

School of Civil and Environmental Engineering UNSW Engineering

## **CVEN9531**

**Unsaturated Soil Mechanics** 

Term 2, 2023



## **Course Overview**

#### **Staff Contact Details**

#### Convenors

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

#### **School Contact Information**

<u>Engineering Student Support Services</u> – 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)

<u>UNSW Exchange</u> – 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 presnted to them by specialists in the area of unsaturated soil mechanics and qeotechnical 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 associate 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 or lecture and 2 hrs of tutorial. Lectures will introduce students to fundamentals of theoretical and applied unsaturated soil mechanic using interactive lectures, critical discussions, case studies and video presentations. During tutorials the students will consolidate the basic concepts introduced during the lectures and became 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 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

Acuracey 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.

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

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## **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 2023 will be held on campus between Friday 11th and Thursday 24th August (inclusive), and Supplementary Exams between Monday 4th and Friday 8th September (inclusive). You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

For students enrolled in the distance offering of a postgraduate course, and who reside further than 100km from UNSW Kensington campus, will be contacted regarding sitting an external exam. The school's External Exam Policy can be found on the Intranet.

#### ACADEMIC ADVICE

- Key Staff to Contact for Academic Advice (log in with your zID and password): <u>https://intranet.civeng.unsw.edu.au/key-staff-to-contact-during-your-studies-at-unsw</u>
- <u>Key UNSW Dates</u> 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): <u>https://intranet.civeng.unsw.edu.au/student-intranet</u>
- Student Life at CVEN, including Student Societies: <u>https://www.unsw.edu.au/engineering/civil-and-environmental-engineering/student-life</u>
- Special Consideration: https://student.unsw.edu.au/special-consideration
- General and Program-Specific Questions: <u>The Nucleus: Student Hub</u>
- Book an Academic Advising session: https://unswengacademicadvising.as.me/schedule.php

#### 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				