MINE5010

Fundamentals of Rock Behaviour for Underground Mining

Term 1, 2022
Course Overview

Staff Contact Details

Convenors

<table>
<thead>
<tr>
<th>Name</th>
<th>Email</th>
<th>Availability</th>
<th>Location</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ismet Canbulat</td>
<td><a href="mailto:i.canbulat@unsw.edu.au">i.canbulat@unsw.edu.au</a></td>
<td>Appointment or emails</td>
<td>School of Minerals and Energy Resources Engineering OMB 164</td>
<td>0432003064</td>
</tr>
</tbody>
</table>

School Contact Information

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

Engineering Student Services
E: mere.teaching@unsw.edu.au
W: www.engineering.unsw.edu.au/minerals-energy-resources
Course Details

Units of Credit 6

Summary of the Course

Introduction to mining rock mechanics and the rock mechanics context within new and operating underground mines. Basic physical principles applied to rock mechanics and geotechnical engineering in an underground mining environment. Elasticity and stress; rock properties and methods of determination; rock response to load; failure modes; time-dependency; stiffness; energy release; rock mass characterisation; geological environment and structure; stress environment and methods of determination; hydro-geological environment; soft rock/soil mechanics considerations.

Course Aims

This course aims to equip the student with knowledge and skills to design and select appropriate Geomechanics techniques for different mining applications.

Course Learning Outcomes

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

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>EA Stage 1 Competencies</th>
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<tbody>
<tr>
<td>1. Basic knowledge of mining rock mechanics and the rock mechanics context within new and operating underground mines.</td>
<td>PE1.1</td>
</tr>
<tr>
<td>2. Principles applied to rock mechanics and geotechnical engineering in an underground mining environment.</td>
<td>PE1.3</td>
</tr>
<tr>
<td>3. Knowledge of elasticity and stress; rock properties and methods; rock mass failure modes; as well as behaviour of rock under loading.</td>
<td>PE1.5</td>
</tr>
<tr>
<td>4. Geotechnical laboratory testing and interpretation of test results.</td>
<td>PE1.4</td>
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</table>

It is intended that students will be able to:

1. Understand the basic mechanical properties of rock and how these are applied to analyse problems in mining geomechanics.
2. Have a sound working knowledge of fundamental mechanisms and geotechnical principles within the context of practical coal mining applications;
3. Recognise the role and importance of these principles in a comprehensive range of coal mining applications, both from a technical perspective, and from the risk and operational management perspective.
4. Have a broad knowledge of key numerical methods used in mining rock mechanics

Teaching Strategies
This course will contribute to the development of the following Graduate Attributes:

1. The skills involved in scholarly enquiry
2. An in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context
3. The ability to engage in independent and reflective learning
4. The skills required for collaborative and multidisciplinary work
5. The skills of effective communication

Additional Course Information

Welcome to MINE5010 Fundamentals of Rock Behaviour. This course is designed to introduce engineers and geologists to the major geomechanics components associated with coal mining operations, from resource evaluation and mine design to daily operations. It is, therefore, ideally suited to open cut and underground coal engineers or geologists who have an understanding and experience in the coal mining industry but are seeking to develop more specialist skills in the geomechanics field.

The course content will include the following components:

• Fundamental of rock mechanics
• Intact rock characterisation
• Discontinuities characterisation and modelling
• Rock mass classification
• Fundamental of coal geology
• Mine Design issues
• Ground control management and environmental geomechanics.

The course is structured to provide an initial overview of basic principles and terminology plus the major geomechanical properties and behavioural characteristics of rock material.

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 assumes a student has knowledge of

• as this is a technical course in a postgraduate program, a fundamental understanding of both Mathematics and Physics to a standard at least equivalent to a first year course in a university engineering program
• basic mining and geological terms and descriptions
• mining systems.
Total student effort hours: Approximately 150 hours
Assessment

All the course materials and assignments will be available online through Moodle. Access to the Moodle site is via the Moodle icon on the MyUNSW homepage, or at https://moodle.telt.unsw.edu.au

<table>
<thead>
<tr>
<th>Assessment task</th>
<th>Weight</th>
<th>Due Date</th>
<th>Course Learning Outcomes Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Laboratory Assignment</td>
<td>35%</td>
<td>27/03/2022 11:59 PM</td>
<td>1, 4</td>
</tr>
<tr>
<td>2. Geology Assignment</td>
<td>35%</td>
<td>17/04/2022 12:00 AM</td>
<td>2</td>
</tr>
<tr>
<td>3. Quizzes</td>
<td>15%</td>
<td>02/03/2022 05:00 PM</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>4. Team-based activities</td>
<td>15%</td>
<td>03/03/2022 12:00 AM</td>
<td>1, 2, 3, 4</td>
</tr>
</tbody>
</table>

Assessment 1: Laboratory Assignment

Due date: 27/03/2022 11:59 PM
Rock testing laboratory report

Assessment criteria

Assessment 1 will be assessed based on the quality of the research proposal; marking rubrics can be found in Moodle.

Assessment 2: Geology Assignment

Due date: 17/04/2022 12:00 AM
Assess overall understanding of students on basic coal geology

Assessment criteria

Assessment 2 will be assessed based on the quality of the research proposal; marking rubrics can be found in Moodle.

Assessment 3: Quizzes

Due date: 02/03/2022 05:00 PM
Basic questions on the course content to assess overall understanding of students.

Assessment 4: Team-based activities

Start date: 28/02/2022 12:00 AM
Due date: 03/03/2022 12:00 AM
Team-based activities in the class
**Attendance Requirements**

All students will need to attend the class/online delivery during the time of delivery.

**Course Schedule**

<table>
<thead>
<tr>
<th>UNSW Days</th>
<th>Day</th>
<th>Hrs.</th>
<th>Topic</th>
<th>Content/Activities</th>
<th>Presenter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>28th Feb</td>
<td>8</td>
<td>Introduction to the Course and the Fundamentals of Rock Behaviour</td>
<td>Introduction to the program and the course, Minerals and Energy Resources Eng student OHS induction and assessment, Introduction to Moodle/Library Access, Fundamental of Geomechanics, Intact Rock, Discontinuity and Rock Mass</td>
<td>IC/CZ</td>
</tr>
<tr>
<td>2</td>
<td>1st March</td>
<td>8</td>
<td>Fundamentals of Rock Behaviour (Cont’d)</td>
<td>Intact Rock, Discontinuity and Rock Mass, Rock mechanics lab inspection/induction, Assignments discussion</td>
<td>CZ</td>
</tr>
<tr>
<td>3</td>
<td>2nd March</td>
<td>8</td>
<td>Coal Mine Geology</td>
<td>Mine geology investigations, Mine geophysical investigations</td>
<td>HR/SC</td>
</tr>
<tr>
<td>4</td>
<td>3rd March</td>
<td>8</td>
<td>Mine Geology Investigations</td>
<td>Impact of geology on mining – case studies</td>
<td>IC</td>
</tr>
</tbody>
</table>
Resources

Prescribed Resources

- MEA Report Writing Guide for Mining Engineers. P Hagan and P Mort (Mining Education Australia (MEA)). (Latest edition available for download from the School website or a hardcopy version is available from the UNSW Bookshop)

Other Resources

• Guide to Authors, 2008. (Australasian Institute of Mining and Metallurgy; Melbourne).

• Style Manual for authors, editors and printers. 6th edition, (John Wiley & Sons).

Online Resources

Selected readings as well as other supporting material (e.g. course outline and lecture notes will be made available on Moodle.

Course Evaluation and Development

The student feedback will be received through myExperience.
Submission of Assessment Tasks

The School has developed a guideline to help you when submitting a course assignment.

We encourage you to retain a copy of every assignment submitted for assessment for your own record either in hardcopy or electronic form.

All assessments must have an assessment cover sheet attached.

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. Please note, a competency hurdle of 50% is applied to the final assessment.

Late Submission of an Assignment

Full marks for an assignment are only possible when an assignment is received by the due date.

We understand that at times you may not be able to submit an assignment on time, and the School will accommodate any fair and reasonable extension. We would recommend you review the UNSW Special Consideration guidelines – see section below.

Late submission will not be accepted and will be considered as no submission.

Special Consideration

You can apply for special consideration through The Nucleus Student Hub when illness or other circumstances interfere with your assessment performance. Sickness, misadventure or other circumstances beyond your control may:

- Prevent you from completing a course requirement
- Keep you from attending an assessable activity
- Stop you submitting assessable work for a course
- Significantly affect your performance in assessable work, be it a formal end-of-semester examination, a class test, a laboratory test, a seminar presentation or any other form of assessment

We ask that you please contact the Course Convenor immediately once you have completed the special consideration application, no later than one week from submission.

More details on special consideration can be found at: www.student.unsw.edu.au/special-consideration

Student Support

The University and the Faculty provide a wide range of support services for students, including:

- Library training and support services - www.library.unsw.edu.au
Equitable Learning Services aims to provide all students with a free and confidential service that provides practical support to ensure that your health condition doesn’t adversely affect your studies. https://student.unsw.edu.au/els
Academic Honesty and Plagiarism

Your lecturer and the University will expect your submitted assignments are truly your own work. UNSW has very clear guidelines on what plagiarism is and how to avoid it. Plagiarism is using the words or ideas of others and presenting them 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. The University has adopted an educative approach to plagiarism and has developed a range of resources to support students. All the details on plagiarism, including some useful resources, can be found at www.student.unsw.edu.au/plagiarism.

All Mining Engineering students are required to complete a student declaration for academic integrity which is outlined in the assignment cover sheets. By signing this declaration, you agree that your work is your own original work.

If you need some additional support with your writing skills, please contact the Learning Centre or view some of the resources on their website: www.lc.unsw.edu.au. The Learning Centre is designed to help you improve your academic writing and communication skills. Some students use the Centre services because they are finding their assignments a challenge, others because they want to improve an already successful academic performance.
Academic Information

Course Results

For details on UNSW assessment policy, please visit: www.student.unsw.edu.au/assessment

In some instances your final course result may be withheld and not released on the UNSW planned date. This is indicated by a course grade result of either:

- **LE** – indicates you have not completed one or more items of assessment; or
- **WD** – indicates there is an issue with one or more assignment; or
- **WC** – which indicates you have applied for Special Consideration due to illness or misadventure and the course results have not been finalised.

In either event it would be your responsibility to contact the Course Convener as soon as practicable but no later than five (5) days after release of the course result. If you don’t contact the convener on time, you may be required to re-submit an assignment or re-sit the final exam and may result in you failing the course. You would also have a NC (course not completed) mark on your transcript and would need to re-enroll in the course.

Studying a course in the School of Minerals and Energy Resources Engineering at UNSW

Report writing guide

The School has a Report Writing Guide (RWG) available. A copy of this is available on the course Moodle site.

Computing Resources and Internet Access Requirements

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

It is essential that you have access to a PC or notebook computer. Mobile devices such as smart phones and tablets may compliment learning, but access to a PC or notebook computer is also required. Note that some specialist engineering software is not available for Mac computers.

- Mining Engineering Students: OMB G48
- Petroleum Engineering Students: TETB LG34 & LG 35

It is recommended that you have regular internet access to participate in forum discussion and group work. To run Moodle most effectively, you should have:
• broadband connection (256 kbit/sec or faster)
• ability to view streaming video (high or low definition UNSW TV options)

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

**How We Contact You**

At times, the School or your course convenors may need to contact you about your course or your enrolment. Your course convenors will use the email function within Moodle or we will contact you on your @student.unsw.edu.au email address.

We understand that you may have an existing email account and would prefer for your UNSW emails to be redirected to your preferred account. Please see instructions on how to redirect your UNSW emails: "How can I forward my emails to another account?"

**How You Can Contact Us**

We are always ready to assist you with your inquiries. To ensure your question is directed to the correct person, please use the email address below for:

- Enrolment or other admin questions regarding your program: https://unswinsight.microsoftcrmportal.com/web-forms/
- Course inquiries should be directed to the Course Convenor

**Image Credit**

Synergies in Sound 2016

**CRICOS**

CRICOS Provider Code: 00098G

**Acknowledgement of Country**
We acknowledge the Bedegal people who are the traditional custodians of the lands on which UNSW Kensington campus is located.
## Program Intended Learning Outcomes

### Knowledge and skill base

| PE1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline | ✔ |
| PE1.2 Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline |
| PE1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline | ✔ |
| PE1.4 Discernment of knowledge development and research directions within the engineering discipline | ✔ |
| PE1.5 Knowledge of engineering design practice and contextual factors impacting the engineering discipline | ✔ |
| PE1.6 Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline |

### Engineering application ability

| PE2.1 Application of established engineering methods to complex engineering problem solving |
| PE2.2 Fluent application of engineering techniques, tools and resources |
| PE2.3 Application of systematic engineering synthesis and design processes |
| PE2.4 Application of systematic approaches to the conduct and management of engineering projects |

### Professional and personal attributes

| PE3.1 Ethical conduct and professional accountability |
| PE3.2 Effective oral and written communication in professional and lay domains |
| PE3.3 Creative, innovative and pro-active demeanour |
| PE3.4 Professional use and management of information |
| PE3.5 Orderly management of self, and professional conduct |
| PE3.6 Effective team membership and team leadership |