

CVEN9531

Unsaturated Soil Mechanics

Term 2, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Nasser Khalili	n.khalili@unsw.edu.au			

School Contact Information

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

Course Details

Units of Credit 6

Summary of the Course

This course provides a fundamental understanding of theoretical and applied unsaturated soil mechanics. Topics cover will include effective stress principle and its applicability, state variables, matric and osmotic suctions, shear strength, seepage, deformation analysis, consolidation, earth pressures, slope stability, laboratory testing, field measurement, parameter determination and constitutive modelling. The students will work individually to apply this knowledge to project based assignments.

Course Aims

The course aims to have students gain the following attributes:

- 1) Knowledge of the fundamentals of theoretical and applied unsaturated soil mechanics as they may be encountered by geotechnical engineers
- 2) Ability to assess data and reports presented to them by specialists in the area of unsaturated soil mechanics and geotechnical engineering
- 3) Capacity for analytical and critical thinking and for creative problem solving
- 4) Ability to engage independent and reflective thinking
- 5) Skills for complex multi disciplinary work

Course Learning Outcomes

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Demonstrate clear knowledge in relation to theoretical concepts in unsaturated soil mechanics.	PE1.1, PE1.3, PE2.1, PE2.3
2. Critically and independently assess reports and data relating to problems associated with unsaturated soils.	PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.4, PE3.1
3. Assess the strengths and weaknesses of various techniques used in practice and adopt state of the art in solving complex problems.	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE3.1, PE3.3, PE3.5
4. Work as part of a team to generate novel solutions to civil and environmental engineering challenges and evaluate the effectiveness of proposed solutions.	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.2,

Learning Outcome	EA Stage 1 Competencies
	PE3.4, PE3.5, PE3.6

Teaching Strategies

This course consists of lectures, tutorials, hand-in assignments. It will place emphasis on problem solving skills and application to real case studies.

In designing this course, the objective has been to train intelligent users of data collected from field, critically assess them, arrive at geotechnical engineering model of the problem and arrive at effective solutions. The core philosophy has been that, regardless of the applications, intelligent use of data, a through understanding of the underlying physics and theoretical concepts in unsaturated soil mechanics as well as an acquaintance with the design of the engineering systems subject to the impact of soil unsaturation. Each day students will attend 6 hrs of lecture and 2 hrs of tutorial. Lectures will introduce students to fundamentals of theoretical and applied unsaturated soil mechanics using interactive lectures, critical discussions, case studies and video presentations. During tutorials the students will consolidate the basic concepts introduced during the lectures and become familiar with exam-style questions. Recent peer reviewed journal articles will be provided for further reading. During assignments the students will learn to apply their acquired knowledge to real life engineering problems in a holistic way.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Assignments	25%	Not Applicable	1, 2, 3, 4
2. Final Exam	50%	Not Applicable	1, 2, 3
3. Tutorials	25%	Not Applicable	1, 2, 3, 4

Assessment 1: Assignments

Deadline for absolute fail: Two weeks before the date of the final exam

Students will be give two assignments to assess the learning outcomes from each lecture and students' ability in applying principles of unsaturated soil mechanics to real life engineering projects in a team environment. Both assignments will be marked and returned to the students along with the relevant feedback at least four weeks prior to the date of the final exams.

Assessment criteria

Acuracy of the calculations, methodology adopted and appropriateness of the final solution.

Assessment 2: Final Exam

The exam will assess students' conceptual understanding of theoretical and applied unsaturated soil mechanics as well as their ability to critically assess data and information relevant to a particular geotechnical engineering problem.

Assessment criteria

Methodology adopted, appropriatness of the solutions, correctness of the numerical and written answers.

Assessment 3: Tutorials

Tutorials will help students to consolidate the basic concepts introduced during the lectures and became familiar with exam-style questions. Completed tutorials will be marked and returned to students with the relevant feedback at least four weeks prior to the date of the final exams. The first tutorial will be marked and returned to the students prior to the census date. Tutorials will be individual work.

Assessment criteria

Methodology adopted, appropriatness of the solutions, correctness of the numerical and written answers.

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

Submission of Assessment Tasks

Please refer to the Moodle page of the course for further guidance on assessment submission.

UNSW has a standard late submission penalty of:

- 5% per day, for all assessments where a penalty applies, capped at five days (120 hours), after which a student cannot submit an assessment, and no permitted variation.

Academic Honesty and Plagiarism

Beware! An assignment that includes plagiarised material will receive a 0% Fail, and students who plagiarise may fail the course. Students who plagiarise are also liable to disciplinary action, including exclusion from enrolment.

Plagiarism is the use of another person's work or ideas as if they were your own. When it is necessary or desirable to use other people's material you should adequately acknowledge whose words or ideas they are and where you found them (giving the complete reference details, including page number(s)). The Learning Centre provides further information on what constitutes Plagiarism at:

<https://student.unsw.edu.au/plagiarism>

Academic Information

Final Examinations:

Final exams in T2 2022 will be held online between 12th - 25th August 2022 inclusive, and supplementary exams between 5th - 9th September 2022 inclusive. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): <https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw>
- [Key UNSW Dates](#) - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.
- CVEN Student Intranet (log in with your zID and password): <https://intranet.civeng.unsw.edu.au/student-intranet>
- Student Life at CVEN, including Student Societies: <https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life>
- Special Consideration: <https://student.unsw.edu.au/special-consideration>
- General and Program-Specific Questions: [The Nucleus: Student Hub](#)
- Book an Academic Advising session: <https://app.acuityscheduling.com/schedule.php?owner=19024765>

Disclaimer

This course outline sets out description of classes at the date the Course Outline is published. The nature of classes may change during the Term after the Course Outline is published. Moodle should be consulted for the up to date class descriptions. If there is any inconsistency in the description of activities between the University timetable and the Course Outline (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Mike Gal.

CRICOS

CRICOS Provider Code: 00098G

Acknowledgement of Country

We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.

Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

Program Intended Learning Outcomes	
Knowledge and skill base	
PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline	✓
PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline	✓
PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline	✓
PE1.4 Discernment of knowledge development and research directions within the engineering discipline	✓
PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline	✓
PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline	✓
Engineering application ability	
PE2.1 Application of established engineering methods to complex engineering problem solving	✓
PE2.2 Fluent application of engineering techniques, tools and resources	✓
PE2.3 Application of systematic engineering synthesis and design processes	✓
PE2.4 Application of systematic approaches to the conduct and management of engineering projects	✓
Professional and personal attributes	
PE3.1 Ethical conduct and professional accountability	✓
PE3.2 Effective oral and written communication in professional and lay domains	✓
PE3.3 Creative, innovative and pro-active demeanour	✓
PE3.4 Professional use and management of information	✓
PE3.5 Orderly management of self, and professional conduct	✓
PE3.6 Effective team membership and team leadership	✓