UNSW Course Outline

MINE5020 Geotechnical Assessment for Underground Mining - 2024

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General Course Information

Course Code : MINE5020
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 : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

This course will cover the Geotechnical components of exploration programs - requirements,

technologies, integration, management. The course will address geotechnical assessment and logging; geophysical methods for geotechnical determinations, in both exploration and operating mine environments; integration of geotechnical data; rock mass characterisation and geotechnical hazard/condition mapping.

Course Aims

This course is designed to introduce engineers and geologists to the major geomechanics components associated with mining operations, from resource evaluation and mine design to daily operations. The course is structured to provide an initial overview of basic principles and terminology plus the use of geotechnical tool in Australian mining industry. An important component will be an emphasis on the interdependencies between geotechnical parameters and mine design/operational decisions and requirements. The link between geological and engineering disciplines is an important component in successfully managing these dependencies.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Describe the geotechnical components of exploration programs
CLO2 : Apply geotechnical and geophysical assessment and logging
CLO3 : Integrate geotechnical data and rock mass characterisation
CLO4 : Identify geotechnical hazards and apply condition mapping

Course Learning Outcomes	Assessment Item
CLO1 : Describe the geotechnical components of exploration programs	• Hazard Plan • Calculation of CMRR
CLO2 : Apply geotechnical and geophysical assessment and logging	• Stress Mapping • Hazard Plan • Calculation of CMRR
CLO3 : Integrate geotechnical data and rock mass characterisation	• Stress Mapping • Calculation of CMRR
CLO4 : Identify geotechnical hazards and apply condition mapping	• Stress Mapping • Hazard Plan • Calculation of CMRR

Learning and Teaching Technologies

Moodle - Learning Management System

Additional Course Information

This course is designed to introduce engineers and geologists to the major geomechanics components associated with mining operations, from resource evaluation and mine design to daily operations. It is, therefore, ideally suited to open cut and underground geotechnical engineers or geologists who have an understanding and experience in the mining industry but are seeking to develop more specialist skills in the geomechanics field.

This course covers the following aspects:

- Geotechnical components of exploration programs - requirements, technologies, integration, management. Geotechnical assessment and logging.
- Geophysical methods for geotechnical determinations, in both exploration and operating mine environments.
- Basic statistics and integration of geotechnical data.
- Australian safety statistics and ground control management strategies.
- Rock mass characterisation
- Geotechnical hazard/condition mapping.
- Activities include course presentations and student presentations

The course is structured to provide an initial overview of basic principles and terminology plus the use of geotechnical tool in Australian mining industry.

An important component will be an emphasis on the interdependencies between geotechnical parameters and coal mine design/operational decisions and requirements. The link between geological and engineering disciplines is an important component in successfully managing these dependencies.

This course is an Intensive, four-day workshop program conducted at UNSW from 4 – 7 Mar 2024.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Stress Mapping Assessment Format: Individual	25%	
Hazard Plan Assessment Format: Individual	35%	
Calculation of CMRR Assessment Format: Individual	40%	

Assessment Details

Stress Mapping

Assessment Overview

(a) Prepare a geotechnical 'condition map' of the nominated area of the mine you visit, to indicate the location, type and intensity of any fracturing, structure, failure or indication of stress magnitude or direction which might constitute an elevated geotechnical hazard.

(b) From your mapping, draw deductions about the geotechnical hazards identified and the possible underlying mechanisms.

(c) For (a) and (b) you should submit

(1) your original underground mapping plan and associated notes.

(2) Annotated sketches on plans or blank sheets, plus brief discussion points to answer (b).

A detailed assessment criteria is included in Moodle to provide a framework for students when preparing
assignments in the course as well as a guideline for assessors when marking an assignment. The
student is advised to review the relevant framework before undertaking their assignment.

Feedback will be provided via moodle or email.

Course Learning Outcomes

- CLO2 : Apply geotechnical and geophysical assessment and logging
- CLO3 : Integrate geotechnical data and rock mass characterisation
- CLO4 : Identify geotechnical hazards and apply condition mapping

Hazard Plan

Assessment Overview

a) Illustrate an example(s) of a typical hazard plan;

b) Discuss the hazard identification procedures;

c) Discuss the methods of displaying the hazards (and hazard level changes) on the plan;

d) Discuss the appropriateness of, and confidence in the “triggers” available to identify changes in hazard level (both elevated and reduced hazard levels);

e) Discuss the implications of the hazards identified to mining;

f) Identify appropriate procedures for communicating the findings to operating and management personnel at the mine.

A detailed assessment criteria is included in Moodle to provide a framework for students when preparing
assignments in the course as well as a guideline for assessors when marking an assignment. The
student is advised to review the relevant framework before undertaking their assignment.

Feedback will be provided via moodle or email.

Course Learning Outcomes

- CLO1 : Describe the geotechnical components of exploration programs
- CLO2 : Apply geotechnical and geophysical assessment and logging
- CLO4 : Identify geotechnical hazards and apply condition mapping

Calculation of CMRR

Assessment Overview

A detailed assessment criteria is included in Moodle to provide a framework for students when preparing
assignments in the course as well as a guideline for assessors when marking an assignment. The
student is advised to review the relevant framework before undertaking their assignment.

Feedback will be provided via moodle or email.

Course Learning Outcomes

- CLO1 : Describe the geotechnical components of exploration programs
- CLO2 : Apply geotechnical and geophysical assessment and logging
- CLO3 : Integrate geotechnical data and rock mass characterisation
- CLO4 : Identify geotechnical hazards and apply condition mapping

General Assessment Information

Specific assessment information will be provided on Moodle, including a detailed assessment criteria is included in Moodle to provide a framework for students when preparing assignments in the course as well as a guideline for assessors when marking an assignment. Student are advised to review the relevant framework before undertaking their assignment.

The criteria listed for each item of assessment and the descriptions contained therein are not intended to be prescriptive, nor is it an exhaustive list. Rather, it should be viewed as a framework to guide the student as to the type of information and depth of coverage that is expected to be evident in a submission for assessment; the framework illustrates, for example, what would distinguish an excellent achievement from a poor achievement.

The student should be cognisant that a range of factors is often being assessed in any one assignment, not just whether the final results are numerically correct. Consideration is given to other relevant elements that contribute to the Learning Outcomes of the course as well as the Graduate Attributes of the overall degree program.

The student is cautioned against merely using the assessment criteria as a checklist. When assessing an assignment, elements in the framework will be examined in terms of quality and creativity. Hence, ensuring all the listed elements are merely covered in an assignment is often not sufficient in itself and will not automatically lead to full marks being awarded. Other factors, such as how the student went about presenting information, how an argument was structured and/or the elements supporting a particular recommendation or outcome, are also important.

Finally, the framework can also be used to provide feedback to a student on their performance in an assignment.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 4 : 4 March - 10 March	Workshop	Day 1: 4th March (duration 8 hours) Introduction to the Course and the Geotechnical Assessment • Course introduction • Overview of ground control management in Australian mines • Safety in the mining industry; how does it compare to other industries • Basic statistics for geotechnical applications • Principles of engineering and strata control design Day 2: 5th March (duration 8 hours) Geotechnical Assessments and risk-based designs • Geotechnical assessment • Group discussions on hazard mapping and design issues • Use of risk-based design examples Day 3: 6th March (duration 8 hours) Rock mass classification and monitoring in UG mines • Geotechnical logging and rock mass classification CMRR & GSR • Instrumentation and Monitoring in underground mines Day 4: 7th March (duration 8 hours) Rock mass classification and monitoring in open cut mines and practical geotechnical management • Other rock mass classification techniques in open cut mining

Attendance Requirements

The course will be delivered face-to-face and online. All students (i.e., face-to-face and online) will be required to attend the course during the dedicated week.

Course Resources

Prescribed Resources

- Galvin, JM. (2016). Ground Engineering - Principles and Practices for Underground Coal Mining (Springer).
- Rock Mechanics for Underground Mining GHG Brady & ET Brown, 3rd edition, Kluwer Academic Press, 2004.
- 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 Fracture Mechanics. BN Whittaker, RN Singh & G Sun, Elsevier (1992).
- 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).
- Diederichs, M., Lato, M., Hammah, R., Quinn, P. 2007. Shear Strength Reduction (SSR) approach for slope stability analyses. Proceedings of the 1st Canada-US Rock Mechanics Symposium, Vancouver. pp. 319-327.
- Duncan, J., Wright, S. 2005. Soil Strength and Slope Stability, John Wiley & Sons Inc.
- Harrison, J., Hudson, J. 2000. Engineering Rock Mechanics: Illustrative Worked Examples. Elsevier Science, Oxford. 530 pp.
- Hatherly, P., Medhurst, T., MacGregor, S. 2008. Geophysical Strata Rating. ACARP project C15019. https://www.acarp.com.au/
- Hatherly, P., Medhurst, T., Zhou, B. 2013. Investigations for open pit geomechanics using geophysical logs, ACARP project C20025. https://www.acarp.com.au/
- Hoek, E. 2007. Practical Rock Engineering, Rocscience (online): https://www.rocscience.com/learning/hoek-s-corner.
- Hoek, E., Brown, E. 1980. Empirical strength criterion for rock masses. Journal of The Geotechnical Engineering Division. ASCE 106 (GT9), pp. 1013-1035.
- Hoek, E., Brown, E. 1988. The Hoek-Brown failure criterion – a 1988 update. Proceedings 15th Canadian Rock Mech. Symp. Toronto.
- Hoek, E., Marinos, P. 2007. A brief history of the development of the Hoek-Brown failure criterion. Soils and Rocks. No. 2.
- International Society for Rock Mechanics (ISRM) Commission on Standardization of Laboratory and Field Tests, 1978. Suggested methods for the quantitative description of discontinuities in rock masses. Int J Rock Mech Min Sci & Geomech Abstr. 15, pp. 319-368.
- Jaeger, J., Cook, N., Zimmerman, R. 2007. Fundamentals of Rock Mechanics (Fourth Edition). Blackwell Publishing, Oxford, UK.
- Mark, C., Molinda, G. 2005. The Coal Mine Roof Rating (CMRR) – A decade of experience. Intl J of Coal Geology. 64, pp. 85-103.
- Priest, S., Brown, E. 1983. Probabilistic stability analysis of variable rock slopes. Institution of Mining and Metallurgy Transactions. 92, pp. A1-A12.
- Sjoberg, J. 1999. Analysis of Large Scale Rock Slopes, Doctoral Thesis, Lulea University of Technology Department of Civil and Mining Engineering Division of Rock Mechanics, Sweden.
- Zhai, H., Canbulat, I., Hebblewhite, B., Zhang, C. 2017. Review of current empirical approaches for determination of the weak rock mass properties. Procedia Engineering. 191, pp. 908-917.

Course Evaluation and Development

The student feedback will be recieved through myExperience.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Ismet Canbulat		159G	+61432003064	By appointment	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