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Fall 2024

CE 644 - 101: APPLIED ENGINEERING GEOLOGY

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CE 644 – FALL 2024 SYLLABUS

CE 644 – Applied Engineering Geology **FALL 2024**
Section: 101

Instructor Dr. Oladoyin Kolawole, Ph.D.
Colton 233
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Office Hours: Tuesdays 2:00-5:00pm
(In person or via WebEx)
https://njit.webex.com/meet/ok62

Room: **CKB 126** 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

West, T.R., Shakoor, A. (2018). Geology Applied to Engineering, 2nd Edition, Waveland Pr Inc, ISBN#: 978-1478635000.
Gonzalles de Vallejo, Ferrer, and de Freitas. Geological Engineering, 1st Edition, ISBN#: 9780415413527.

Other Recommended Texts & Reading

- Goodman, R.E. (1993). Engineering Geology: Rock in Engineering Construction, 1st Edition, Wiley, ISBN#: 978-0471544241.
- Kehew, A.E. (2022). Geology for Engineers and Environmental Scientists, 4th Edition, Waveland Pr Inc, ISBN#: 978-1478637653.
- Waltham, T. Foundations of Engineering Geology, 3rd Edition, Spon Press, New York, 2002 ISBN#: 0-415-25449-3.

Course Description

Geology has a significant influence on how we plan, design, and construct engineering works. This course examines how geologic formations and natural features can potentially and ultimately affect the planning, design, data collection, and construction of engineering infrastructures. This course helps students to learn how to apply engineering principles to predict and mitigate natural and artificial geo-hazards, including the availability, selection, and use of geomaterials. The course also explores on a field scale the engineering impacts of natural geologic hazards, including landslides, sinkholes, earthquakes, and subsiding geomaterials. Case study applications and individual field trips within New Jersey are included.

Course Objectives (General)

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

- Identify various minerals, rocks, & the various rock-forming processes & geologic agents that have shaped Earth's surface.
- Gain a better understanding of the complicated interaction between all of Earth's processes & structures.
- Understand the importance of such interactions & processes for civil engineering, particularly geotechnical engineering.
- Know how engineers must design & build their infrastructural projects with geologic materials & protect them from potentially hazardous geologic processes.

- Understand the engineering impacts of natural geologic hazards including landslides, sinkholes, earthquakes, & subsiding soils.
- Understand the importance of existing site & geotechnical conditions that can affect site selection, & ultimately, surface & underground constructions.

Course Schedule:

Week(s)	Topic(s)
1	Introduction Historical Notes Role of Geology in Engineering Environmental Concerns Earth Structure – Continental Features Earth Structure – Oceanic Features
2	Earth Processes & Systems – Hydrologic System Earth Processes & Systems – Tectonic System & Plate Motion Minerals: Soil & Rock Mineral Properties & Identification, Formation, & Industrial/Engineering Properties Silicate Minerals vs. Non-Silicate Minerals
3	No Class
4	Intro to Rocks & Rock Classification Rock Cycle Igneous Rocks: Intrusive/Extrusive, Processes & Structure Igneous Rocks: Volcanoes and Flows
5	Sedimentary Rocks: Formation & Processes Sedimentary Rocks: Clastic vs. Non-Clastic rocks
6	Metamorphic Rocks: Formation & Processes Metamorphic Rocks: Foliated vs. Non-Foliated Metamorphic Rocks: Mineral Veins Ores and Mining
7	Field Rock Identification and Rock ID Chart Rock and Minerals as Construction & Engineering Materials Rocks and Minerals as Aggregates Engineering Issues with Minerals & Rocks as Construction & Engineering Materials Rock Quarrying
8	Midterm Exam
9	Standard Reconnaissance Investigations by Geological & Geotechnical Engineers
10 & 11	Structural Geology Geologic Structures: Strike & Dip, Faults, Folds Field Rock Mass Characterization
11 & 12	Engineering Geophysics Geophysical Methods Applied to Engineering Geology Seismic Reflection & Seismic Refraction in Geomaterials Compressional & Shear Velocities Well Logging Seismicity & Earthquakes Earthquake Hazards Seismic Building Codes Liquefaction & Landslides Landslide Hazard and Risk Assessment Earthquake & Seismic Influence on Civil & Geo-Engineering Design
13	Thanksgiving Break
14 & 15	Groundwater & Boreholes Karst Geology: Formation of Caves in Carbonate Rocks and Karst Areas Sinkhole Hazards Depth to Groundwater Engineering Geomorphology Weathering Physiographic Provinces
15	Topographic Maps Geologic Time Scale Geologic History of the NJ-NY Metro Area

	River Systems and Impact on Geological Engineering
15	Engineering geology of Highways & Dams Revision
16	Final Exam

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 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, speakers, musicians, artists, 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.

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

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 on Mon - Fri between 9 am - 5 pm

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 is to get you started on a problem (not necessarily finished) that will then be discussed. 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 lectures. 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 should be presented in an organized manner and submitted online on canvas in pdf format using recommended HW submission template provided. Laboratory and homework assignments must be handed in or submitted before the beginning of the class. 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.

Late Homework: Homework will be due at the beginning of class on the date it is due. Late Homework will NOT be accepted after the due date.

Homework Solutions: It is your responsibility to make sure you understand how to solve the problems by attending office hours with the instructor/TA 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 may be considered for acceptance.

Exams: There will be one midterm exam held during class time and one final exam as scheduled by the University Registrar. All exams in this course will be in-person. 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: There will be a term project/assignment for this course that must be carried out individually. This term project is made up of two parts: (1) rock collection, and (2) reconnaissance investigation. All students are required to assemble their own collection of 10 rocks. 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.

Instructor Commitment: You can expect the instructor to be courteous, punctual, organized, and prepared for lectures 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.

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

Class Participation	10% (Total 100 points)
Homework	10% (Total 100 points)
Rock Collection & Analyses	15% (Total 150 points)
Reconnaissance Investigation	25% (Total 250 points)
Midterm Exam	25% (Total 250 points)
Final Exam	15% (Total 150 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.

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).

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 and other humanitarian endeavors.

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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