Colorado State University
Department of Civil & Environmental Engineering

ADVANCED SOIL MECHANICS

CIVE 655 – Spring 2018

General Information

Instructor:	Christopher Bareither, PhD, PE
Email:	christopher.bareither@colostate.edu
Office:	A219 Engineering Building
Office Hours:	Tuesday & Thursday 1:00 - 2:00 pm
Meeting Time:	Lecture – Tuesday & Thursday 8:00 - 9:15 am
Meeting Place:	Engineering Building B4
Prerequisites:	CIVE 355 (Introduction to Geotechnical Engineering) or consent
Course Webpage:	Canvas
Text:	Holtz, Kovacs, & Sheenan (2011). *An Introduction to Geotechnical Engineering* (2nd Ed.), ISBN-10 0132496348.

Purpose

This course will focus on the shear strength of geomaterials. Key concepts of soil shear strength will include drained and undrained behavior in triaxial compression testing, modified Mohr-Coulomb diagrams (e.g., p-q diagrams), stress paths, laboratory shear strength testing, and drained and undrained failure criteria and shear strength definition. Special topics in soil shear strength, such as stress history and normalized soil engineering properties (SHANSEP), critical state soil mechanics (CSSM), dynamic shear strength, and geosynthetics, also will be covered.

Objectives

1. Develop an enhanced understanding of the influence of soil composition on deformation and volume change behavior and engineering properties.
2. Understand and describe drained and undrained shear behavior as a function of loading scenario and soil type.
3. Determine the appropriate type of soil shear strength for analysis and design of geotechnical structures (e.g., slopes, foundations, retaining structure, etc.).
4. Understand fundamentals of critical state soil mechanics, stress history effects on soil properties and behavior, and soil behavior under dynamic loading.
5. Understand mechanisms that govern geosynthetic interface and internal shear strength of geosynthetic clay liners.

Instructional Methodology

The course will meet as a single group two days per week. These meetings will be organized as discussion / lecture / problem-solving sessions. Students are required to complete assigned readings prior to coming to class. The instructor will lead the course from a discussion perspective and expect participation and engagement from students. All students are expected

to come prepared to class with questions pertaining to the assigned reading, homework assignments, or any aspect of the class in general to facilitate an interactive discussion between the course participants (i.e., peer students and instructor).

Grading

Homework. Periodic homework assignments will be given throughout the semester and will have a defined due date identified on the assignment. Homework will be due at the start of class on the due date indicated. Late homework will not be graded. All students must turn in individual work that will be graded for correctness, completeness, and professionalism. This is a graduate-level course and students are expected to complete their work in a neat and orderly manner and provide logical documentation of the necessary equations, definitions, assumptions, example calculations, references, and any additional supporting material used in solving the problems.

Quizzes. Periodic quizzes will be given throughout the semester. Quizzes will be administered at the beginning or end of lecture and may or may not be announced prior to the instructor administering a given quiz. Quiz questions may include multiple choice, true / false, matching, short answer, and/or computation questions, and cover any and all content discussed throughout the course (e.g., concepts from the readings, topics discussed in class, calculations conducted in homework assignments, etc.).

Exams. The course will include two exams during the semester. Exam I will be a traditional written exam and will be administered during an agreed-upon time outside of the scheduled class time. Exam II may also be a written exam, or if mutually agreed on, may be a written paper, presentation, or other relevant project. The scheduled final exam time based on CSU may be used for the written exam. Exams will be closed notes and closed book unless otherwise noted. Content on the exams will include quantitative (e.g., calculation problems) and qualitative (short answer) assessments. The distribution of the quantitative and qualitative portions may vary, but will be announced prior to the exam date.

Grading. This course is worth 3-credits, and course grades will be based on the following:

- Participation and professionalism = 5 %
- Quiz (5 @ 3%) = 15 %
- Homework (6 @ 5%) = 30 %
- Exams (2 @ 25%) = 50 %

Grades in this course will be based on the following straight-grading scale:

96.7 % ≤ A^+ ≤ 100 %	80.0 % ≤ B^- < 83.3 %
93.3 % ≤ A < 96.7 %	76.7 % ≤ C^+ ≤ 80.0 %
90.0 % ≤ A^- < 93.3 %	70.0 % ≤ C < 76.7 %
86.7 % ≤ B^+ < 90.0 %	60.0 % ≤ D < 70.0 %
83.3 % ≤ B < 86.7 %	F < 60.0 %

Exam grades and final course grades will be based on the above straight-grading scale when the class average is above 75 %. If the average is below 75 %, the grading scheme will reflect the actual class average. Borderline decisions will be made by examining the student's motivation and quality of work (i.e., participation and professionalism).

Other Important Items

Travel. On occasion, my academic duties require that I must travel (e.g., attend conferences and meetings, present seminars, etc.). I will try to let you know as far in advance as possible. In all cases, we will make up any postponed classes, such that the full semester of lectures will be provided. Thus, I need everyone's course schedules for the semester to determine mutually agreeable dates and times to hold make-up classes.

Make-up Exams. Make-up exams will not be given, except in extraordinary situations and only if I have been notified well in advance of the original exam date.

Course Webpage. All handouts and homework assignments will be placed on the course website. I do not plan on posting solutions to homework or exams; however, you are welcome to compare your answers with mine should a conflict arise.

Change in Assignment. A change in the date of a homework or exam during the semester may be necessary. When such changes are needed, they will be announced in class. If you are absent, you are responsible for finding out what changes, if any, have been made.

Cell Phone Policy. Cell phones will not be allowed during exams. Please turn off or silence phones during class.

Academic Integrity Policy. Colorado State University adopted an Academic Integrity Policy in the Fall of 2011 and faculty members are responsible for the following items:

1) *"Each course instructor shall state in his or her course syllabus that the course will adhere to the Academic Integrity policy of the Colorado State University General Catalog (page 7) and the Student Conduct Code."*
2) *"By the end of the second week of the course and/or in the course syllabus, the course instructor shall address academic integrity as is applied to his or her course components, such as homework, written assignments, lab work, group projects, quizzes, and exams. Examples of items to address include, but are not limited to, the use of class notes, study sheets, and solutions manuals; appropriate uses of sources, internet or otherwise; receiving assistance from others; and the use of prior work."*

Assessment Methods and Student Outcomes

1) Homework and quizzes will be used to evaluate how students are learning course content and to provide the instructor feedback on student progression in the course.

2) Exams are to determine the students' level of understanding of fundamental definitions, concepts, and engineering methodologies as well as calculations presented in the text, handouts, lectures, and on homework assignments.

Outline and Tentative Schedule[1]

Week	Date	Lecture Topic	Readings & Notes
1	Tue, 1/16	Class Introduction	Ch. 1 & 2 (Ch. 3 if no geology)
	Thu, 1/18	Soils Overview	
2	Tue, 1/23	Soil Composition (**Quiz 1**)	Ch. 4
	Thu, 1/25	Soil Structure & Environmental Effects	
3	Tue, 1/30	Stress and Strength Generation in Soils	Ch. 6.1-6.3, 6.9-6.11; handout
	Thu, 2/01	Stress-Strain Behavior	
4	Tue, 2/06	Stress-Strain Behavior	Ch. 11.1-11.5; Ch. 13.1-13.2
	Thu, 2/08	Strength & Deformation Measurement (**Quiz 2**)	
5	Tue, 2/13	*No Class*	Ch. 8 & 9 (review general concepts)
	Thu, 2/15	Compressibility & Consolidation	
6	Tue, 2/20	Drained & Undrained Shear Behavior	Ch. 12; Ch. 13.3-13.6; Ch. 13.9-13.10; handouts
	Thu, 2/22	Drained & Undrained Shear Behavior	
7	Tue, 2/27	Drained & Undrained Shear Behavior	
	Thu, 3/01	Drained & Undrained Shear Behavior (**Quiz 3**)	
8	Tue, 3/06	Drained & Undrained Shear Behavior	
	Thu, 3/08	*No Class* (**Exam 1** outside of class)	
9	3/13 & 3/15	Spring Break - No Class	
10	Tue, 3/20	Shear Strength Mechanisms and Applications	Handout
	Thu, 3/22	Critical State Soil Mechanics	Ch. 13.7-13.8; handout
11	Tue, 3/27	Critical State Soil Mechanics	
	Thu, 3/29	Strength Theories	
12	Tue, 4/03	SHANSEP	Ch. 13.13; handout
	Thu, 4/05	SHANSEP (**Quiz 4**)	
13	Tue, 4/10	Dynamic Shear Strength	Ch. 13.15; handout
	Thu, 4/12	Dynamic Shear Strength	
14	Tue, 4/17	Geosynthetics Shear Strength	Handouts
	Thu, 4/19	Geosynthetics Shear Strength	
15	Tue, 4/24	Geosynthetics Shear Strength	
	Thu, 4/26	Geosynthetics Shear Strength (**Quiz 5**)	
16	Tue, 5/01	*To Be Determined*	
	Thu, 5/03	*To Be Determined*	

[a] Book readings from Holtz et al. (2011); other readings to be handed out in class.

[1] All dates, lecture content, homework assignments subject to change.