UNSW Course Outline

# CVEN4201 Rock and Slope Engineering - 2024

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## General Course Information

**Course Code :** CVEN4201
**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 :** Postgraduate, Undergraduate
**Units of Credit :** 6

**Useful Links**

Handbook Class Timetable

## Course Details & Outcomes

### Course Description

Description of rock mass and discontinuities; rock strength and failure criteria. Core logging; field data collection, mapping and fracture surveys; data presentation; hemispherical projections; introductory rock slope stability; foundations on rock; excavation on rock; in-situ stress; stresses

about underground openings; classification systems and tunnel support requirements; site investigations for landslides and slope stabilisation techniques; use of slope stability anlaysis programs. The course includes a compulsory 3 day field trip.

## Course Aims

To teach you the basic principles related to the theory and design of rock engineering including methods for describing, recording and presenting features of rock masses.
To enable you to be able to perform basic designs in rock including foundations, slope stability and
tunnel designs.
To study the basic principles related to the theory and design of rock and soil slopes including an examination of the different types of slope instability and different site investigation methods, methods
of analysing slopes and different methods for stabilising slopes.
To give you some experience in using computer software to assess the stability of a slope and various remediation measures.
To give you a practical understanding of rock and slope engineering using the field trip and assignments.

## Course Learning Outcomes

| Course Learning Outcomes |
| --- |
| CLO1 : Describe the basic principles related to the theory and design of rock engineering including methods for describing, recording and presenting features of rock masses |
| CLO2 : Perform basic design in rock engineering including foundation, slope stability and tunnel designs |
| CLO3 : Describe the basic principles related to the theory and design of rock and soil slopes |
| CLO4 : Illustrate the methods of site investigation, soil and rock slope analysis and different methods of slope stabilisation |
| CLO5 : Utilise software to assess the stability of a slope and various remediation measures |
| CLO6 : Work effectively in a team |

| Course Learning Outcomes | Assessment Item |
| --- | --- |
| CLO1 : Describe the basic principles related to the theory and design of rock engineering including methods for describing, recording and presenting features of rock masses | • Rock Engineering<br>• Final exam |
| CLO2 : Perform basic design in rock engineering including foundation, slope stability and tunnel designs | • Rock Engineering<br>• Final exam |
| CLO3 : Describe the basic principles related to the theory and design of rock and soil slopes | • Slope Stability<br>• Rock Engineering<br>• Final exam |
| CLO4 : Illustrate the methods of site investigation, soil and rock slope analysis and different methods of slope stabilisation | • Slope Stability<br>• Rock Engineering<br>• Final exam |
| CLO5 : Utilise software to assess the stability of a slope and various remediation measures | • Slope Stability |
| CLO6 : Work effectively in a team | • Slope Stability<br>• Rock Engineering |

## Learning and Teaching Technologies

Moodle - Learning Management System

## Additional Course Information

Up until now you have studied soil properties and geology and basic geotechnical design in soils in third year. Part of this course will teach you the basics of rock mechanics and introduce you to design techniques for rock masses. The other part of this course covers slope stability that will

use your existing knowledge of soil mechanics and what you learnt about rock mechanics in the first part of this course. The geology you studied in earlier courses will be very important in this course for developing geotechnical models that can be used to develop good engineering designs.

The course begins by examining methods of describing, recording and presenting rock mass features. This will be followed by learning about methods for determining the engineering properties of rock masses. This initial work will then be used to perform basic foundation, slope stability and tunnel designs.

The second part of the course will begin by examining the different types of slope instability and how to characterise them followed by a discussion of different site investigation techniques. Methods of analysing slopes including the use of stability analysis programs will be learnt. Finally different methods for stabilising slopes will be covered.

# Assessments

## Assessment Structure

| Assessment Item | Weight | Relevant Dates |
|---|---|---|
| Rock Engineering<br>Assessment Format: Group | 30% | Start Date: Week 2<br>Due Date: In parts - see schedule |
| Slope Stability<br>Assessment Format: Individual | 15% | Start Date: Week 4<br>Due Date: 28/03/2024 11:59 PM |
| Final exam<br>Assessment Format: Individual | 55% | Start Date: Formal UNSW Exam Period |

## Assessment Details

### Rock Engineering

**Assessment Overview**

This assignment will be carried out in groups of three or four and will cover the entire rock engineering component of the course including: hemispherical projections and a simple rock slope design, rock core logging, a foundation design and a tunnel design. It is important that you all contribute to each part of the assignment so that you can practice applying everything you are presented with in class.

**Course Learning Outcomes**

- CLO1 : Describe the basic principles related to the theory and design of rock engineering including methods for describing, recording and presenting features of rock masses

- CLO2 : Perform basic design in rock engineering including foundation, slope stability and tunnel designs
- CLO3 : Describe the basic principles related to the theory and design of rock and soil slopes
- CLO4 : Illustrate the methods of site investigation, soil and rock slope analysis and different methods of slope stabilisation
- CLO6 : Work effectively in a team

**Assessment information**

The assignment will assess: how well you develop your geotechnical model (if required); your ability to record, plot and synthesise information; your ability to perform appropriate calculations with an appreciation of the impact of your assumptions; and how well you assess your answer/s. Quality of presentation is also important.

Students in surveys in previous years have expressed the desire for ongoing feedback. To facilitate this, the assignment will be split into components with due dates distributed throughout the session. This will allow you to complete each part as it is taught in class (similar to a workshop) so as not to overload yourselves at the end of the session and to enable me to give you some marks/feedback prior to the end of the year. It is aimed to give feedback within two weeks of submission.

Late submissions will be penalised at the standard UNSW rate of 5% per day after the due time and date have expired, capped at five days (120 hours), after which a student cannot submit an assessment for marks.

**Assignment submission Turnitin type**

Not Applicable

## Slope Stability

**Assessment Overview**

This assignment will cover the slope stability component of the course. It will assess your ability to analyse a slope using the program Slope/W and to consider and design possible remediation measures. Geotechnical engineers often use computers to design and analyse slopes so it is important that you learn how to use them properly and also very importantly learn their limitations. Quality of presentation is also important.

**Course Learning Outcomes**

- CLO3 : Describe the basic principles related to the theory and design of rock and soil slopes
- CLO4 : Illustrate the methods of site investigation, soil and rock slope analysis and different methods of slope stabilisation

- CLO5 : Utilise software to assess the stability of a slope and various remediation measures
- CLO6 : Work effectively in a team

**Submission notes**

To be submitted as a report in Moodle

**Assessment information**

Late submissions will be penalised at the standard UNSW rate of 5% per day after the due time and date have expired, capped at five days (120 hours), after which a student cannot submit an assessment.

**Assignment submission Turnitin type**

This is not a Turnitin assignment

### Final exam

**Assessment Overview**

The final OPEN BOOK exam will assess your understanding of the whole course with particular emphasis on your ability to synthesise data and investigate and design structures in rock masses and slopes.

**Course Learning Outcomes**

- CLO1 : Describe the basic principles related to the theory and design of rock engineering including methods for describing, recording and presenting features of rock masses
- CLO2 : Perform basic design in rock engineering including foundation, slope stability and tunnel designs
- CLO3 : Describe the basic principles related to the theory and design of rock and soil slopes
- CLO4 : Illustrate the methods of site investigation, soil and rock slope analysis and different methods of slope stabilisation

**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 55% of the Final Mark if class work is included and 100% if class work is not included. The class work is worth 45% 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.

Grading Basis

Standard

# Course Schedule

| Teaching Week/Module | Activity Type | Content |
|---|---|---|
| Week 1 : 12 February - 18 February | Lecture | Description of rock mass and discontinuities<br>Data collection and presentation<br>Core logging. |
| Week 2 : 19 February - 25 February | Lecture | Rock strength and failure criteria |
| | Assessment | Ass 1a out 23/2 |
| Week 3 : 26 February - 3 March | Lecture | Hemispherical projections<br>Introductory rock slope stability. |
| | Assessment | Ass 1b out 1/3 |
| Week 4 : 4 March - 10 March | Lecture | Site investigations for landslides<br>Slope stability analysis |
| | Assessment | Ass 1a due 4/3<br>Ass 2 out 8/3 |
| Week 5 : 11 March - 17 March | Lecture | Slope stabilisation techniques |
| | Assessment | Ass 1b due 15/3 |
| Week 6 : 18 March - 24 March | Other | Flexibility Week - No lecture/workshop |
| Week 7 : 25 March - 31 March | Lecture | Foundations on rock |
| | Assessment | Ass 1c out 27/3 |
| Week 8 : 1 April - 7 April | Lecture | In-situ stress<br>Stresses about underground openings |
| | Assessment | Ass 2 due 2/4<br>Ass 1d out 5/4 |
| Week 9 : 8 April - 14 April | Lecture | Classification systems and tunnel support requirements |
| | Assessment | Ass 1c due 12/4 |
| Week 10 : 15 April - 21 April | Lecture | Review |
| | Assessment | Ass 1d due 19/4 |

## Attendance Requirements

For courses with Workshops and/or Labs, attendance for those classes is a necessary part of the course. You must attend at least 80% of the workshop/lab in which you are enrolled for the duration of the session.

It is strongly recommended that students attend all lectures in-person.

The class schedule shown is approximate and may be altered by the course co-ordinator.

# Course Resources

## Prescribed Resources

No compulsory texts. Students will be provided with notes and references to explore in Moodle and during class.

## Recommended Resources

The following are recommended reading.

- Hoek, E. (2023) Practical Rock Engineering. FREE DOWNLOAD: https://www.rocscience.com/learning/hoeks-corner
- Brady, B.H.G. and Brown, E.T. (2006) Rock Mechanics for Underground Mining, 3rd Edition. [E-book Available Online through library]
- Wyllie, D.C. (2018) Rock Slope Engineering, 5th Edition. Taylor & Francis. [Note: continues Hoek & Bray, 3rd Edition & Wylie & Mah, 4th Edition]. [E-book Available Online through library]
- Hoek E. and Brown E.T. (1982) Underground Excavation in Rock, The Institution of Mining and Metallurgy, London.
- Hoek, E., Kaiser, P.K. and Bawden, W.F. (1995) Support of Underground Excavations in Hard Rock.
- Hudson, J.A. and Harrison, J.P. (2005) Engineering Rock Mechanics. 3rd Impression. Permagon. [E-book Available Online through library]
- Bell, F.G. (2007) Engineering Geology. Burlington : Elsevier. [E-book Available Online through library]

Websites of interest include:

- Australian Geomechanics Society: https://australiangeomechanics.org/
- Australian Geomechanics Society, Sydney: https://australiangeomechanics.org/chapter/sydney-nsw/
- Int. Soc. for Soil Mechanics & Geotechnical Engineering: https://www.issmge.org/
- International Society for Rock Mechanics: https://www.isrm.net/
- International Association of Engineering Geology: https://www.iaeg.info/
- The Australasian Institute of Mining and Metallurgy: https://ausimm.com/
- The U.S. Geological Survey: https://www.usgs.gov/
- Science Direct Journal Search: https://www.sciencedirect.com/

More will be provided on Moodle as required.

iPhone (and other almost as smart phones)

There are numerous geological and engineering apps for various smart phones. A geological compass, that can be used for basic rock mapping, would be useful (measures and plots dip and

dip direction of a plane). Examples for iPhone would be GeoID or Stereonet.

Computer Software

The School computer laboratories provide you access to Rocscience programs, Dips (plotting defect data) and Examine and RS2 (underground stress analysis); and the GeoStudio program GeoSlope (soil slope stability analysis). Software can also be accessed via Access Anytime Anywhere (TIP: You should use the virtual machine option which is faster, the app version often doesn't work - see top of page for link). For example for Rocscience software: https://www.myaccess.unsw.edu.au/applications/rocscience-suit

## Course Evaluation and Development

The course is reviewed annually through the myExperience survey. All responses are considered and I make changes to the course annually in response. I am also always happy to get feedback during the course for immediate consideration. You can email me directly or use the feedback discussion tool I have placed in Moodle.I am 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<br>Kurt Douglas | | CE 506 | 9385 5046 | TBC in class | No | Yes |

# 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.