CVEN9525

Fundamentals of Geomechanics

Term One // 2021

School of Civil and Environmental Engineering // UNSW Engineering

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Babak Shahbodagh	b.shahbodagh@unsw.edu.au		CE 507, Civil Engineering Building	

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

Credit Points 6

Summary of the Course

This is an introductory course to fundamentals of soil mechanics. It covers the most important topics in soil mechanics; 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 soil. It also covers the behaviour of soil under imposed loads, in particular the time-dependent behaviour of clay, the shearing strength of soil, failure criteria, and Mohr-Coulomb failure criterion.

There is no pre- or co-requisite to this course; students are expected to have a good understanding of the fundamentals of geology.

Course Aims

To introduce students to the state of the fundamentals of soil mechanics and the important concepts of soil behaviour. By the end of the course, successful students should:

- understand the fundamentals of the behaviour of soil as an engineering material,
- relate to those aspects of soil behaviour which have a significant environmental impact,
- be able to solve a range of soil-related problems especially those involving water flow, soil settlement and soil strength,
- have a sound basis for further formal study and self-study in the geotechnical area,
- develop a rational approach to problem-solving which will lead to the development of design skills.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Understand the fundamentals of the behaviour of soil as an engineering material,	PE1.1, PE1.2, PE1.3, PE1.5, PE2.3
2. Relate to those aspects of soil behaviour which have a significant environmental impact,	PE1.3, PE1.6, PE3.1
3. Be able to solve a range of soil related problems especially those involving water flow, soil settlement and soil strength	PE1.1, PE1.2, PE2.1, PE2.2, PE3.3, PE3.5
4. Have a sound basis for further formal study and self-study in the geotechnical area,	PE1.1, PE1.4
5. Be developing a rational approach to problem solving which will lead to the development of design skills.	PE2.1, PE2.3, PE2.4, PE3.4

Teaching Strategies

The contents of this subject will be presented in a series of lectures followed by workshop questions. 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.

A series of assignments will be given so that students can examine their understanding of the theories. Students are advised to tackle some of the assignments during the two days break between the lectures and reflect on their learning. 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 lecture material and class problems, solve workshop and assignment problems, and generally study the concepts taught in a soil mechanics book.

An example of the approaches to learning is:
Lectures

- Find out what you must learn
- Follow worked examples
- Observe solution methods

Workshops

- Practice solving set problems
- Ask questions

Private Study

- Review lecture material and textbook
- Do set problems and assignments
- Reflect on class problems and assignments

Assessments (examinations and assignments)

- Demonstrate your knowledge and skills
- Demonstrate higher understanding and problem solving

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Assignments	40%	The due date for each assignment will be provided on Moodle.	1, 2, 3, 4, 5
Final Exam	60%	Formal UNSW Exam Period	1, 2, 3, 4, 5

Assessment Details

Assessment 1: Assignments

Details:

There are three sets of assignments with the combined value of 40%.

Topics covered in the assignments: Phase relationships, soil classification, stress in soil, 1D and 2D seepage, 1D settlement, rate of settlement, shear strength, slope stability

Additional details:

Late submission will be penalised at the rate of 10% per day after the due time and date have expired.

Assessment 2: Final Exam

Details:

A comprehensive final exam covering all the materials.

The final exam will be open book and you may use any textbooks or course materials during the exam.

Final Exam: The final exam is held in the formal exam period and normally consists of 5 to 7 questions of different topics. The Lecturer reserves the right to adjust the final scores by scaling if agreed to by the Head of School.

In order to pass the subject, students must receive 40% or more in the final examination and receive an overall total of 50% marks or more for the subject.

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
O Week: 8 February - 12 February		
Week 1: 15 February - 19 February		Introduction & Phase relationships
Week 2: 22 February - 26 February		Classification / Compaction
Week 3: 1 March - 5 March		Stress and Mohr circle
Week 4: 8 March - 12 March		Stresses in Soil / Quiz
Week 5: 15 March - 19 March		One-Dimensional Seepage
Week 6: 22 March - 26 March		Flexibility Week - No Lectures/Workshops
Week 7: 29 March - 2 April		Good Friday - No Lectures/Workshops
Week 8: 5 April - 9 April		Two-Dimensional Seepage
Week 9: 12 April - 16 April		One-Dimensional Settlement/ Quiz
Week 10: 19 April - 23 April		Rate of Settlement & Shear Strength of Soils

Resources

Prescribed Resources

No compulsory text for this course however the following books can give you a better and deeper understanding of various aspects of the course.

Learning will be greatly enhanced by reading a text book on the topic. Also, people working in industry where geomechanics is used are recommended to buy a text book to add to their own library. There are many books published on the topic, and the main UNSW library has dozens.

One of the best text books, on which most of the course PowerPoint slides are based and contains thorough explanations and dozens of worked examples, is:

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 may also be useful for additional reading, many of them can be found in the UNSW library:

- Craig, R. F. "Soil Mechanics", CRC press, 2004
- Das, B. M., “Principles of Geotechnical Engineering”, PWS publishing, 1998-2006
- Lambe and Whitman, "Soil Mechanics", Wiley, 1975
- Scott, C., "An Introduction to Soil Mechanics and Foundation Engineering", AS Publisher, 1980
- Budhu, M., “Soil Mechanics and Foundations”, Wiley & Sons, 2007
- Smith, I, “Smith’s Element of Soil Mechanics”, Blackwell, 2006

Course Evaluation and Development

The course is reviewed annually through the myExperience survey. All responses are considered and we make changes to the course annually in response. We are also always happy to get feedback during the course for immediate consideration.

Submission of Assessment Tasks

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

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

Key UNSW Dates - eg. Census Date, exam dates, last day to drop a course without academic/financial liability etc.

Final Examinations:

Final exams in Term 1 will be held online between 30th April - 13th May inclusive. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

Supplementary Examinations:

Supplementary Examinations for Term 1 2021 will be held on 24th - 28th May inclusive should you be required to sit one. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

ACADEMIC ADVICE

For information about:

- Notes on assessments and plagiarism;
- Special Considerations: student.unsw.edu.au/special-consideration;
- General and Program-specific questions: The Nucleus: Student Hub
- Year Managers and Grievance Officer of Teaching and Learning Committee, and
- CEVSOC/SURVSOC/CEPCA

Refer to Academic Advice on the School website available at:

https://www.engineering.unsw.edu.au/civil-engineering/student-resources/policies-procedures-and-forms/academic-advice

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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	