



蘇州大學
Soochow University

CEN 449 Unsaturated Soil Mechanics

Summer 2024

Course Credits: 4

Contact Hours: 56 hours

Instructor: TBA

Email: TBA

COURSE OBJECTIVES

This course provides civil students with an in-depth understanding of the concepts in unsaturated soil mechanics, emphasizing the behavior and properties of soils that are not fully saturated with water. Topics covered include soil-water interaction, suction, shear strength, estimation of permeability function, and the influence of unsaturation on the engineering behavior of soils. Both theoretical concepts and practical applications in geotechnical engineering are explored.

Upon Completion of this Course, students will be able to:

1. Understand the fundamental principles of unsaturated soil mechanics and its application in geotechnical engineering.
2. Evaluate the role of suction in unsaturated soils and its influence on shear strength.
3. Analyze and quantify the soil-water interaction and its impact on soil behavior.
4. Demonstrate proficiency in laboratory techniques for characterizing unsaturated soil properties.
5. Apply theoretical concepts to real-world geotechnical problems involving unsaturated soils.

PREREQUISITES

CEN 310 Soil Mechanics

GRADING

Grades will be determined by accumulating points, with 100 points being the



maximum, as follows:

ITEM	POINTS
3 Quizzes	15 Points
2 Labs	10 Points
Laboratory Report	20 Points
Midterm Exam	25 Points
Final Exam	30 Points
Total	100 Points

Late submissions will be graded at the end of the course. Grades will be assigned according to the following rule:

$$A \geq 90 > B \geq 80 > C \geq 70 > D \geq 60 > F.$$

We reserve the right to make adjustments to the overall grading policy.

COURSE MATERIALS

Required Texts:

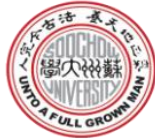
D. G. Fredlund, H. Rahardjo, M. D. Fredlund, *Unsaturated Soil Mechanics in Engineering Practice*, Wiley-Interscience, 2012.

Recommended (Optional) Texts or Other Materials:

None

COURSE TOPICS

MODULE	TASKS
Module 1	Topics: Topic 1: Theory to Practice of Unsaturated Soil Mechanics Topic 2: Nature and Phase Properties of Unsaturated Soil Topic 3: Soil Classification and Soil Compaction Topic 4: Volume-Mass Variables Assessments: Quiz 1 Laboratory 1



Module 2	<p>Topics: Topic 5: State Variables for Unsaturated Soils Topic 6: Stress State Variables for Unsaturated Soils Topic 7: Measurement and Estimation of State Variables Topic 8: Measurement of Soil Suction and Total Suction</p> <p>Assessments: Quiz 2 Laboratory 2</p>
Module 3	<p>Topics: Topic 9: Measurement of Osmotic Suction Topic 10: Soil-Water Characteristic Curves for Unsaturated Soils Topic 11: Ground Surface Moisture Flux Boundary Conditions Topic 12: Theory of Water Flow through Unsaturated Soils</p> <p>Assessments: Midterm Exam</p>
Module 4	<p>Topics: Topic 13: Solving Saturated/Unsaturated Water Flow Problems Topic 14: Estimation of Permeability Function Topic 15: Application to Saturated-Unsaturated Water Flow Problems Topic 16: Air Flow through Unsaturated Soils</p> <p>Assessments: Quiz 3 Laboratory Report</p>
Module 5	<p>Topics: Topic 17: Heat Flow Analysis for Unsaturated Soils Topic 18: Shear Strength of Unsaturated Soils Topic 19: Application to Practical Shear Strength Problems in Geotechnical Engineering Topic 20: Solving Stress-Deformation Problems with Unsaturated Soils</p> <p>Assessments: Final Exam</p>

ATTENDANCE

1) Class attendance is required. Missing classes without permission will lead to decrease in overall grade.

Missing less than two classes: no penalty.

Missing more than two classes: 7% will be taken off from the overall grade.

If the instructor reports a student's frequent missing of class to the Soochow University Academic Administration Office, the student might get a written warning



and might be prohibited from attending final exam.

2) Participants in this course are expected to arrive in class promptly and adequately prepared. The primary objective of this course is to critically engage with the readings and the subject matter. Therefore, course participants are expected to have completed the reading prior to class and prepare thoughtful reflections/commentaries to share with fellow colleagues.

LEARNING REQUIREMENTS

- 1) Late assignments are not acceptable and are subjected to grade deductions.
- 2) Assignments submitted in the wrong format will be counted as not submitted.
- 3) Failure to submit or fulfill any required course component results in failure of the class.
- 4) Make-up for midterm and final exams only with valid excuses, as defined by the University.
- 5) In order to earn a Certificate of Completion, participants must thoughtfully complete all assignments by stated deadlines and earn an average quiz score of 50% or greater.

TECHNOLOGY POLICY

The use of electronic devices in class is distracting, both for the user and for the rest of the class. Only non-programmable calculators can be used in the tests and exam. Any attempts to use cell phones and other electronic communication devices will be seemed as cheating. Laptops are discouraged, unless you use them for activities DIRECTLY related to the course (eg., note taking, reading course documents).

ACADEMIC INTEGRITY POLICY

Soochow University highly values the academic integrity and aims to promote the academic fairness, honesty and responsibility. Any academic dishonesty behaviors and any attempts to cheats and plagiarism will be reported to the university administration office. A written warning and the relevant penalties will be imposed. The record might be shown on the official university transcript.



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DISABILITY ACCOMMODATION

Soochow University is committed to maintaining a barrier-free environment so that students with disabilities can fully access programs, courses, services, and activities at Soochow University. Students with disabilities who require accommodations for access to and/or participation in this course are welcome.

Note:

Please contact the University Administrative Office immediately if you have a learning disability, a medical issue, or any other type of problem that prevents professors from seeing you have learned the course material.