### **CIVL2282: Introduction to Geomechanics**

Singapore BCA and Callaghan Semester 2 - 2023



# **OVERVIEW**

**Course Description** 

This is a first course in Geomechanics devoted to soil index properties, stress, seepage, and deformation. It introduces the concepts of porous granular materials, total and effective stress, pore pressure and excess pore pressure, stress distributions in elastic materials, elastic deformation consolidation and timedependent settlement.

#### Assumed Knowledge

CIVL1200 Earth Systems, CIVL1100 Fundamentals of Engineering Mechanics

#### **Contact Hours**

#### Laboratory \*

Face to Face On Campus 2.5 hour(s) per Week for 8 Weeks starting Week 2 Students will attend only four (4) laboratory classes of the timetabled sessions (TBA). The laboratory classes are essential to providing a hands-on experience with soils.

#### Lecture

Face to Face On Campus 2 hour(s) per Week for Full Term starting Week 1 Attendance at lectures is expected

#### Tutorial

Face to Face On Campus 3 hour(s) per Week for Full Term starting Week 1 Attendance at tutorials is strongly recommended.

Unit Weighting Workload \* This contact type has a compulsory requirement.

#### 10 Students are required to spend on average 120-140 hours of effort (contact and non-contact) including assessments per 10 unit course.



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## CONTACTS

**Course Coordinator** 

Singapore BCA and Callaghan

Prof Olivier Buzzi Olivier.Buzzi@newcastle.edu.au (02) 4921 5454 Consultation: Open door policy but it is best to send me an email to make an appointment if you need to see me.

**Teaching Staff** At BCA: Dr. Adnan Anwar Malik (AdnanAnwar.Malik@newcastle.edu.au)

#### School Office

School of Engineering EAG02 EA Building Callaghan +61 2 4921 5798 9.00am-1.00pm and 2.00pm-5.00pm (Monday to Friday) School of Engineering (Callaghan) SENG-ADMIN@newcastle.edu.au +61 2 4921 5798

## SYLLABUS

**Course Content** 

- Phase relationships in porous materials and basic soil properties
- Soils in earthworks
- Effective stress
- Pore pressure under hydrostatic and steady state seepage conditions
- The theory of elasticity
- Three dimensional stresses beneath loaded areas
- Strain integration and elastic settlement
- One dimensional settlement and consolidation
- Time-dependent settlement
- Fundamentals of soil strength

Course Learning Outcomes	<b>On successful completion of this course, students will be able to:</b> 1. Quantify important physical characteristics of partially saturated and saturated porous materials from basic measured data.
	2. Identify/estimate important soil properties and describe and classify soils according to AS1726.
	3. Recall and describe common laboratory tests in soil mechanics and analyse data from these tests to determine quantities of interest.
	4. Determine the total stress, pore pressure and effective stress in the ground, under both hydrostatic and steady-state seepage conditions.
	5. Estimate steady-state seepage rates using flow net theory.

6. Estimate the stress distribution in the ground due to a range of spatially discrete surface loadings.

7. Calculate primary settlements and rates of settlement in coarse- and fine-grained soils using appropriate theories.

8. Recognise that soil strength contains two components (cohesion, friction).

9. Explain which strength component applies to granular soils and cohesive soils for different loading and time scenarios.



#### **Course Materials**

# **COMPULSORY REQUIREMENTS**

In order to pass this course, each student must complete ALL of the following compulsory requirements:

#### **Contact Hour Requirements:**

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#### **Course Assessment Requirements:**

**Pre-Placement Requirements:** 

WHS Requirement - Students must complete a Workplace Safety Induction or Risk Assessment. Students must
attend a specified session. Students must complete and pass an online WH & S laboratory induction module in
Canvas before being allowed to undertake any activity in the laboratory.

# ASSESSMENTS

This course has 5 assessments. Each assessment is described in more detail in the sections below.

	Assessment Name	Due Date	Involvement	Weighting	Learning Outcomes
1	Soil Mechanics Assignment 1	Week 7	Individual	10%	1, 2, 3, 4, 5, 6, 7
2	Soil Mechanics Assignment 2	Week 11	Individual	10%	1, 2, 3, 4, 5, 6, 7
3	Laboratory Exercise Quizzes	At the end of each lab class. The lab activities and the quizzes are to be completed within the timetabled 2.5 hours. Lab classes are timetabled from week 2 to week 5 inclusive.	Individual	20%	1, 2, 3, 5, 7, 8
4	Mid Semester Test	Tuesday 19th of September, Week 10. Exam will take place between 12pm to 3pm.	Individual	30%	1, 2, 3, 4, 5, 6, 7
5	Formal Examination	Exam period	Individual	30%	1, 2, 3, 4, 5, 6, 7, 8, 9

Late Submissions The mark for an assessment item submitted after the designated time on the due date, without an approved extension of time, will be reduced by 10% of the possible maximum mark for that assessment item for each day or part day that the assessment item is late. Note: this applies equally to week and weekend days.

### Assessment 1 - Soil Mechanics Assignment 1

Assessment Type	Written Assignment
Purpose	This assignment is designed to assess knowledge of students on the content covered from week 1 to week 5. These are provided to encourage students to practice the development of
	quantified solutions to geomechanics problems and to provide feedback.
Description	Calculation questions of the type that might be in the quiz and final exam.
Weighting	10%



Length	Unspecified
Due Date	Week 7
Submission Method	Assignment Boxes
	Assignment boxes on first floor of EA building
Assessment Criteria	Students are assessed on their ability to develop correct solutions in a logical and justified
	manner.
Return Method	In Class
Feedback Provided	Returned Work - As assignments are returned.

### **Assessment 2 - Soil Mechanics Assignment 2**

Assessment Type Purpose	Written Assignment This assignment is designed to assess knowledge of students on the content covered from week 1 to week 5. These are provided to encourage students to practice the development of quantified solutions to geomechanics problems and to provide feedback.
Description	Calculation questions of the type that might be in the quiz and final exam.
Weighting	10%
Length	unspecified
Due Date	Week 11
Submission Method	Assignment Boxes Assignment boxes on first floor of EA building
Assessment Criteria	Students are assessed on their ability to develop correct solutions in a logical and justified manner.
Return Method Feedback Provided	In Class Returned Work - As assignments are returned

### Assessment 3 - Laboratory Exercise Quizzes

Assessment Type	Quiz
Purpose	The purpose of laboratory activities is to provide real, firsthand experience of soil tests, and the properties they measure, as are described in the lectures. This is experience is essential for Geomechanics. The assessment items are to encourage students to prepare for their lab classes in advance and to actively participate in the exercises, so they get the most out of them. They test the ability of students to record data in experiments and to synthesise this real data to determine a material property
Description	Short calculations based on measurements made during lab classes. Students may be required to plot and analyse experimental data. There are four lab guizzes worth 5% each
Weighting	20%
Length	unspecified
Due Date	At the end of each lab class. The lab activities and the quizzes are to be completed within the timetabled 2.5 hours.
	Lab classes are timetabled from week 2 to week 5 inclusive.
Submission Method	In Class
Assessment Criteria Return Method	Assessment is based on their ability to develop correct solutions in a logical and justified way. Not Returned
Feedback Provided	In Person

### Assessment 4 - Mid Semester Test

Assessment Type Purpose Description	In Term Test To assess students' knowledge of course content and concepts. 2 hours invigilated face to face exam in the usual time slot of tutorial. Students will have to be in class at 12:00pm and available until 3pm as per normal timetabled tutorial session. Details about rooms will be provided later.
Weighting	30%
Length	Unspecified
Due Date	Tuesday 19th of September, Week 10. Exam will take place between 12pm to 3pm.
Submission Method	In Class
Assessment Criteria	Students are assessed on their ability to develop correct solutions in a logical and justified manner.
Return Method	Not Returned
Feedback Provided	In Class



### **Assessment 5 - Formal Examination**

Assessment Type	Formal Examination
Purpose	To assess students' knowledge of course content and concepts.
Description	2 hour invigilated exam
Weighting	30%
Length	unspecified
Due Date	Exam period
Submission Method	Formal Exam
Assessment Criteria	Students are assessed on their ability to develop correct solutions in a logical and justified manner.
Return Method	Not Returned
Feedback Provided	No Feedback

# **ADDITIONAL INFORMATION**

**Grading Scheme** 

This course is graded as follows:

Range of Marks	Grade	Description			
85-100	High Distinction (HD)	Outstanding standard indicating comprehensive knowledge and understanding of the relevant materials; demonstration of an outstanding level of academic achievement; mastery of skills*; and achievement of all assessment objectives.			
75-84	Distinction (D)	Excellent standard indicating a very high level of knowledge and understanding of the relevant materials; demonstration of a very high level of academic ability; sound development of skills*; and achievement of all assessment objectives.			
65-74	Credit (C)	Good standard indicating a high level of knowledge and understanding of the relevant materials; demonstration of a high level of academic achievement; reasonable development of skills*; and achievement of all learning outcomes.			
50-64	Pass (P)	Satisfactory standard indicating an adequate knowledge and understanding of the relevant materials; demonstration of an adequate level of academic achievement; satisfactory development of skills*; and achievement of all learning outcomes.			
0-49	Fail (FF)	Failure to satisfactorily achieve learning outcomes. If all compulsory course components are not completed the mark will be zero. A fail grade may also be awarded following disciplinary action.			

\*Skills are those identified for the purposes of assessment task(s).

**Communication** Communication methods used in this course include:

Methods

**Course Evaluation** Each year feedback is sought from students and other stakeholders about the courses offered in the University for the purposes of identifying areas of excellence and potential improvement.

Oral Interviews (Vivas) As part of the evaluation process of any assessment item in this course an oral examination (viva) may be conducted. The purpose of the oral examination is to verify the authorship of the material submitted in response to the assessment task. The oral examination will be conducted in accordance with the principles set out in the <u>Oral Examination (viva) Procedure</u>. In cases where the oral examination reveals the assessment item may not be the student's own work the case will be dealt with under the <u>Student Conduct Rule</u>.

## Academic Misconduct All students are required to meet the academic integrity standards of the University. These standards reinforce the importance of integrity and honesty in an academic environment.



	Academic Integrity policies apply to all students of the University in all modes of study and in all locations. For the Student Academic Integrity Policy, refer to <a href="https://policies.newcastle.edu.au/document/view-current.php?id=35">https://policies.newcastle.edu.au/document/view-current.php?id=35</a> .
Adverse Circumstances	<ul> <li>The University acknowledges the right of students to seek consideration for the impact of allowable adverse circumstances that may affect their performance in assessment item(s). Applications for special consideration due to adverse circumstances will be made using the online Adverse Circumstances system where: <ol> <li>the assessment item is a major assessment item; or</li> <li>the assessment item is a minor assessment item and the Course Co-ordinator has specified in the Course Outline that students may apply the online Adverse Circumstances system;</li> <li>you are requesting a change of placement; or</li> <li>the course has a compulsory attendance requirement.</li> </ol> </li> <li>Before applying you must refer to the Adverse Circumstance Affecting Assessment Items Procedure available at: <ul> <li>https://policies.newcastle.edu.au/document/view-current.php?id=236</li> </ul> </li> </ul>
Important Policy Information	The Help button in the Canvas Navigation menu contains helpful information for using the Learning Management System. Students should familiarise themselves with the policies and procedures at <a href="https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures">https://www.newcastle.edu.au/current-students/no-room-for/policies-and-procedures</a> that support a safe and respectful environment at the University.



### **Graduate Profile Statements**

This course builds students' capacity in the following University of Newcastle Bachelor of Engineering Graduate Profile Statements (based on 2011 Engineers Australia revised Stage 1 Competency Standards for Professional Engineers):

UON Att.	University of Newcastle Bachelor of Engineering Graduate Profile Statements/ Engineers Australia Stage 1 competency statements	Taught	Practised	Assessed	Skill Level (1-4)
	Professional Attributes				
11	3.1. Ethical conduct and professional accountability	Х			1
12	3.2. Effective oral and written communication in professional and lay domains.				
13	3.3. Creative, innovative and pro-active demeanour.				
14	3.4. Professional use and management of information.	Х	х	Х	1
15	3.5. Orderly management of self, and professional conduct.				
16	3.6. Effective team membership and team leadership.				
	Engineering Ability				
7	2.1. Application of established engineering methods to complex engineering problem solving.	х	х	Х	2
8	2.2. Fluent application of engineering techniques, tools and resources.	Х	х	х	2
9	2.3. Application of systematic engineering synthesis and design processes.	Х			
10	2.4. Application of systematic approaches to the conduct and management of engineering projects.				
	Knowledge Base				
1	1.1. Comprehensive, theory-based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	Х	X	Х	1
2	1.2. Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.	Х	X	Х	2
3	1.3. In-depth understanding of specialist bodies of knowledge within the engineering discipline.	Х	X	Х	2
4	1.4. Discernment of knowledge development and research directions within the engineering discipline.				
5	1.5. Knowledge of contextual factors impacting the engineering discipline.	Х	Х	Х	1
6	1.6. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.	Х			1

This course outline was approved by the Head of School on the 28/06/2023. No alteration of this course outline is permitted without Head of School approval. If a change is approved, students will be notified and an amended course outline will be provided in the same manner as the original.

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