UNSW Course Outline

MINE4310 Mine Geotechnical Engineering - 2024

Published on the 01 Feb 2024

General Course Information

Course Code : MINE4310
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Minerals & Energy Resources 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 provides students with a practical understanding of the application of geotechnical engineering principles in mining - from the perspective of planning, design and operations, covering both, soft and hard rock, as well as underground and open cut mining systems.

The course is intended to develop the capability and requisite skills of a mining engineer to build the foundation of knowledge related to the mining and underground excavation geotechnical problems. This foundation provides a basis on applying geomechanics in mining and tunnelling (design and operations), including mine safety, risk assessment and management systems, and impact of geological factors on geotechnical behaviour and design, tailing dam design considerations.

The course provides an opportunity for the student to bring together engineering principles learned over their previous years of study and apply these principles to innovatively solve problems such as the development of a specific design, process and/or the investigation of a hypothesis.

Course Aims

The purpose of the course is to introduce the student to methods of testing, analysis and design appropriate to structures which consist of soil and rock.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Recognise the major geotechnical applications and their significance within the mainstream mining systems and conditions
CLO2 : Analyse large geotechnical datasets to enable appropriate rock mass characterisation and practical geotechnical design
CLO3 : Apply appropriate geotechnical principles and methodologies in a comprehensive range of mining and related applications, both from a technical risk and operational management perspective
CLO4 : Identify the innovative opportunities and technological trends in geotechnical engineering applications

Course Learning Outcomes	Assessment Item
CLO1 : Recognise the major geotechnical applications and their significance within the mainstream mining systems and conditions	• Individual report 1 • Individual report 2 • Individual report 3 • Final Exam
CLO2 : Analyse large geotechnical datasets to enable appropriate rock mass characterisation and practical geotechnical design	• Individual report 1 • Individual report 2 • Individual report 3 • Final Exam
CLO3 : Apply appropriate geotechnical principles and methodologies in a comprehensive range of mining and related applications, both from a technical risk and operational management perspective	• Individual report 1 • Individual report 2 • Individual report 3 • Final Exam
CLO4 : Identify the innovative opportunities and technological trends in geotechnical engineering applications	• Individual report 1 • Individual report 2 • Individual report 3 • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

Other Professional Outcomes

This course will contribute to the development of the following Graduate Attributes: appropriate technical knowledge having advanced problem solving, analysis and synthesis skills with the ability to tolerate ambiguity ability for engineering design and creativity awareness of opportunities to add value through engineering and the need for continuous improvement

being able to work and communicate effectively across discipline boundaries having HSEC consciousness being active life-long learners.

Additional Course Information

This course assumes that a student:

- is currently enrolled in the Mining Engineering single degree program or a Mining Engineering double degree program at UNSW; and has satisfactorily completed all the courses in Stages 1 to 3 of the Mining Engineering single degree program or equivalent in the Mining Engineering double degree program and is in the Stage/Year of the program; and
- has successfully completed MINE3430 (Mining Systems) and MINE3310 (Mine Geomechanics); and
- has a sound knowledge of mining terms and systems and has had previous exposure to mining operations through industry employment and/or field trips.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Individual report 1 Assessment Format: Individual	15%	Due Date: 06/03/2024 10:00 AM
Individual report 2 Assessment Format: Individual	15%	Due Date: 01/04/2024 10:00 AM
Individual report 3 Assessment Format: Individual	20%	Due Date: 15/04/2024 10:00 AM
Final Exam Assessment Format: Individual	50%	

Assessment Details

Individual report 1

Assessment Overview

Coal and hard rock pillar design: the assignment will focus on identifying the geotechnical considerations in coal and hard rock pillar design and assessing the pillar stability using empirical methods.

Marking will be against assessment criteria and feedback on the assessment task will be provided after the marking is finalised.

Course Learning Outcomes

- CLO1 : Recognise the major geotechnical applications and their significance within the

mainstream mining systems and conditions
- CLO2 : Analyse large geotechnical datasets to enable appropriate rock mass characterisation and practical geotechnical design
- CLO3 : Apply appropriate geotechnical principles and methodologies in a comprehensive range of mining and related applications, both from a technical risk and operational management perspective
- CLO4 : Identify the innovative opportunities and technological trends in geotechnical engineering applications

Individual report 2

Assessment Overview

Excavation stability and application of numerical methods: the assessment introduces a scenario of mining extension, where students need to evaluate the ground stability for a decline tunnel using numerical modelling (i.e. Map3D). The potential damage zones around the excavation will be identified and recommendations for ground support will be made.

Marking will be against assessment criteria and feedback on the assessment task will be provided after the marking is finalised.

Course Learning Outcomes

- CLO1 : Recognise the major geotechnical applications and their significance within the mainstream mining systems and conditions
- CLO2 : Analyse large geotechnical datasets to enable appropriate rock mass characterisation and practical geotechnical design
- CLO3 : Apply appropriate geotechnical principles and methodologies in a comprehensive range of mining and related applications, both from a technical risk and operational management perspective
- CLO4 : Identify the innovative opportunities and technological trends in geotechnical engineering applications

Individual report 3

Assessment Overview

Report of an investigation of a mining operation focusing on geotechnical applications; or alternatively report on geotechnical management after a mine visit.

Marking will be against assessment criteria and feedback on the assessment task will be provided after the marking is finalised.

Course Learning Outcomes

- CLO1 : Recognise the major geotechnical applications and their significance within the mainstream mining systems and conditions

- CLO2 : Analyse large geotechnical datasets to enable appropriate rock mass characterisation and practical geotechnical design
- CLO3 : Apply appropriate geotechnical principles and methodologies in a comprehensive range of mining and related applications, both from a technical risk and operational management perspective
- CLO4 : Identify the innovative opportunities and technological trends in geotechnical engineering applications

Final Exam

Assessment Overview

Final exam

Course Learning Outcomes

- CLO1 : Recognise the major geotechnical applications and their significance within the mainstream mining systems and conditions
- CLO2 : Analyse large geotechnical datasets to enable appropriate rock mass characterisation and practical geotechnical design
- CLO3 : Apply appropriate geotechnical principles and methodologies in a comprehensive range of mining and related applications, both from a technical risk and operational management perspective
- CLO4 : Identify the innovative opportunities and technological trends in geotechnical engineering applications

General Assessment Information

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	1: Course introduction; Advances in rock mechanics 2: Geotechnical exploration, data collection and analysis
Week 2 : 19 February - 25 February	Lecture	1: Coal pillar mechanics 2: Hard Rock Pillar Design
Week 3 : 26 February - 3 March	Blended	1: Ground reaction curve/ Tunnel behaviour 2: In class activity: Pillar design
Week 4 : 4 March - 10 March	Lecture	1: Rock reinforcement and support 2: Excavation stability and spans
Week 5 : 11 March - 17 March	Blended	1: Application of numerical methods to mine design 2: In class activity: Using MAP3D for stope stability analysis
Week 6 : 18 March - 24 March	Other	Feedback on previous sessions
Week 7 : 25 March - 31 March	Lecture	1: Longwall Geomechanics 2: Hard Rock Caving Mechanics
Week 8 : 1 April - 7 April	Lecture	1: Mining methods selection criteria and geotechnical risks 2: Dynamic rock failures
Week 9 : 8 April - 14 April	Lecture	1: Tailing dam design fundamental principle and slope stability 2: Mine subsidence, mine fill design and application
Week 10 : 15 April - 21 April	Lecture	1: Instrumentation and monitoring 2: Smart sensing in mines; Course review

Attendance Requirements

Students are strongly encouraged to attend all classes and review lecture recordings.

General Schedule Information

The learning activity summary is a guide only and the indicated week and course content is subject to change.

Course Resources

Recommended Resources

Followings are the recommended books for this course.

- MEA Report Writing Guide for Mining Engineers. P Hagan and P Mort (Mining Education Australia (MEA)).
- Rock Mechanics and the Design of Structures in Rock. L Obert & WI Duvall, John Wiley & Sons (1967)
- Fundamentals of Rock Mechanics. JC Jaeger & NGW Cook, Chapman & Hall (1979).
- Rock Mechanics for Underground Mining. GHG Brady & ET Brown, (3rd ed. 2005) published by Springer.
- Coal Mine Ground Control. SS Peng, John Wiley & Sons (1986).
- Geotechnical Instrumentation and Monitoring in Open Pit and Underground Mining. T Szwedzicki (ed.), AA Balkema (1993).

- Rock Support in Mining and Underground Construction. PK Kaiser & DR McCreath (eds.), AA Balkema (1992).
- Rock Slope Engineering. E Hoek & JW Bray, Inst. of Mining & Metallurgy, London (1994).
- Rockbursts in Coal Mines and their Prevention. G Brauner, AA Balkema (1994).
- Australian Coal Mining Practice - Monograph 12. AJ Hargraves, CH Martin (eds.), AusIMM (1975)
- Subsidence Engineers' Handbook. National Coal Board (1975).
- Rock Support and Reinforcement Practice in Mining. E Villaescusa, C Windsor & A Thompson (eds.), AA Balkema (1999).
- Cablebolting in Underground Mines. D Hutchinson & M Diederichs, BiTech Publishers (1996).
- Deep and high stress mining, 1st Int'l Seminar, ACG, Perth, 2002 (This is a series)
- Mass Mining Conf. Series Proceedings. AusIMM, Brisbane. (This is a 4-year series recent one in 2015 in Sydney)
- ISRM 2003 Proceedings - Technology roadmap for rock mechanics, South Africa (SAIMM)
- Ground control in mining - Technology and practice, Proc. Of 1st Aust. Ground control in Mining Conf., UNSW, ed. Hebblewhite, 2003. (This is a series – Recent one in 2014)
- Surface support in mining, ed. Potvin, Stacey & Hadjigeorgiou, ACG - WA, 2004.
- How to Write a Better Thesis, 2002. D Evans and P Gruba (Melbourne University Press: Melbourne)

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Chengguo Zhang		School of Minerals and Energy Resources Engineering OMB, 159E	+61 2 9385 4035		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

Course completion

Course completion requires submission of all assessment items. Failure to submit all assessment items may result in the award of an Unsatisfactory Failure (UF) grade for the Course unless special consideration has been submitted and approved.

Submission of Assessment Tasks

We encourage you to retain a copy of every assignment submitted for your own record, either in hardcopy or electronic form. All assessments must have an assessment cover sheet attached.

Student Resources

The School has student resources section, containing useful advice and information to ensure you're able to focus on your studies.

Computing Resources and Internet Access Requirements

UNSW Minerals and Energy Resources Engineering provides blended learning using the online Moodle LMS (Learning Management System). Also see - Transitioning to Online Learning: www.covid19studyonline.unsw.edu.au

Note that some specialist engineering software is not available for Mac computers.

- Mining Engineering Students: OMB G48
- Petroleum Engineering Students: TETB LG34 & LG35

For more information about system requirements is available at www.student.unsw.edu.au/moodle-system-requirements

Accessing Course Materials Through Moodle

Course outlines, support materials are uploaded to Moodle, the university standard Learning Management System (LMS). In addition, on-line assignment submissions are made using the assignment dropbox facility provided in Moodle. All enrolled students are automatically included in Moodle for each course. To access these documents and other course resources, please visit: www.moodle.telt.unsw.edu.au

School Contact Information

School of Minerals and Energy Resources
Old Main Building, Level 1, 159 (K15)
UNSW SYDNEY NSW 2052 AUSTRALIA

For current students, all enquiries and assistance relating to enrolment, class registration, progression checks and other administrative matters, please see The Nucleus: Student Hub.

Web & Important Links:
School of Minerals and Energy Resources
The Nucleus: Student Hub
Moodle

UNSW Handbook

UNSW Timetable

Student Wellbeing

Urgent Mental Health & Support

Equitable Learning Services