geotechnical Investigations for Wind Energy Infrastructure Installations
12	Thanksgiving Break
13	Underground Resources Transport Infrastructure & Systems Risk Assessment of Underground Engineering Infrastructure & Energy Geotechnics Impact of Underground Engineering & Resources on Environment & Sustainability Greenhouse Gases & Their Effect on Climate Change Geotechnical Engineering Solutions to Climate change Mitigation Challenges of Underground Energy Transport Infrastructure & Systems
14	Deep Underground Engineering – Industry Perspective Underground Thermal Energy Storage – Industry Perspective Underground Extraction & Storage Infrastructure & Systems - Industry Perspective
	Safety of Underground Transport & Storage Infrastructure & Systems - Industry Perspective
15	Final Project Presentations

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.

POLICIES & PROCEDURES

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

Plagiarism and Copying:
Plagiarism and copying will NOT be tolerated in this course. Homework problems and term project reports require written responses and each student is expected to write their own response. Plagiarism is not tolerated. If you are not familiar with citations please work with an NJIT librarian to learn more. Assignments and reports will be submitted via plagiarism detection software. Any evidence of plagiarism, copying, or cheating during exams, on homework, or on project reports will result in an immediate grade of zero for the assignment and will be reported to the Dean of Students. A second instance of this will result in a failing grade for the course.

Plagiarism is the dishonest presentation of the work of others as if it were one's own. Writers, presenters, engineers or computer programmers – whether students or professionals – commit plagiarism when they present, without acknowledgement, all or part of another person's work as if it were their own. Because plagiarism violates the expectations of trust and honesty necessary for academic work in an ethical community, it is a serious offense. In addition, plagiarism undercuts the basic purposes of higher education by short-circuiting the process of inquiry, reflection and communication that leads to learning.

Plagiarism can take several forms, including but not limited to:
- Using the exact words of another writer in part of a paper without both citation and quotation marks (or block indentation in the case of longer quotations).
- Cutting and pasting material from internet or other electronic resources without proper citation of sources.

- Including the paraphrased or summarized idea of another writer without acknowledging its source.
- Accepting excessive assistance from another person in writing a paper without informing readers of the nature and extent of that collaboration.
- Submitting for credit a complete paper or portion of a paper written by another person, no matter whether the paper was purchased, shared freely, stolen, found, or acquired by other means.
- Submitting a copy or relying closely on the work of other people, without explicitly citing the original source.
- Writing a computer program that is the same or closely similar to existing sources.
- Accepting credit for a project, multimedia presentation, poster, or other assignment that draws dishonestly on the work of others.

Duplicate submission is also a violation of academic integrity, because every assignment presumes that a new inquiry and effort will produce new learning, and submitting a paper already written for another occasion subverts this learning. Submitting the same original paper for credit in more than one class in the same semester, without the expressed permission of both instructors involved, is not acceptable. Using the same paper or closely similar material from one semester to fulfill a requirement in another semester is normally not allowed without specific permission from the instructor. If students receive the same or similar assignments in a different course, they should consult with the professor about alternate assignments.

Communication: All communications by the instructor will be during the class and via NJIT e-mail. It is your responsibility to check your NJIT e-mail regularly. Expect an e-mail response/reply from the instructor only on Monday - Friday between 9am - 5pm.

Lectures/Class: Some weekly lectures will start with quizzes. During the class, the instructor can 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 and discussion is to get you started on a problem (not necessarily to finish) and improve how you think about the problem which will then be discussed. Lectures will NOT be recorded for subsequent access to students; therefore, students have the burden of making up for missed lectures. Please be respectful to the course instructor and your classmates. You should always bring a pencil and calculator with you to class. Please put your cell phones on silent or turned off during class.

Lecture Notes: Copies of the notes used in class will be posted on Canvas throughout the semester before lecture. It is highly recommended that you download or print out or have access to the set of lecture notes to follow along during lecture.

Attendance: Attendance at all lecture/class periods is compulsory, regardless of location or modality. A student is permitted a maximum of two (2) unexcused absences throughout the semester. If a student is absent for more than two (2) classes for the entire semester without a DOS-approved excused absence, the student will receive a final grade of "**F**."

Homework: All homework MUST be presented in an organized manner and ***submitted online via canvas in pdf format using recommended HW submission template provided***. ***Submissions to the instructor's email will NOT be accepted***. ***Late Submissions will NOT be accepted after the due date***. Homework assignments MUST be submitted at the due date and time. Assignments MUST be typed, however, hand sketches (as necessary) may be submitted. If plots or calculations are required, either use hand calculations of the problem in your submitted HW solution or you can use Excel program and attach the solution excel files along with pdf homework submissions. Begin each problem on a new page and number all pages; collate all homework pages together and have your name written clearly on the front page. It is your responsibility to make sure you understand how to solve the problems by attending office hours with the instructor or asking questions in class. As with many conceptual problems, multiple solutions may be possible. This means that all rational solutions to the assignments may be considered for acceptance.

Exams: There will be two exams held during class time and no final exam. All exams in this course will be inperson and may be delivered in the form of an oral exam. No electronic devices (such as

laptops/cellphones/tablets/smart watches, etc.) are allowed during quizzes/exams. No recording devices shall be allowed during class or examinations.

Term Project and Presentation: There will be a term project for this course that must be carried out individually. This term project is made up of two parts: (1) term project paper/report, and (2) term project presentation. Necessary background information and knowledge, in addition to the expectations and format of the term project will be provided during class lectures throughout the semester.

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

Homework	10% (Total 100 points)
Term Paper Report & Presentation	25% (Total 250 points)
Class Quizzes & Participation	15% (Total 150 points)
Midterm Exam	25% (Total 250 points)
Final Exam	25% (Total 250 points)
Total:	**100% (Total 1000 points)**

The final letter grades are computed as follows:

A = > 90.0%, B+ = 85.0% - 89.9%, B = 80.0% - 84.9%, C+ = 75.0% - 79.9%, C = 70.0% - 74.9%, F = < 69.9%

Grades are not curved in computing the final grade. It is theoretically possible for everyone in the class to get an A (or an F). Your performance depends only on how you do and how much you learn, not on how everyone else in the class does.
Changes to the exam dates if any will be notified in advance.

AI Usage in this Course: This course expects students to work without artificial intelligence (AI) assistance in order to better develop their skills in this content area. As such, AI usage is not permitted throughout this course under any circumstance.

Eating and Drinking: Eating and drinking in class is prohibited during lectures. They are only allowed during class breaks.

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, fairly, 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).

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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 ethical practice of civil engineering within industry, government, and private practice, working toward safe, practical, 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 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

Updated 1/6/2025