UNSW Course Outline

CVEN3203 Applied Geotechnics and Engineering Geology - 2024

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General Course Information

Course Code : CVEN3203
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Civil and Environmental Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course covers two important areas of geotechnical engineering: geology and applied geotechnics. The geology section covers the earth and it's formation, rock types; their behaviour and properties and subsurface mapping. The topics in the applied geotechnics include:

theoretical and presumptive bearing capacity of shallow foundations, allowable settlement and foundations on sand and clay, lateral earth pressures, retaining wall design, single axially and laterally loaded piles and pile groups, excavation and dewatering.

Course Aims

It is an aim of this course to help develop the following graduate attributes:
To give students a solid grasp of the theory and practice of geotechnical engineering, and to be familiar with the
bases of research to further develop its technology. In addition, graduates should be able to apply theory to
practice in familiar and unfamiliar situations;
To stimulate the intellectual curiosity of students so that they will be motivated to undertake independent reflective
learning as a lifelong skill;
To teach students how to define, analyse and solve problems clearly and logically and in doing so be able to find,
evaluate, interpret and collate information;
To develop independent critical thought within students so that when necessary they will be able to challenge
current knowledge and thinking;
To encourage proactive behaviour in students and to give them the associated entrepreneurial skills necessary;
To promote a respect within students for individual human rights and dignity, particularly when it relates to
members of the public or other people who will be affected by the projects that they design and execute;
To foster effective self-management skills;
To nurture the skills required for effective leadership including an ability to manage and deliver projects, an
understanding of the social dynamics of group performance, a repertoire of processes for the effective management
of groups, and the ability to value diverse backgrounds and opinions and function effectively in multidisciplinary
teams; and
To impart sound IT working skills.

Relationship to Other Courses

Geotechnical Engineering is the study of the behaviour of soil, rock and groundwater under engineered environments. Most engineering structures will inevitably have some sort of interaction with the ground surface. Geotechnical Engineers attempt to describe and/or model this interaction to achieve a safe and efficient design.

So far, you have studied CVEN3202 Soil Mechanics. Therefore, by now you should understand: the basic engineering classification of soil; how soil behaves under imposed stresses and strains; and how groundwater flows through soil and its effect on engineered structures. There are two main areas that you have not covered that will be addressed in this course:

(A) How to relate the 'real-world' geological environment to your knowledge of 'class-room' soil; and

(B) How to combine your current knowledge and Part (A) to perform a Geotechnical Engineering design.

Part (A) Engineering Geology - A Geotechnical Engineer must have an understanding not only of engineering principles but also of geology and the inherent variability and challenges it has for engineering. This course will teach you a basic understanding of geology including how geotechnical materials are formed, what their characteristics are and how to describe them using engineering and geological terms. It will attempt to give you some understanding of the challenges a geological environment may have for a particular engineering project. At the end of the course you should, for any site and engineering project, be able to either: (a) develop a preliminary geotechnical model for the site that can be used for design or (b) be able to discuss more complex geology with Engineering Geologists to again come up with a suitable geotechnical model.

Part (B) Applied Geotechnics - This part of the course represents the 'final stage' of a Geotechnical project. It will require you to study the conventional methods for the design and analysis of common geotechnical constructions including shallow and deep (pile) foundations and retaining walls. For many of you, this will be your final course in Geotechnical Engineering and we hope you gain an appreciation of some of the complexities of Geotechnical Engineering.

Those, no doubt attractive and highly intelligent students, looking for a demanding and challenging yet very satisfying career will obviously wish to pursue Geotechnical Engineering further. We have a number of Geotechnical electives in final year that will extend your knowledge

even further into areas like advanced soil mechanics; applications of computer simulation techniques to geotechnical engineering problems; ground improvement and the design of pavements, tunnels and slopes. Come and talk to us if you want to know more.

As a graduate Geotechnical Engineer, you might expect to work on projects as diversified as: building and bridge foundation design; dam design and construction; road pavement design; slope stability analysis and stabilisation; and tunnel and mine design. Most typically you will do a part-time coursework masters with us after working for a year or two to supplement your knowledge (and provide an excuse for your high charge-out rate). Some of you may even wish to do a PhD (if interested come and talk with us any time, we have lots of projects/scholarships available).

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply fundamental geological and geotechnical scientific concepts in the geotechnical design process.
CLO2 : Identify geological materials
CLO3 : Formulate preliminary geotechnical models that can be used as the basis for engineering design by identifying the geological history of a site
CLO4 : Effectively communicate with engineering geologists on geologically complex sites.
CLO5 : Interpret the basic principles related to geotechnical theories that apply to the design and analysis of shallow foundations, deep foundations and retaining walls.

Course Learning Outcomes	Assessment Item
CLO1 : Apply fundamental geological and geotechnical scientific concepts in the geotechnical design process.	• Geology Workshops • Geology Quiz 2 • Geology Assignment • Final Exam
CLO2 : Identify geological materials	• Geology Workshops • Geology Assignment
CLO3 : Formulate preliminary geotechnical models that can be used as the basis for engineering design by identifying the geological history of a site	• Geology Quiz 2 • Geology Workshops • Geology Assignment
CLO4 : Effectively communicate with engineering geologists on geologically complex sites.	• Geology Workshops
CLO5 : Interpret the basic principles related to geotechnical theories that apply to the design and analysis of shallow foundations, deep foundations and retaining walls.	• Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Additional Course Information

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Geology Workshops Assessment Format: Individual	5%	Start Date: Workshops Weeks 1-4 Due Date: Workshops Weeks 1-4
Geology Quiz 2 Assessment Format: Individual	20%	Start Date: 26/03/2024 06:00 PM Due Date: Not Applicable
Geology Assignment Assessment Format: Individual	25%	Start Date: Released Week 3 Due Date: 25/03/2024 11:59 PM
Final Exam Assessment Format: Individual	50%	Start Date: Formal UNSW Exam Period Due Date: Not Applicable

Assessment Details

Geology Workshops

Assessment Overview

Completion of pre-work and full completion of weekly activity during the workshop

Course Learning Outcomes

- CLO1 : Apply fundamental geological and geotechnical scientific concepts in the geotechnical design process.
- CLO2 : Identify geological materials
- CLO3 : Formulate preliminary geotechnical models that can be used as the basis for engineering design by identifying the geological history of a site
- CLO4 : Effectively communicate with engineering geologists on geologically complex sites.

Submission notes

Work must be shown to demonstrators at the workshop each week

Assessment information

Satisfactory completion of pre-work and the complete weekly activity during the workshop will receive full marks. Significant partial completion, half marks.

Marking will occur during each geology workshop.

Assignment submission Turnitin type

Not Applicable

Geology Quiz 2

Assessment Overview

Geology quiz will be closed book and will test understanding of the geology component of the course.

Course Learning Outcomes

- CLO1 : Apply fundamental geological and geotechnical scientific concepts in the geotechnical design process.
- CLO3 : Formulate preliminary geotechnical models that can be used as the basis for engineering design by identifying the geological history of a site

Assessment Length

1 hour 15 mins

Assessment information

Students are to attend timetabled exam room. Marks are expected to be returned within 3 weeks of submission.

Assignment submission Turnitin type

Not Applicable

Geology Assignment

Assessment Overview

Field mapping and self-guided fieldtrip. Part A: You will be assessed on your ability to: create a preliminary geological model; develop a site description and plan; perform and present geological mapping. Part B: You will be assessed on the quality of your description of your geological observations

Course Learning Outcomes

- CLO1 : Apply fundamental geological and geotechnical scientific concepts in the geotechnical design process.
- CLO2 : Identify geological materials
- CLO3 : Formulate preliminary geotechnical models that can be used as the basis for engineering design by identifying the geological history of a site

Detailed Assessment Description

Assessment of Part A will focus on the quality of your model development (including support for your model), your field observations, and your engineering characterisations. Part B will assess the quality of your geological discussion/description of the current geological environment and

the geological history of the site and your presentation.

Assessment Length

No more than 15 pages

Submission notes

Submit one assignment per group into Moodle

Assessment information

The content and requirements of the assignment will be released through Moodle and discussed in lectures.

Marks are expected to be returned within 3 weeks of submission.

The nature of the assignment may be modified by the course co-ordinator as a result of safety and/or COVID restrictions.

Assignment submission Turnitin type

This is not a Turnitin assignment

Final Exam

Assessment Overview

The final exam will only cover the Applied Geotechnics component of the course.

Course Learning Outcomes

- CLO1 : Apply fundamental geological and geotechnical scientific concepts in the geotechnical design process.
- CLO5 : Interpret the basic principles related to geotechnical theories that apply to the design and analysis of shallow foundations, deep foundations and retaining walls.

Assessment Length

2 hours

Assignment submission Turnitin type

Not Applicable

General Assessment Information

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 50% of the Final Mark if class work is included and 100% if class work is not included. The class work is worth 50% of the Final Mark if included.

A mark of at least 40% in the final examination is required before the other assessment tasks are included in the final mark. The formal exam scripts will not be returned but you are permitted to view the marked script.

Students who perform poorly in the assessment tasks and workshops are recommended to discuss progress with the lecturer during the term Note: The lecturer reserves the right to adjust the final scores by scaling if agreed by the Head of School.

The geology workshops will be used to teach you more about practical 'hands-on' geology. They are not directly related to lecture content. Marks will be awarded by demonstrators based on satisfactory completion and effort (both pre work and during the workshop) with the activities.

The geology assignment will comprise two parts. (1) A field mapping/model component which will give you experience in mapping rock defects (joints, bedding etc.). (2) A Geology Poster design component which will give you a better understanding of the geological history and current geological setting of a chosen site. It will also give you some research and presentation skills.

The Geology Quiz will test your understanding of the Geology component of the course.

The Final Exam will test your understanding of the Applied Geotechnics component of the course.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	Plate tectonics & geological time. Minerals.
	Workshop	Engineering Geology (assessed)
Week 2 : 19 February - 25 February	Lecture	The rock cycle, rock formation & classification
	Workshop	Engineering Geology (assessed)
Week 3 : 26 February - 3 March	Lecture	Structural geology. The geotechnical model & site investigations. Engineering rock descriptions
	Workshop	Engineering Geology (assessed)
Week 4 : 4 March - 10 March	Lecture	Soils – including residual, alluvial, aeolian, colluvial
	Workshop	Engineering Geology (assessed)
Week 5 : 11 March - 17 March	Lecture	Geology review. Geotechnical design methods
	Workshop	Applied Geotech.
Week 6 : 18 March - 24 March	Other	Flexibility Week - No Lectures/Workshops
Week 7 : 25 March - 31 March	Lecture	Bearing capacity of shallow foundations
	Workshop	Applied Geotech
	Assessment	Monday: Geology Assignment Due Tuesday: Geology Quiz (Closed Book)
Week 8 : 1 April - 7 April	Lecture	Settlement of shallow foundations
	Workshop	Applied Geotech.
Week 9 : 8 April - 14 April	Lecture	Design of pile foundations. Lateral earth pressure
	Workshop	Applied Geotech.
Week 10 : 15 April - 21 April	Lecture	Design of retaining walls
	Workshop	Applied Geotech.

Attendance Requirements

Your contribution to the geology workshops (Weeks 1-4) will be assessed. You are required to attend your allocated workshops in these weeks to receive a Workshop mark.

You must attend at least 80% of all the workshops in which you are enrolled for the duration of the session.

Students are strongly encouraged to attend all online lectures, workshops, the rock lab and to review lecture recordings.

General Schedule Information

The weekly lecture schedule shown is approximate and may be modified by the lecturers.

Course Resources

Prescribed Resources

Textbooks - Geology

No compulsory text for geology however the following gives a good summary of various engineering geology topics:

- Waltham, A. (2009, Ebook 2017) Foundations of Engineering Geology, 3rd Edition, Spon Press. [E-book Available Online through library]

Moodle

Materials including videos, additional lessons, geological animations, lecture notes and presentations, workshop solutions, quizzes, past papers, Web links and student submissions will be provided through Moodle. Note that the pages have been split into: A – Geology and B – Applied Geotechnics. Group work for assignments will also be facilitated via Moodle.

Recommended Resources

Additional Readings - Geology

The following books may give you a better and deeper understanding of various aspects of the course. Duff (1997) and Skinner and Potter (2000) provide the geology basics whilst **Fell et al (2015)**, Hencher (2012), Goodman (1993) and Bell (2007, 2008) do a good job of relating geology (Goodman - rock only) to engineering using a number of geotechnical engineering case studies. The books can be sourced via UNSW library at the locations shown. This is only a sample, there are also a lot of other geology books in the library that you may find useful. You are encouraged to do your own research.

- Bell, F.G. (2007) Engineering Geology. Burlington : Elsevier. [E-book Available Online through library]
- Bell, F.G. (2008) Basic Environmental and Engineering Geology. Whittles Publishing. [551/227 C]
- Branagan, D. (2000) Field Geology of New South Wales. NSW Department of Mineral Resources. [P 559.44/12]
- Duff, D. (1997) Holmes' Principles of Physical Geology, 4th Edition, Chapman and Hall. [PQ551/18 AB]
- Fell, R., MacGregor, P., Stapledon, D., Bell, G. and Foster, M. (2015) Geotechnical Engineering of Dams, Balkema, 2nd Edition [627.83/31 B and Online via library]
- Goodman, R.E. (1993) Engineering Geology: Rock in Engineering Construction, Wiley.

[P624.151/166]
- Hencher, S. (2012) Practical Engineering Geology, Spon Press, London. [624.151/214 and Online via library]
- Johnson, R.B. and DeGraff, J.V. (1988) Principles of Engineering Geology, Wiley, 1st Edition. [P 624.151/157 A]
- Skinner, B. and Porter, S. (2000) The Dynamic Earth, 4th Edition, Wiley. [PQ551/194]
- Standards Association of Australia, (2017) AS1726-2017: Geotechnical Site Investigations [All available online through UNSW Library – search for resource: Australian Standards (TechStreet)]
- Standards Association of Australia, (2005) AS4482.1-2005: Guide to the investigation and sampling of sites with potentially contaminated soil - Non-volatile and semi-volatile compounds

iPhone (and other almost as smart phones)

There are numerous geological apps developed for various smart phones. At the moment, there are only a handful developed for geology that are free. You should download a geological compass app to do your assignment if you can. Stereonet or GeoID are examples. They need to be able to measure the dip and dip direction of a plane.

Textbooks – Applied Geotechnics

No texts are required. Although the texts below may be useful.

- Bowles, J.E. (2001) Foundation Analysis and Design, McGraw-Hill (any edition)
- Das, B. (2023) Principles of Foundation Engineering, 10th edition, Cengage Learning – concentrates on foundations (other editions still useful)
- Das, B. (2021) Principles of Geotechnical Engineering, 10th edition, Cengage Learning – concentrates on geotechnical properties
- Holtz, R.D., Kovacs, W.D. & Sheahan, T.C. (2010) An Introduction to Geotechnical Engineering, 2nd edition, Pearson International
- Poulos, H.G. and Davis, E.H. (1980) Pile Foundation Analysis and Design, Wiley
- Smith, I. (2021) The Elements of Soil Mechanics, 10th edition, John Wiley & Sons
- Standards Association of Australia, (2009) AS2159-2009: Piled footings - Design and installation
- Standards Association of Australia, (2011) AS2870-2011: Residential Slabs and Footings
- Standards Association of Australia, (2002) AS4678-2002: Earth-Retaining Structures
- Tomlinson, M.J. (2001) Foundation Design and Construction, 7th edition, Harlow : Prentice Hall
- Tomlinson, M. and Woodward, J. (2020) Pile Design and Construction Practice, 6th edition, Taylor & Francis

Other Useful Geotechnical Sources

Journals:

- Australian Geomechanics Journal PJ624.1513205/3
- Canadian Geotechnical Journal PJ620.19105/1
- Engineering Geology: an International Journal. PJ624.1505/12
- Ground Engineering PJ624.05/91
- Journal of Geotechnical and Geoenvironmental Engineering. PJ624.05/66
- Geotechnical and Geological Engineering. PJ622.05/158
- Environmental & Engineering Geoscience. PJ550/E650
- Geotechnique. PJ624.15105/10
- Proc. of the Institution of Civil Engineers. Geotechnical Engineering. PJ624.05/46
- Bulletin of Engineering Geology and the Environment. PQ624.1505/11
- Rock Mechanics and Rock Engineering. PJ624.1505/7
- International Journal of Rock Mechanics and Mining Sciences. PJ622.05/4

Internet sites:

Many Internet sites exist. Useful links are available in Moodle for many of the lectures. The following are links to some of the main Geotechnical sites:

- Australian Geomechanics Society: http://australiangeomechanics.org [Those looking for geotechnical work opportunities should see the 'corporate members' page for a list of geotechnical related companies working in Australia]
- Australian Geomechanics Society, Sydney: http://australiangeomechanics.org/chapters/sydney/ (has monthly Geotechnical talks)
- International Society for Soil Mechanics and Geotechnical Engineering: http://www.issmge.org
- International Society for Rock Mechanics: http://www.isrm.net
- International Association of Engineering Geology: http://www.iaeg.info
- The Australasian Institute of Mining and Metallurgy: http://www.ausimm.com.au/
- The U.S. Geological Survey: http://www.usgs.gov/
- Google Scholar: https://scholar.google.com.au/ (good for looking at research papers on specific topics)

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. You can email us directly or use the feedback discussion tool we have placed in Moodle.

We are aware from feedback that there is a lot of content in our course. You do not have to read and watch everything you are provided with, it is there if you need it or want to explore further. It is much like solving problems in industry, where you are required to identify the information you

need to solve and delve deeply into the literature where required.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Dr Kurt Douglas		CE 506	9385 5046	TBC in class	Yes	Yes
Lecturer	Dr Babak Shahb odaghkhan		Room 541, Level 5, Hilmer Building (E10)		TBC in class	No	No

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the 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 or your primary learning management system (LMS) 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/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of five percent (5%) of the maximum mark possible for that assessment item, per calendar day.

The late penalty is applied per calendar day (including weekends and public holidays) that the assessment is overdue. There is no pro-rata of the late penalty for submissions made part way through a day. This is for all assessments where a penalty applies.

Work submitted after five days (120 hours) will not be accepted and a mark of zero will be awarded for that assessment item.

For some assessment items, a late penalty may not be appropriate. These will be clearly indicated in the course outline, and such assessments will receive a mark of zero if not completed by the specified date. Examples include:

- Weekly online tests or laboratory work worth a small proportion of the subject mark;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific 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)

School-specific Information

Final Examinations

Final Exams in T1 2024 will be held on campus between the 26th April and 9th May, and Supplementary Exams between the 20th - 24th May 2024. You are required to be available on these dates. Please do not to make any personal or travel arrangements during this period.

School Contact Information

For assistance with enrolment, class registration, progression checks and other administrative matters, please see the Nucleus: Student Hub. They are located inside the Library – first right as you enter the main library entrance. You can also contact them via http://unsw.to/webforms or reserve a place in the face-to-face queue using the UniVerse app.

For course administration matters, please contact the Course Coordinator.

Questions about the this course should normally be asked during the scheduled class so that everyone can benefit from the answer and discussion.