School of Civil and Environmental Engineering

Term 3, 2020

CVEN9525 FUNDAMENTALS OF GEOMECHANICS

COURSE DETAILS

Units of Credit	6		
Contact hours	35 hours per week		
Lecture	Tuesdays,	17:00 – 21:00	online
			online
Workshop	Optional workshops TBA		
Course Coordinator and Lecturer	Dr. Mohammad Vahab email: M.Vahab@unsw.edu.au office: CE 507, Civil Engineering Building Consultation times: Wednesdays from 9 to 11:00		

INFORMATION ABOUT THE COURSE

This is an introductory course to fundamentals of soil mechanics, designed for geologist. 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.

HANDBOOK DESCRIPTION

This is a Professional Development Course. Fundamentals of Geomechanics for geologists and other professionals who wish to work in geotechnical engineering, engineering geology, and environmental engineering. Classification of soil, phase relationships, flow of water in soil, the principle of effective stress, consolidation theory, stress distribution and settlement, Mohr Circle, failure criteria, stress paths and strength of soils and lateral earth pressures.

OBJECTIVES

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,
- be developing a rational approach to problem solving which will lead to the development of design skills.

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. The class meets in two sessions every day, each session include a lecture followed by problem solving workshop session.

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. 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:

Private Study	• Review lecture material and textbook • Do set problems and assignments • Join Moodle discussions of problems • Reflect on class problems and assignments • Download materials from Moodle • Keep up with notices and find out marks via Moodle
Lectures	• Find out what you must learn • See methods that are not in the textbook • Follow worked examples • Hear announcements on course changes
Workshops	• Be guided by Demonstrators • Practice solving set problems • Ask questions
Assessments	• Demonstrate your knowledge and skills • Demonstrate higher understanding and problem solving

EXPECTED LEARNING OUTCOMES

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

Learning Outcome		EA Stage 1 Competencies
1.	*Evaluate the major properties of soils, and classify soils based on different standards*	PE1.1, PE1.2

2.	*Estimate effective in-situ stresses due to layers of soil, pore water pressure, and surcharges*	PE1.1, PE1.2
3.	*Calculate settlement of soil layers*	PE1.1, PE1.3
4.	*Understand shear strength concept under drained and undrained conditions*	PE1.1, PE1.6
5.	*Slope stability analysis*	PE1.3, PE2.3

For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

COURSE PROGRAM

A table of lectures and workshops or practical class topics for each week, indicating the name of lecturer involved (where multiple lecturers teaching in course), online activities, such as discussion forums, and relevant readings from textbook and other reference material identified for the course.

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Date	Topic	Lecture Content	Demonstration Content
14/09/2020 (Week 1)	Introduction & Phase relationships	Introduction & Phase relationships	
21/09/2020 (Week 2)	Classification/ Compaction	Classification/ Compaction	WORKSHOP 1
28/09/2020 (Week 3)	Compaction / Stress and Mohr circle	Compaction / Stress and Mohr circle	WORKSHOP 2
06/10/2020 (Week 4)	Stresses in Soil	Stresses in Soil	WORKSHOP 3
12/10/2020 (Week 5)	One-D seepage	One-D Seepage	**Quiz 1**
19/10/2020 (Week 6)		***Flexibility week for all courses (non-teaching)***	WORKSHOP 4
26/10/2020 (Week 7)	Two-D seepage	Two-D Seepage	WORKSHOP 5
02/11/2020 (Week 8)	One-D Settlement	One-D Settlement	WORKSHOP 6
09/11/2020 (Week 9)	Rate of Settlement	Rate of Settlement	WORKSHOP 7
16/11/2020 (Week 10)	Shear Strength of Soils	Shear Strength of Soils	**Quiz 2**

ASSESSMENT

Assessment will be based on assignments and a final exam, as follows:

Item	*Marks*	*Date*	*Assessment Criteria*
Assignments	40%	#1due: 02/10/2020 #2due: 06/11/2020 #3due: 23/11/2020	phase relationships, soil classification, stress in soil 1D and 2D seepage, 1D settlement rate of settlement, shear strength, slope stability (bonus)
Final Exam	60%	Exam period	The final exam will cover the entire course. It will be assessed against the learning outcomes of the course. The final exam is **open** book and you may bring any textbooks or course materials to the exam.

Assignments: The solutions to the assignments should be done in a work book, like an exercise book. The work book must be well organised and clear to follow. Your solutions must be neat and clearly legible. Your work book should be handed in before the due date. Hard copy submission is still required even if you email me the scanned copy of your solutions. You should make a copy of your assignment to keep before you submit the original.

Final Exam: The written final exam is held in the formal exam period and normally consists of 5 to 7 questions of different topics. The formal exam scripts will not be returned. The Coordinator or 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.

Notes:

- A mark of at least 40% in the final examination is required before the class work is included in the final mark.
- Late work may not be accepted or assessed. If you have a good reason for being unable to submit your work on time, it is important that you let your course coordinator know promptly. There are two kinds of provisions made for students who have good reasons for late submission, as detailed in the next two points.
- Supplementary Examinations for Term 3 2020 will be held on Monday 11th January – Friday 15th January 2021 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

PENALTIES

Penalties for late submissions should also be included here. For example, late work will be penalised at the rate of 10% per day after the due time and date have expired.

ASSESSMENT OVERVIEW

Item	Length	Weighting	Learning outcomes assessed	Assessment Criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
1.Quizzes							
Quiz 1	1	2% extra		Check list	13/10/2020		within two weeks
Quiz 2	1	2% extra		Check list	17/11/2020		within two weeks
3. Assessments							
Assessment 1	#1-#2	10%		Check list + random check	02/10/2020	05/10/2020	within two weeks
Assessment 2	#3-#6	15%		Check list + random check	06/11/2020	09/11/2020	within two weeks
Assessment 3	#7-#10	15%		Check list + random check	23/11/2020	27/11/2020	within two weeks
4. Final Exam	5-7	60%		Complete check			

RELEVANT RESOURCES

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 sold in the UNSW bookshop:

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

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

Also, students may find the following Soil Mechanics Book in PDF (5.5MB) in a table under the “software” section” from <http://geo.verruijt.net/> website, as SoilMechBook.pdf

DATES TO NOTE

Refer to MyUNSW for Important Dates available at:

https://student.unsw.edu.au/dates

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 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

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex 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
PE3: Professional and Personal Attributes	PE3.1 Ethical conduct and professional accountability
	PE3.2 Effective oral and written communication (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