

NCSU Department of Civil, Construction, and Environmental Engineering

CE 548 – Engineering Properties of Soils

Instructor: Dr. Brina M. Montoya

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Office: Fitts-Woolard Hall 3161

In-Person Office Hours: M 11:00 – 12:30 PM, or by appointment

Zoom Office Hours: by appointment, including evenings and lunch breaks

Course Text (recommended): Robert D. Holtz, William D. Kovacs, and Thomas C. Sheahan, *An Introduction to Geotechnical Engineering*, 2nd Edition, Pearson (2011).

Course prerequisites: All students must have completed an undergraduate soils mechanics course (CE 342 or equivalent)

Course Description: Significant soil properties in earthwork engineering, including soil elasticity and soil mineralogy, hydraulic conductivity, stress-strain relations and shear strength, compressibility and compaction. Laboratory work including plasticity, triaxial compression, permeability, consolidation and compaction tests.

Learning Outcomes:

The main objective of CE 548 is to introduce graduate-level geotechnical engineering students to the fundamentals of laboratory testing. This course provides the background necessary to pursue further studies in the area of geotechnical and geoenvironmental engineering.

By the end of the semester, students will be able to...

...Analyze data (prepared by others) from a variety of advance testing techniques (e.g., triaxial compression tests, one-dimensional compression tests, plasticity tests, direct shear tests, permeability tests, and compaction tests),

...Evaluate testing data for accuracy,

...Explain comprehensive soil behavior by synthesizing results of experiments with existing geomechanics theories,

...Formulate engineering recommendations in a professional format using appropriate technical terminology.

Lecture Meetings: T, Th 1:30 PM – 2:45 PM, 2220 Engineering Building 3

Tentative Course Schedule

Week	Dates	Topic	Assigned Reading	Assignments
1	Aug. 20 & 22	Introduction to course, Soil Composition, and Laboratory Testing for Stress-Strain-Strength	Ch. 1 - 3 Ch. 11, <i>Black and Lee 1973</i> ¹	HW 1 Assigned 8/22
2	Aug. 27 & 29	Elastic Properties of Soils	Ch. 11, Duncan and Bursey 2013	
3	Sept. 3	Soil Shear Strength: M-C and CSSM ² <i>(pre-recorded lecture)</i>	Ch. 12 & 13	HW 1 Due 9/6
	Sept. 5	Drained Shear Strength of Saturated Sand	Ben and Jeffries 1985; Bolton 1986	HW 2 Assigned 9/6
4	Sept. 10 & 12	Undrained Shear Strength of Saturated Sand Shear Strength of Sands - Special Topics	Ch. 12 & 13 Frost and Jang 2000	
5	Sept. 17	Wellness Day		
	Sept. 19	Shear Strength of Saturated Clays	Ch. 12 & 13	HW 2 Due 9/20 HW 3 Assigned 9/20
6	Sept. 24 & 26	Normalized Shear Strength of Clays Shear Strength Testing of Saturated Clays	Ch. 12 & 13	
7	Oct. 1 & 3	Shear Strength Testing of Saturated Clays Yield Surface	Ch. 12 & 13	HW 3 Due 10/4
8	Oct. 8	Soil Models: Cam Clay	<i>Ladd and DeGroot 2003</i> ¹ (assigned 10/10)	
	Oct. 10-11	Take Home Midterm Exam, Due by 10/11/24 at 6 pm; 75 min time limit, can be taken any time Oct. 10-11		
9	Oct. 15	Fall Break		
	Oct. 17	Consolidation	Ch. 8 & 9	HW 4 Assigned 10/17
10	Oct. 22 & 24	Consolidation ² <i>(pre-recorded lecture on Oct. 24)</i>	Ch. 8 & 9, <i>Wroth and Wood 1978</i> ² Appendix B.2	
11	Oct. 29	Secondary Compression		
	Oct. 31	Soil Plasticity and Mineralogy	Ch. 2 & Ch. 4; <i>Carrier 2003</i> ²	
12	Nov. 5 & 7	Shrinkage and Swelling Hydraulic Conductivity	Ch. 6 Ch. 7	HW 4 Due 11/8 HW 5 Assigned 11/8
13	Nov. 12 & 14	Hydraulic Conductivity Compacted Soil Properties & Field Compaction	Ch. 7 Ch. 5	
14	Nov. 19	Compacted Soil Properties & Field Compaction	<i>Duncan 2000</i> ¹ ; Notes	
	Nov. 21	In Situ Testing		
15	Nov. 26	In Situ Testing/Soil Variability	Notes	HW 5 Due 11/26
	Nov. 28	Thanksgiving		
16	Dec. 3	Final Review		Term Project Due Tuesday Dec. 3rd
		** Please note that the term project will be due the final week of class**		
	Dec. 10-11	Take Home Exam, Due by 12/11/22 at 6:00 pm; 2.5 hour time limit, can be taken any time btwn Dec 10-11		

Notes:

1 – Reading quizzes are assigned the week indicated in the schedule above. The quiz is due one week after they are assigned to ensure completion of reading prior to discussion in lecture. The reading quizzes will be available in Moodle and take approximately 10 minutes to complete.

2 – I will be unavailable due to travel multiples times during the semester: Sept. 3, Oct. 24-26, and Dec. 9-13.

CE 548: Engineering Properties of Soils POLICIES AND PROCEDURES

Return to Campus

Due to the COVID-19 pandemic, public health measures continue to be implemented across campus. Students should stay current with these practices and expectations through the [Protect the Pack](https://www.ncsu.edu/coronavirus/) website (<https://www.ncsu.edu/coronavirus/>). The sections below provide expectations and conduct related to COVID-19 issues.

Health and Participation in Class

We are most concerned about your health and the health of your classmates and instructors/TAs.

- If you test positive for COVID-19, or are told by a healthcare provider that you are presumed positive for the virus, you should not attend any hybrid or face-to-face (F2F) classes and work with your instructor on any adjustments necessary; also follow other university guidelines, including self-reporting ([Coronavirus Self Reporting](#)): Self-reporting is not only to help provide support to you, but also to assist in contact tracing for containing the spread of the virus.
- If you feel unwell, even if you have not been knowingly exposed to COVID-19, please do not come to a F2F class or activity.
- If you are in quarantine, have been notified that you may have been exposed to COVID-19, or have a personal or family situation related to COVID-19 that prevents you from attending this course in person (or synchronously), please connect with your instructor to make alternative plans, as necessary.
- If you need to make a request for an academic consideration related to COVID-19, such as a discussion about possible options for remote learning, please talk with your instructor.

Health and Well-Being Resources

These are difficult times, and academic and personal stress are natural results. Everyone is encouraged to [take care of themselves](#) and their peers. If you need additional support, there are many resources on campus to help you:

- Counseling Center ([NCSU Counseling Center](#))
- Student Health Services ([Health Services | Student](#))
- If the personal behavior of a classmate concerns or worries you, either for the classmate's well-being or yours, we encourage you to report this behavior to the NC State CARES team: ([Share a Concern](#)).
- If you or someone you know are experiencing food, housing or financial insecurity, please see the Pack Essentials Program ([Pack Essentials](#)).

Community Standards related to COVID-19

We are all responsible for protecting ourselves and our community. Please see the [community standards](#) (which have been updated for 2021) and Rule 04.21.01 regarding Personal Safety Requirements Related to COVID-19 [RUL 04.21.01 – Personal Safety Requirements Related to COVID-19 – Policies, Regulations & Rules](#)

Course Expectations Related to COVID-19:

- **Course Attendance:** NC State attendance policies can be found at: [REG 02.20.03 – Attendance Regulations – Policies, Regulations & Rules](#). Please refer to the course's attendance, absence, and deadline policies for additional details. If you are quarantined or otherwise need to miss class because you have been advised that you may have been exposed to COVID-19, you should not be penalized regarding attendance or class participation. However, you will be expected to develop a plan to keep up with your coursework during any such absences. If you become ill with COVID-19, you should follow the steps outlined in the health and participation section above. COVID 19-related absences will be considered excused; documentation need only involve communication with your instructor.

- **Technology Requirements:** This course may require particular technologies to complete coursework. Be sure to review the syllabus for these expectations, and see the [syllabus technical requirements](#) for your course. If you need access to additional technological support, please contact the Libraries' Technology Lending Service: ([Technology Lending](#)).
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Students are responsible for reviewing the NC State University PRR's which pertains to their course rights and responsibilities:

- Equal Opportunity and Non-Discrimination Policy Statement <https://policies.ncsu.edu/policy/pol-04-25-05>[This link will open in a new window](#) with additional references at <https://oied.ncsu.edu/equity/policies/>
- Code of Student Conduct <https://policies.ncsu.edu/policy/pol-11-35-01>
- Grades and Grade Point Average <https://policies.ncsu.edu/regulation/reg-02-50-03>
- Credit-Only Courses <https://policies.ncsu.edu/regulation/reg-02-20-15>
- Audits <https://policies.ncsu.edu/regulation/reg-02-20-04>

Additional discussion of policies and procedures are discussed below.

Academic Integrity. Students are required to comply with the university policy on academic integrity found in the Code of Student Conduct found at <http://policies.ncsu.edu/policy/pol-11-35-01>. It is the instructor's understanding and expectation that the student's signature on any test or assignment means that the student contributed to the assignment in question (if a group assignment) and that they neither gave nor received unauthorized aid (if an individual assignment). Authorized aid on an individual assignment includes discussing the interpretation of the problem statement, sharing ideas or approaches for solving the problem, and explaining concepts involved in the problem. Any other aid would be unauthorized and a violation of the academic integrity policy. This includes referring to homework from previous semesters. (Note that the instructor will provide students with sample exams from previous years). Any computer work submitted must be completed on your own personal computer or from your own NCSU account to avoid confusion about the origin of the file, and no sharing of files outside your group is allowed. All cases of academic misconduct will be submitted to the Office of Student Conduct. If you are found guilty of academic misconduct in the course, you will be on academic integrity probation for the remainder of your years at NCSU and may be required to report your violation on future professional school applications. It's not worth it!

Class Communication. Students are encouraged to submit questions about lecture content and homework through the forums set up in the course Moodle page. ***This is the most direct way to receive a quick response.*** Emails to the instructor may take a longer time for a response. If there is a personal concern or question, email to the instructor is preferred, and a personal appointment for a phone call can be set up. Office hours are also a preferred method to discuss questions about the class, geotechnical engineering, our graduate program, career paths, you name it.

Homework and Written Assignments. All students (e.g., on campus and EOL students) will submit homework assignments and term projects via Moodle (i.e., upload link associated with each assignment).

Late homework assignments will lose one letter grade –later than one week will not be graded for credit. Homework may be due within a week of tests or exams; if this is the case, no late homework will be accepted in order for the assignment solutions to be posted prior to the examination.

Reading Quizzes. Journal articles will be assigned throughout the semester to reinforce the lecture material and introduce the students to essential literature. A selection of these journal articles will be used for reading quizzes. The reading quizzes are denoted on the tentative course schedule. The reading quiz will be short (approximately 10 mins), be accessible on the course Moodle site, and will focus on the main objective of the article, as it relates to the course. Five reading quizzes will be given throughout the semester. There will be no make-up for any quizzes

given. Quizzes not taken will be assigned a grade of zero. The lowest quiz grade will be dropped in calculating the course semester grade.

Exams. There will be one midterm exam and a comprehensive final exam. Exams will be take-home exams. *Students are expected to follow the Academic Integrity policies at all times while taking the exam and will not seek help from outside sources or fellow classmates.* If this is not upheld, then the format of subsequent exams are subject to change.

Make-up tests will be given under only the most extraordinary circumstances, and require a written request and documentation of a suitable excuse. If the midterm exam is missed, the intended credit for that exam will be assigned to the Final Exam (which will then count for 45% of the course grade).

Grading. If you believe that an error was made in grading, you should write a short justification of your claim and attach it to the original assignment or exam in question. Return your justification to the instructor. The instructor will review your concern and respond to you directly. The “statute of limitations” for submitting such claims is one week after the assignment or exam is returned.

Attendance Policy. Full participation in classes and examinations is expected of all students. If you do not come to class having reviewed the assigned material, you will likely experience unnecessary difficulty with understanding the lectures, doing the assigned laboratory experiments and successfully completing the exams.

For complete attendance policies, please see <http://policies.ncsu.edu/regulation/reg-02-20-03>

If one is absent from class (unless the absence is one for a medical or other justifiable reason with written documentation), he or she assumes the responsibility to make arrangements with a fellow student to obtain class notes.

Calculation of course grade. A weighted average will be calculated as follows:

- Homework Assignments = 30%
- Research Project Report = 15%
- Reading Quizzes = 10%
- Midterm = 20%
- Final Exam = 25%

The course grades will be determined using the Standard NCSU Letter Grading:

Score	97-100	93-97	90-93	87-90	83-87	80-83	77-80	73-77	70-73	67-70	63-67	60-63	0-60
Grade	A+	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F

Requirements for Credit-Only (S/U) Grading. In order to receive a grade of S, students are required to take all exams, complete all assignments, and earn a grade of C- or better. Conversion from letter grading to credit only (S/U) grading is subject to university deadlines. Refer to the Registration and Records calendar for deadlines related to grading. For more details refer to <http://policies.ncsu.edu/regulation/reg-02-20-15>.

Requirements for Auditors (AU). Information about and requirements for auditing a course can be found at <http://policies.ncsu.edu/regulation/reg-02-15-04>.

Policies on Incomplete Grades. If an extended deadline is not authorized by the Graduate School, an unfinished incomplete grade will automatically change to an F after either (a) the end of the next regular semester in which the student is enrolled (not including summer sessions), or (b) by the end of 12 months if the student is not enrolled,

whichever is shorter. Incompletes that change to F will count as an attempted course on transcripts. The burden of fulfilling an incomplete grade is the responsibility of the student. The university policy on incomplete grades is located at <http://policies.ncsu.edu/regulation/reg-02-50-03>. Additional information relative to incomplete grades for graduate students can be found in the Graduate Administrative Handbook in Section 3.18.F at http://www.fis.ncsu.edu/grad_publicns/handbook/

Electronically-Hosted Course Components. Students may be required to disclose personally identifiable information to other students in the course, via electronic tools like email or web-postings, where relevant to the course. Examples include online discussions of class topics, and posting of student coursework. All students are expected to respect the privacy of each other by not sharing or using such information outside the course.

Accommodations for Disabilities. Reasonable accommodations will be made for students with verifiable disabilities. In order to take advantage of available accommodations, students must register with the Disability Resource Office at Holmes Hall, Suite 304, 2751 Cates Avenue, Campus Box 7509, 919-515-7653. For more information on NC State's policy on working with students with disabilities, please see the [Academic Accommodations for Students with Disabilities Regulation \(REG02.20.01\)](#)

Non-Discrimination Policy. NC State University provides equality of opportunity in education and employment for all students and employees. Accordingly, NC State affirms its commitment to maintain a work environment for all employees and an academic environment for all students that is free from all forms of discrimination. Discrimination based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation is a violation of state and federal law and/or NC State University policy and will not be tolerated. Harassment of any person (either in the form of quid pro quo or creation of a hostile environment) based on race, color, religion, creed, sex, national origin, age, disability, veteran status, or sexual orientation also is a violation of state and federal law and/or NC State University policy and will not be tolerated. Retaliation against any person who complains about discrimination is also prohibited. NC State's policies and regulations covering discrimination, harassment, and retaliation may be accessed at <http://policies.ncsu.edu/regulation/reg-04-25-2> or http://www.ncsu.edu/equal_op/. Any person who feels that he or she has been the subject of prohibited discrimination, harassment, or retaliation should contact the Office for Equal Opportunity (OEO) at 919-515-3148.

Supporting Fellow Students in Distress: As members of the NC State Wolfpack community, we each share a personal responsibility to express concern for one another and to ensure that this classroom and the campus as a whole remains a safe environment for learning. Occasionally, you may come across a fellow classmate whose personal behavior concerns or worries you. When this is the case, I would encourage you to report this behavior to the NC State Students of Concern website: <http://studentsofconcern.ncsu.edu/>. Although you can report anonymously, it is preferred that you share your contact information so they can follow-up with you personally.

Instructor's commitment. You can expect your instructor to be courteous, punctual, well-organized, and prepared for lecture and other class activities; to be available during office hours or to notify you beforehand if they are unable to keep them; to provide a suitable guest lecturer when they are traveling; and to grade uniformly and consistently according to the posted guidelines.

Course Evaluation. Online class evaluations will be available for students to complete during the last 2 weeks of the term.

Students will receive an email message directing them to a website where they can login using their Unity ID and complete evaluations. All evaluations are confidential; instructors will not know how any one student responded to any question, and students will not know the ratings for any instructors.

Evaluation website: <https://classeval.ncsu.edu/>

Student help desk: classeval@ncsu.edu

More information about ClassEval: <http://www.ncsu.edu/UPA/classeval/>

Need Help?

If you find yourself in a place where you need help, academically or otherwise, please review these [Step-by-Step Help Topics](#).

Other Important Resources

- **Keep Learning:** [Keep Learning](#)
- **Protect the Pack FAQs:** [Frequently Asked Questions | Protect the Pack](#)
- **NC State Protect the Pack Resources for Students:** [Resources for Students | Protect the Pack](#)
- **Academic Success Center** (tutoring, drop in advising, career and wellness advising): [Academic Success Center](#).
- **NC State Keep Learning, tips for students opting to take courses remotely:** [Keep Learning Tips for Remote Learning](#)
- **Introduction to Zoom for students:** <https://youtu.be/5LbPzzPbYEw>
- **Learning with Moodle, a student's guide to using Moodle:** <https://moodle-projects.wolfware.ncsu.edu/course/view.php?id=226>
- **NC State Libraries** [Technology Lending Program](#)