

CVEN9511

Geotechnical Models and Site Investigation

Term 1, 2022



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
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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

Geotechnical features of geological environments including igneous, volcanic, metamorphic, sedimentary and carbonate. Geological structure and environmental effects including; stress, valley bulging, tectonic setting, glaciation, weathering and alteration; and Holocene geology. Geomorphology, the surface expression of the underlying geology and geological processes. Total geology and geotechnical engineering models. Planning of site investigations and the parameters required. In-situ testing of soil, including SPT, CPT, piezocone, vane shear. Laboratory testing of soil including triaxial, direct shear and ring shear. Field instrumentation for pore pressure and displacement. Geotechnical mapping. Geological, structural, geotechnical, geomorphological, air photo, specialised vector maps and landslides.

Course Aims

To introduce students to engineering geology, the development of geotechnical engineering models, geotechnical mapping skills and site investigation techniques in Geotechnical Engineering. The course is specialised, and designed for those who will work in Geotechnical Engineering and Engineering Geology. It will also be useful for those who are majoring in other areas, but will be briefing geotechnical specialists.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Be familiar with the fundamental science behind engineering geology.	PE1.1
2. Be familiar with and apply geological mapping skills for engineering applications.	PE1.1, PE1.3, PE1.5, PE2.2, PE2.4
3. To be able to develop effective geological/geotechnical models for engineering applications.	PE1.1, PE1.3, PE1.4, PE1.5, PE2.2, PE2.3, PE2.4, PE3.2, PE3.4
4. Be familiar with site investigation techniques.	PE1.3, PE1.5, PE2.2, PE2.4
5. Work effectively in a team	PE3.6, PE1.6

Teaching Strategies

The contents of this subject will be presented to you in a number of formats. Each of these formats are explained below together with our expectations of you.

This course will include a compulsory one week face-to-face on-campus component where we will have a strong focus on the fieldtrip and workshops. The course runs Wednesday to Tuesday to enable

students to review material on the weekend to enable informed questions of the lecturers in-person the following week. Students are strongly encouraged to revise their geological knowledge prior to the on-campus component. There will be a considerable amount of assignment work to be completed after the on-campus component.

Lectures: Formal lectures will be presented to discuss the basic principles of geology and its use in forming effective geotechnical models. An introduction to site investigation concepts will also be presented. Lectures will vary from standard PowerPoint lectures to more hands on demonstrations of various engineering techniques. You are expected to attend all the lectures as they will greatly assist in understanding what is presented in the lecture notes. The lectures will also be a primary point of communication between the class and the lecturers. Further communication will be via your student email and Moodle. It is very important that you frequently check your messages.

Demonstrations/workshops: The demonstrations/workshops in this subject are used to teach you 'hands on' methods for assessing the engineering geology of a site. They will also contain opportunities for you to work on example problems, to do pre-work on the fieldtrip and to complete components of the assignment. You will be expected to be present and participate at all demonstrations/workshops, as they will contain material not covered in lectures. It is strongly recommended that you take advantage of the face-to-face opportunity to ask your lecturers questions.

Fieldtrip: The field trip is compulsory as it gives you a practical understanding of the content of the course and a chance to practice field mapping techniques. The major assignment will be based on the fieldwork location and the information you collect there. We understand that some of you will have limited field mapping skills and we will try and deliberately mix students of different abilities into groups to assist with this. If you are struggling it is very important that you seek out a demonstrator or lecturer for assistance early. We are there to help you. Do not just wander behind the class as you will then struggle in the later assignment tasks.

Assignment: The Long Reef assignment will be divided into 3 parts. The first part will be done prior to the fieldtrip and will require development of a preliminary model that you will use on site. The second, major component will require you to incorporate the information collected on site and in the literature into your geotechnical model. The third component will be to suggest a site investigation program that could address uncertainties in the geology or engineering properties of the materials related to the engineering project. These assignments will provide a practical application of the material learnt through the course.

Private study: The lectures and workshops are presented in a very condensed form. Therefore your private study post the course is very important and you should commence the assignment and review and reflection of lecture material immediately after the on-campus component. Your private study should also include: pre-reading; workshop and assignment problems; accessing provided links and supplementary material on Moodle and performing your own literature research. For each hour of contact it is expected that you will put in at least 1.5 hours of private study.

Additional Course Information

The course will consist of a five day internal short course followed by external assignments, study and an exam. There will be a full day fieldtrip to Long Reef on the Monday of the course.

Students should bring masks to each day of the course. It is a UNSW requirement that they be worn in class. This includes in lecture/workshop settings, on transport and where 1.5m spacing can not be achieved during the fieldtrip.

The fieldtrip will be discussed in class. Students are required to be at Gate 14 Barker St at 7:45am Monday for an 8:00am departure (subject to change). The coach is expected to return at about 7:00pm. Students may commence the day at Long Reef if they do not wish to use the coach. Please discuss this during the short course, prior to the fieldtrip, with your lecturers. You must attend the fieldtrip introduction and safety briefing in class on the Friday.

In previous surveys of geotechnical employers, engineering geology was seen as a critical element of a MEngSc education. Thus, the focus of the course is to enable students to develop appropriate geological models for engineering design. Site investigation concepts considering these models are also covered. The first four days focus solely on the models component with the final day introducing site investigation concepts and some site investigation methods.

Although students can do the course at any stage of their degree, it is recommended that it be done early as it is essentially assumed knowledge for the other Masters courses (i.e. effective design requires the development of an effective geotechnical model).

As the course is substantially about engineering geology and its application in developing geotechnical models, you are expected to come with some understanding of geology. Engineers in particular can find the course challenging and demanding. It is recommended that you refresh your geological knowledge by reading some of the suggested texts prior to attending the course. You can also expect to have to do significant reading and open ended assignments after the course and should timetable this into your schedule.

Assessment

The final grade for this course will normally be based on the sum of the scores from each of the assessment tasks. The Final Examination is worth 40% of the Final Mark if class work is included and 100% if class work is not included. The class work is worth 60% of the Final Mark if included. A mark of at least 40% in the final examination is required before the class work is included in the final mark. The formal exam scripts will not be returned. Students who perform poorly in the assessment tasks and workshops are recommended to discuss progress with the lecturer during the semester. Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

Late submissions will be penalised at the UNSW standard rate of 5% per day after the due time and date have expired. Late submissions are not accepted for Assignment 1 as it is required prior to the fieldtrip.

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Long Reef Assignment - Workshop Submission	15%	11/03/2022 05:00 PM	1, 3, 5
2. Long Reef Assignment Geotechnical Model	35%	18/04/2021 04:00 PM	1, 2, 3, 5
3. Long Reef Assignment Site Investigation	10%	18/04/2021 04:00 PM	1, 3, 4
4. Final Exam	40%	Formal UNSW Exam period	1, 3, 4

Assessment 1: Long Reef Assignment - Workshop Submission

Submission notes: Submitted in hard copy at the Friday Workshop

Due date: 11/03/2022 05:00 PM

Deadline for absolute fail: 11/03/2022

The overall assignment requires you to develop a geotechnical model for Long Reef for a specific engineering project. Activities will be carried out on campus during workshops and on site at Long Reef. You will then be required to complete the assignments at home. It is strongly recommended that you complete this as early as possible whilst the information is still fresh in your mind.

The first part of the assignment (workshop submission) will assess how well you synthesise preliminary information from papers, maps, aerial photographs etc. into a preliminary geological model that can be used for the basis of your information collecting on the fieldtrip. This is due in class on the Friday of the short course.

Assessment 2: Long Reef Assignment Geotechnical Model

Start date: During Short course

Due date: 18/04/2021 04:00 PM

This assignment requires you to develop a geotechnical model for Long Reef for a specific engineering project. Activities will be carried out on campus during workshops and on site at Long Reef. You will then be required to complete the assignments at home. It is strongly recommended that you

complete this as early as possible whilst the information is still fresh in your mind.

This second, more substantial part of the assignment will assess your ability to collect and interpret appropriate site information and incorporate this with your preliminary model and further research findings into a geological model.

From previous feedback, some have found this very challenging due to the self-guided and open ended nature of the process. We will hold a consultation period online during the term to enable you to discuss your model progress with a lecturer.

Assessment 3: Long Reef Assignment Site Investigation

Start date: During Short course

Due date: 18/04/2021 04:00 PM

The site investigation component of the assignment will assess your ability to identify uncertainties in the geological model and the appropriate parameters required for design. Once complete, you will then be required to develop a site investigation to address questions raised from the model and the engineering project.

Assessment 4: Final Exam

Due date: Formal UNSW Exam period

The exam will assess all the elements of the course. Process is important when building models and you will need to show that process at work in your exam answers. The course covers global tectonic settings, geomorphology and geotechnical characteristics in different geological terrains. These broad overviews then lead into taking site-specific information, following a process of sifting and collation to arrive at a model. Your ability to understand and follow this process will be assessed.

Attendance Requirements

This course is field and workshop based. It can not be done online/by distance. Students are required to attend the short course and the fieldtrip in person.

Course Schedule

[View class timetable](#)

Timetable

Date/Module	Type	Content
Wed 24th February		Engineering Geology and Geotechnical Models; Geotechnical Mapping. Details in class and on Moodle.
Thurs 25th February		Engineering Geology and Geotechnical Models; Geotechnical Mapping. Details in class and on Moodle.
Fri 26th February		Engineering Geology and Geotechnical Models; Geotechnical Mapping. Details in class and on Moodle.
Mon 1st March - FIELDTRIP	Fieldwork	Fieldwork – IMPORTANT: You will need to bring appropriate clothing and footwear suitable for (highly exposed) outdoor geotechnical field work. You should also bring any field mapping equipment that you have. You are also required to bring your own food and drink - there are no facilities during the fieldtrip to purchase these. NOTE: COACH LEAVES Gate 14 Barker St, UNSW AT 8:00am SHARP (subject to change - advice in class) and RETURNS at approx. 7:00pm
Tues 2nd March		Fieldwork review; Lab Visit; Site Investigation Concepts.

Resources

Prescribed Resources

Extensive resources have been placed in Moodle for this course.

Recommended Resources

Basic geology texts should be reviewed prior to the course if you are concerned about your knowledge. There are many available as E-books through the UNSW library (you will need to log in with your ZID to access).

Examples of texts introducing engineering geology (good for civil engineers with limited training):

- Hencher, S. (2012) Practical Engineering Geology. Spon Press. [E-book available in through UNSW library]
- Bell, F.G. (2007) Engineering Geology [E-book available]
- West, T.R. (1995) Geology Applied to Engineering, Prentice Hall. 1st ed.
- Waltham, A.C. (2009) Foundations of Engineering Geology. CRC Press. 3rd ed. [E-book available]
- Johnson, R.B. and DeGraff, J.V. (1988) Principles of Engineering Geology, Wiley. 1st ed.
- Note that a geological dictionary will also assist those with limited geological knowledge.

A very good text that covers geological issues for engineering projects (not just dams) and site investigations:

- Fell et al. (2014) Geotechnical Engineering of Dams, Taylor and Francis. 2nd ed. [E-book available]

Further papers/book references can be found in the notes and on Moodle.

Course Evaluation and Development

We welcome any feedback you have as we continue to try and improve the course. Formal surveys are carried out at the end of session by UNSW. You are also very welcome to give feedback during the course for more immediate consideration via email or the discussion forum on Moodle.

Laboratory Workshop Information

There will be a visit to the soil mechanics laboratories on Tuesday. Please wear closed shoes for this exercise. Boots would be preferred. Masks are required for all work indoors.

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 2022 will be held online between 29th April - 12th May inclusive, and supplementary exams between 23rd - 27th May inclusive. 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](#)
- 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>

Image Credit

Dr Kurt Douglas

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	✓