UNIVERSITY OF ILLINOIS **DEPARTMENT OF CIVIL ENGINEERING**

CEE 483 – Soil Mechanics and Soil Behavior
Fall, 2025

Instructor: Professor Timothy D. Stark, Ph.D, P.E., Dist.M.ASCE
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Teaching Assistant: Zarely Moreno: lzm2@illinois.edu

Prerequisite: CEE 380 – Introduction to Geotechnical Engineering.

Course Credit: 4 credit hours

Class Schedule: Tuesday and Thursday – 3:30-5:00 p.m.
3019 CEE Building

Required Course Notes:
Course Notes and Laboratory Notes by Professor G. Mesri
Soil Mechanics in Engineering Practice by Terzaghi, Peck and Mesri 3rd Edition, 1996.

Supplemental Textbook:
Holtz, R.D., Kovacs, W.D., and Sheehan, T., *Introduction to Geotechnical Engineering, Prentice Hall*, 2011, 853 p.

Introductory Course Comments:
Typical projects for a geotechnical engineer include: (1) design of foundations for structures, such as buildings and bridges, (2) retaining walls, (3) the static and seismic stability of slopes, (4) design of earth and rockfill dams, (5) design of tunnels in soil and rock, (6) design of excavation bracing systems, (7) pavement design and performance, (8) design and construction of soil-geosynthetic liner systems for waste containment facilities, (9) waste containment facility closure or cover design, (10) contaminant migration through soils, (11) contaminated site remediation, railroad design and performance, and (13) design of dewatering systems for underground construction. This course will provide the necessary Soil Mechanics and Behavior of natural soil deposits required for the solution of these geotechnical engineering projects. This includes composition and structure of soil; water flow and hydraulic properties; stress in soil; compressibility behavior and properties of soils; consolidation and settlement analysis; shear strength of granular soils, soft clays, and stiff clays and shales; compaction and unsaturated soils; and experimental measurements.

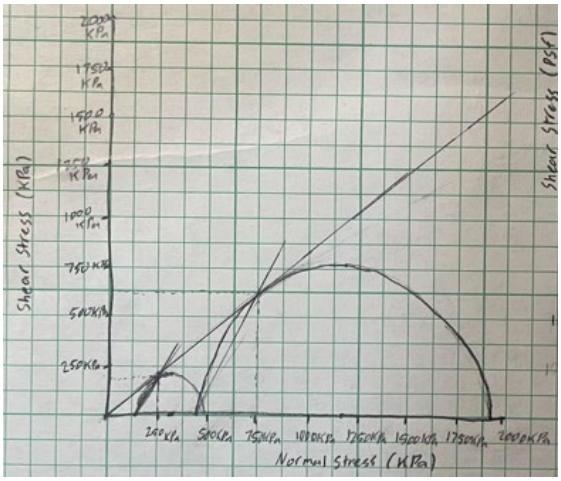
Tentative Course Outline and Schedule:

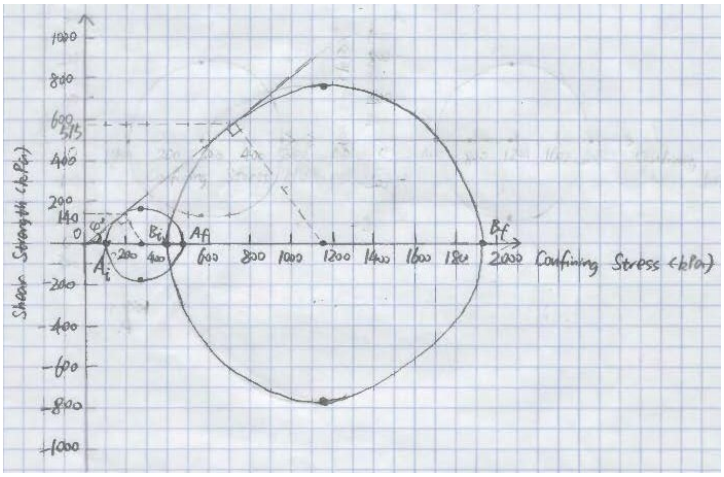
Course Week	Lecture Topic	Reference Texts	
		Mesri Notes (1999)	Terzaghi et al. (1996)
1	**Composition and Mineralogy of Soil Solids** - Interaction of Water with Soil Solids, Interaction of Soil Particles, Weight-Volume Relationships and Index Props	Pages 1 – 39	Pages 3-17 & 17 - 26
2	**Unified Soil Classification System** – Sieve Analyses, Atterberg Limits, and Hydrometer/Clay-Size Fraction	39 - 46	27-29
3	**Natural Soil Deposits** – Origin of Natural Deposits, Glaciation Deposits, Windblown Deposits, River and Continental Deposits, Organic and Shore Deposits, Unweathered Bedrock, Weathered Bedrock and Residual Soil	Chapter 6 – Peck, Hanson & Thornburn	
4	**Water Flow Through Soils** – Total Head, 1-D & 2-D Steady State Seepage, Hydraulic Conductivity, and Flow Nets	46-77	213-221
5	**Concept of Effective Stress** – Effective Vertical and Horizontal Stress	93 - 106	83 – 85
6	**Applied Stresses** - Contact Pressure, Elastic Stress Distribution Theories, Mohr Diagram, & Pore-Water Pressure Coefficients	106 - 132	292 – 293, 298, 130, and 87 - 89
7	**Unsaturated Soils and Soil Compaction** – Compaction, Capillary Pressure, Effective Stress, Pore-Water Pressure Coefficient B, Compressibility, and Shear Strength	279 - 321	90 – 96, 310 – 313, 311, 90, 116, 87 – 88, 116 – 118, 155 - 156
7	**1st Mid-Term Exam: Week 7 – October 9, 2025 (Tentative)**		
8	**Consolidation of Soils** – One-Dimensional, Primary Consolidation, and Deformation and Drainage Boundary Conditions	132 - 146	100 – 106 & 223
9	**Time Rate of Settlement** – Terzaghi's Theory of Consolidation, Consolidation History and Compressibility Parameters	146 – 194	223 – 224 & 100 – 116
10	**Secondary Compression** – Settlement Resulting from Secondary Compression, Preconsolidation Pressure, Coefficient of Consolidation	194 - 218	108, 103, & 226 - 227
11	**Shear Strength of Soils** – Shearing Resistance, Shear Strength, Mohr's Theory of Failure, Drained v. Undrained Shear Strength, & Measurement	218 - 232	122 – 186, 135 – 136, 241 – 242, 130 – 132, 135 – 136, 137 – 141, 127 - 129
12	**Shear Strength of Cohesionless Soils** - Sands	233	146 - 150
12 & 13	**Shear Strength of Clays – Normally Consolidated** – Shear-Induced Pore-Water Pressures, Undrained Strength, Unconfined Compression Test, Relationship between Su and Consolidation Pressure, Terminology, & Sensitivity, & Sample Disturbance	237 – 248, 254 - 279	89, 161, 181 – 186, 168 – 169, 173, 241, 181 - 186
14 & 15	**Shear Strength of Clays – Over Consolidated** - Drained	248	151 – 158
15	**Final Exam Review – December 9, 2025**		
	COMPREHENSIVE (Closed Book) FINAL EXAM – Monday, December 15, 2025 – 1:30 – 4:30 p.m.		

Homework Assignments:

Homework is an essential part of this course and should be given the attention due a professional or job assignment. **Analyses and design computations of an engineer are legal documents.** Consequently, all homework assignments are subject to the following guidelines:

- Homework will be assigned each Thursday and will be due at the beginning of class on the following Thursday. **Late homework will not be graded; however, all homework assignments must be turned in for completion of the course.**
- Only a selected number of problems assigned each week will be graded. However, students will receive credit for the ungraded problems if they clearly show their analysis and solution. If all homework assignments are submitted on time, the student will be allowed to drop or omit the lowest homework score.
- Because this class is design oriented, all homework assignments must reflect a professional approach. Free-hand drawings and curves, smudged and/or sloppy lettering and undocumented calculations do not reflect a professional approach. **Homework submittals with these characteristics will be returned ungraded. Remember: "If you have time to do it, you have time to do it right." (J. Wooden)**
- All graphs, tables, figures, etc. must be clearly labeled with descriptions, units, scales, sign conventions, etc. Homework submittals that do not meet these requirements will either not be graded or only receive partial credit.
- Computer generated calculations and graphs are acceptable and encouraged. Use of engineering paper is **required** for hand calculations and hand-drawn graphs. An example of an unacceptable graph is shown below. Computer Spiral bound paper with frayed edges is unacceptable. Use only the front side of the engineering paper, put your name on each page, number the pages, e.g., 1/5 or 1 of 5, and use only pencil. Ball point pens and felt tip pens are inappropriate for engineering computations. All assignments must be stapled together. Loose pages will not be accepted.





Examinations and Grading:

Reading assignments from the course notes and supplemental resources will be assigned every week and must be studied in depth before the corresponding class to facilitate understanding and class participation. These reading assignments should be completed prior to lecture. Unannounced quizzes on the reading will be given periodically and included in the homework grade (25% of final grade). One

of the most important aspects of this course is class participation (10%), which is discussed further below. Class participation includes questions and discussion about reading, homework, geotechnical practice, foundation design, specification, construction, inspection, defects, litigation, and any other geotechnical related topics. Students are encouraged to bring questions and experiences to class because it helps everyone learn and the instructor better understand your knowledge and interest in the course. The course grade distributions are explained below and will be followed for computation of final letter grade:

Class Participation, Questions, and Discussion	10%
Homework and Quizzes	25%
Mid-Term Exam	25%
Comprehensive Final Exam	40%

The time and the date of the one 90-minute-long mid-term exam will be announced at least one week in advance but it is anticipated that they will be tentatively given on October 9, 2025. The three-hour long final exam is scheduled for 1:30 – 4:30 p.m. on Monday, December 15, 2024. All of the exams will be closed book, closed notebooks, and closed calculator memory.

Class Participation:

Class participation really facilitates learning and can reduce the time required for homework and exam preparation. Class participation will account for 10% of your grade so review your prior notes and bring questions to class or ask questions during class. Because this is a design-oriented class, I want this to be more of a discussion than a lecture class. I will use the class role to keep track of your class participation and as a "volunteer list" if you have not participated.

Professor Stark's Office Hours in Room 2217 NCEL:

Tuesday	5:00 p.m. - 7:00 p.m.
Thursday	5:00 p.m. - 7:00 p.m.

TA Office Hours in Room 2206 NCEL:

Monday	5:00 p.m. - 7:00 p.m.
Wednesday	5:00 p.m. - 7:00 p.m.

E-mail Contact:

Please feel free to correspond with me using email. HOWEVER, please make sure that the email subject starts with "CEE483:" followed by the topic of your message. This will ensure that your message is directed to my CEE483 email box and I will respond promptly to your message. If you do not receive a response in a short period of time, please ensure your subject line starts with "CEE483" and resend your message.

To facilitate dissemination of answers to Frequently Answered Questions, a CEE483-Soil Mechanics Facebook page may be available. Please join the Facebook page and feel free to post any questions or comments about the course. I will be monitoring the Facebook page and posting answers and suggestions but other can post responses too.

CANVAS Website:

The class will have a website in the "Illinois CANVAS" system. Class lecture notes/PowerPoint slides, homework assignments, exams, and solution keys will be posted on the course website. Students are responsible for announcements and course materials that will be posted periodically on the website. I hope that students will use the discussion board on the site, as well as other features, and I will monitor the discussions when I am online. If you are new to CANVAS, a number of CANVAS Help documents for students can be obtained from http://go.illinois.edu/student_help.

Academic Integrity

"The University has the responsibility for maintaining academic integrity so as to protect the quality of education and research on our campus and to protect those who depend upon our integrity. It is the responsibility of the student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions." (Code of Policies and Regulations Applying to All Students, Academic Integrity – Preamble, 1-402). Please familiarize yourself with this section of University policy. In this course, you are expected to submit your own, original work that has not been previously submitted for credit. If you have additional questions or concerns about academic integrity, please bring these to my attention.

Teachings of Ralph B. Peck on Foundation Engineering:

Foundation Engineering was developed at the University of Illinois at Urbana-Champaign by Ralph B. Peck. Professor Peck co-authored your textbook (*Foundation Engineering*) which was the first Foundation Engineering book. Professor Peck had a profound impact on geotechnical engineering. He was world renowned and received the Medal of Science from President Gerald Ford. In addition to his teaching, research, and consulting expertise, he left the geotechnical engineering profession with many "words of wisdom". Some are repeated below and will probably be useful throughout your career.

- "If you can't reduce a difficult engineering problem to an 8 ½ x 11-inch sheet of paper, you will probably never understand it."
- "Geology enables us to establish what constraints may exist for a particular project."

Advice to a Young Engineer – R.B. Peck – Pub. No. 167, Military Eng., Vol. 69, p. 450, July, 1977. Acquire two additional skills besides your course work: (1) engineering judgment and (2) professional and public responsibility

1) **Engineering Judgment**
   - Is a good sense of proportion
   - Make every assignment count because there is "always something to be learned"
   - "teach your brain to register what your eyes see" – keep a notebook
   - "learn how to think quantitatively" – visualize numerical quantities, dimensions, rates, and loads to develop a sense of proportion
   - "continue to read and study", and
   - "study precedents to cultivate engineering judgment".

2) **Professional and Public Responsibility**
   - "Our personal, individual attitudes toward engineering and toward society have a potential impact on our country's future. However small that impact, each of us should try to make it for good."

Additional Words of Wisdom – John Wooden, legendary UCLA Basketball Coach

- "It's what you learn after you know it all, that counts."
- "If you don't have time to do it right, when will you have time to do it over?" (If you have time to do it, you have time to do it right.)
- "Little things make big things happen."
- "Failure to prepare, is preparing to fail."
- "Don't let what you cannot do, interfere with what you can do."
- "Don't measure yourself by what you have accomplished, but by what you should have accomplished with your ability."
- "Be prepared and be honest."
- "Remember: Substance over Hype."
- "Never mistake activity for achievement."
- "The worst thing about new books is that they keep us from reading the old ones."

Rules for the Game of Engineering – K. Terzaghi (Bjerrum, 1960)

- "Engineering is a noble sport which calls for good sportsmanship. Occasional blundering is part of the game. Let it be your ambition to be the first one to discover and announce your blunders. If somebody else gets ahead of you, take it with a smile and thank him for his interest."
- "The worst habit you can possibly acquire is to become uncritical towards your own concepts and at the same time skeptical towards those of others."
- "When you commit one of your ideas to print, emphasize every controversial aspect of your thesis which you can perceive."
- "Very few people are either so dumb or so dishonest that you could not learn anything from them."

Bjerrum, L. (1960). "Some Notes on Terzaghi's Method of Working," From Theory to Practice in Soil Mechanics, John Wiley and Sons, New York, pp. 22-25 on p. 24.