CVEN9525

Fundamentals of Geomechanics

Term 1, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Arman Khoshghalb	arman.khoshghalb@unsw.edu.au	Fridays from 3 pm to 4:30 pm	CE 503, Civil Engineering Building	Email only

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 is an introductory course to fundamentals of soil mechanics, designed for geologist. It covers the most important topics in soil mechanics including the basic classification of soil, phase relationships, the principle of effective stress and its importance in soil mechanics and geotechnical engineering, how water flows through soil and the equations governing the one-dimensional and two-dimensional flow of water in soils. It also covers the behaviour of soil under imposed loads, in particular the time-dependent behaviour of clay, the shearing strength of soil, and the Mohr-Coulomb failure criterion.

Course Aims

To introduce students to the state of the fundamentals of soil mechanics and the important concepts of soil behaviour.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Identify the major physical properties of soils, and classify soils based on different standards.	PE1.1, PE1.3, PE1.5, PE2.3
2. Estimate effective in-situ stresses due to layers of soil, pore water pressure and surcharges.	PE1.1, PE1.3, PE1.4, PE1.5, PE2.1, PE2.2, PE2.3
3. Predict the amount of soil settlement.	PE1.1, PE1.2, PE1.3, PE1.5
4. Explain the concepts of soil shear strength, including drained and undrained conditions.	PE1.1, PE1.3, PE1.5, PE2.1
5. Be able to solve a range of soil related problems particularly those involving water flow, soil settlement and soil strength.	PE1.1, PE1.2, PE1.3, PE1.4, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3

Teaching Strategies

The contents of this subject will be presented in a series of lectures followed by workshops. The lectures explain the theory of soil behaviour and greatly assist in understanding the different concepts in classical soil mechanics. Understanding and application of each concept will be enhanced in workshops.
In order to understand different soil mechanics topics well, it is essential for students to attend the workshops and solve the workshop problems by themselves. It is expected that students will put in at least 1.5 hours of private study for each hour of contact. During private studies, students should review and reflect on the lecture materials and class problems, solve workshop problems, and generally study the concepts taught in a soil mechanics book.

Additional Course Information

Further details on all assessments and assessment criteria will be provided in the first Lecture and on Moodle during the term.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Online quiz	10%	Not Applicable	1, 5
2. Assignments	30%	21th April at 5pm	1, 2, 3, 4, 5
3. Final Exam	60%	Formal UNSW Exam Period	1, 2, 3, 4, 5

Assessment 1: Online quiz

Start date: 28/02/2023 09:05 AM
Assessment length: between 15 to 30 minutes, depending on the question.

The quiz will cover the materials of Week 1 only. The quiz will be in online format (in Moodle) and open book. You can take the quiz remotely (from home, workplace, etc.).

Assessment 2: Assignments

Start date: Week 1
Due date: 21th April at 5pm

There is one assignment that includes a range of questions from different topics covered in this course. The students are expected to work on the assignment questions during the term and submit their work-outs by the submission deadline. The work-outs should be submitted as a single pdf file to a assignment submission link that will be available on Moodle. Detailed solutions to the assignment questions should be included in your submission. Both handwritten and typed solutions are accepted (as long as converted to a single pdf file). The submission must be well organised and clear to follow. Your solutions must be neat and clearly legible. Late submissions will be penalised according to the UNSW policy regarding late penalty for assignments, which is as follows:
- 5% per day, for all assessments where a penalty applies.
- capped at five days (120 hours), after which a student cannot submit an assessment.

Assessment 3: Final Exam

Start date: Formal UNSW Exam Period
Due date: Formal UNSW Exam Period

A comprehensive final exam covering all the materials.

Hurdle requirement

A mark of at least 40% in the final examination is required before other assessment items are included in the final mark.

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 13 February - 17 February	Lecture	Introduction, Phase relationship, Classification of soils
Week 2: 20 February - 24 February	Lecture	Classification of soils (cont.), Compaction, Stress and Mohr circle
Week 3: 27 February - 3 March	Lecture	Stress in soils **Online Quiz**
Week 4: 6 March - 10 March	Lecture	One-dimensional seepage; Two-dimensional seepage
Week 5: 13 March - 17 March	Lecture	Two-dimensional seepage (cont.), Consolidation theory
Week 6: 20 March - 24 March	Reading	Flexibility week - No Lecture.
Week 7: 27 March - 31 March	Lecture	Rate of consolidation, Shear strength of soils, Direct shear test
Week 8: 3 April - 7 April	Lecture	Triaxial test
Week 9: 10 April - 14 April	Lecture	Slope stability
Week 10: 17 April - 21 April	Lecture	Finishing the class examples and workshop questions.
Stuvac: 22 April - 27 April		No Lecture

Resources

Prescribed Resources

The textbook for the course, on which most of the course PowerPoint slides are based and contains thorough explanations and dozens of worked examples, is sold at the UNSW bookshop:

Holtz, R.D., Kovacs, W.D. and Sheahan, T.C. (2011), “An Introduction to Geotechnical Engineering”, Second Edition. International Edition. Pearson.

Recommended Resources

The following reference books are useful for additional reading. Many of these can be found in the UNSW library.

- Indraratna, Heitor, and Vinod, “Geotechnical Problems and Solutions - A Practical Perspective”, CRC press, 2020
- Craig, R. F. "Soil Mechanics", CRC press, 2012
- Das, B. M., “Principles of Geotechnical Engineering”, PWS publishing, 1998-2006
- Lambe and Whitman, "Soil Mechanics", Wiley, 1975
- Barnes, G., "Soil Mechanics, Principles and practice", Palgrave MacMillan; 3rd Ed, 2011
- Budhu, M., “Soil Mechanics and Foundations”, Wiley & Sons, 2007
- Smith, I, “Smith’s Element of Soil Mechanics”, Blackwell, 2006

Also, students can download the Soil Mechanics Book by Prof Verruijt in PDF fromat for free, from here:

http://geo.verruijt.net/software/SoilMechBook2012.pdf

Course Evaluation and Development

The course is reviewed annually through the myExperience survey. All responses are considered and changes may be made to the course annually in response. I am always happy to get feedback during the course for immediate consideration too.

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 T1 2023 will be held on campus between the 28th of April and the11th of May, and Supplementary Exams between the 22nd of May and the 26th of May. 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://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	