MINE5040

Coal Mining Methods, Mine Planning and Applied Geomechanics

Term 2, 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>OMB 156</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

Welcome to MINE5040 Geotechnical Assessment for Underground Coal Mining. In this course, range of mining methods used in underground coal mining and the core geotechnical parameters and criteria that effect the choice or application of the methods are presented. Mine entry systems; pillar mechanics and design procedures; geomechanics of longwall mining; caving mechanics, periodic weighting, windblasts; outbursts and rock bursts/bumps; pillar extraction; highwall mining; mine subsidence mechanics and design; geotechnical equipment considerations; mine planning considerations; geotechnical design methodologies (methods, excavations, pillars etc). A range of case studies will supplement this course content. Activities include course presentations and student assignments.

Course Aims

This course aims to equip the student with knowledge and skills to design and select appropriate engineering 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>
</tr>
</thead>
<tbody>
<tr>
<td>1. Knowledge of mining methods used in underground coal mining and the core geotechnical parameters in different mining methods.</td>
<td>PE1.5, PE2.3</td>
</tr>
<tr>
<td>2. Knowledge of principles of coal pillar mechanics and design procedures</td>
<td>PE1.3, PE2.1, PE3.5</td>
</tr>
<tr>
<td>3. Knowledge of longwall mining and caving mechanics and associated risks.</td>
<td>PE1.5, PE2.4</td>
</tr>
<tr>
<td>4. Knowledge of mine subsidence mechanics and design for subsidence control</td>
<td>PE1.1, PE2.1</td>
</tr>
<tr>
<td>5. Mine planning considerations and design methodologies.</td>
<td>PE1.3</td>
</tr>
</tbody>
</table>

Teaching Strategies

Presentations and reading material will be provided students with technical information and examples of design and management processes are applied in the mining industry.

Discussions will be used to encourage students to articulate and defend positions, consider different points of view and evaluate evidence. Case studies will be used to provide practice in identifying potential problems and evaluating alternative course of actions.

A pillar design tutorial will also be provided.
Additional Course Information

This course covers the following aspects:

- Pillar design
  - Pillar loading
  - Pillar strength
- Longwall geomechanics
- Periodic weighting
- Pillar extraction
- Windblast and airblast mechanisms and controls
- Mine subsidence
- Other mine design applications
  - Thick seam mining issues and
  - Top coal caving,
- Practical case studies in longwall geomechanics

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

The assessment criteria 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.

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.

<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. Individual report – dynamic failures and longwall periodic weighting</td>
<td>30%</td>
<td>03/07/2022 11:59 PM</td>
<td>2, 3</td>
</tr>
<tr>
<td>2. Individual report – Crandall Canyon – pillar design calculations</td>
<td>35%</td>
<td>17/07/2022 11:59 PM</td>
<td>1, 2, 3, 4</td>
</tr>
<tr>
<td>3. Pillar design exercise</td>
<td>35%</td>
<td>31/07/2022 11:59 PM</td>
<td>1, 2, 4</td>
</tr>
</tbody>
</table>

**Assessment 1: Individual report – dynamic failures and longwall periodic weighting**

**Due date:** 03/07/2022 11:59 PM

1. **Dynamic Geotechnical Events**

Provide a succinct definition and/or description; summary of the range of conditions (parameters) required; plus the geotechnical mechanisms involved in each of the following dynamic events that can occur in underground coal mines:
- rock burst or coal burst
- dynamic (sudden) pillar system collapse

Discuss the above events types and for each of the two event types, identify the prevention and/or control strategies available to mitigate against such events.

This should be a maximum 5-page assignment and will require additional reading beyond the lecture material provided.

2. Longwall Periodic Weighting

What is meant by periodic weighting? Explain in terms of geotechnical conditions and mechanisms, with the aid of sketches.

Obtain some face monitoring data from your own mine (or any other documented or available site) that illustrates the phenomenon of periodic weighting and the associated mechanisms.

What prevention/control strategies are available to mitigate against varying levels of periodic weighting severity?

*This should be a maximum 5-page assignment and will require additional reading beyond the lecture material provided.*

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

**Assessment criteria**

See assessment criteria (rubric) under assessment tab on Moodle.

**Assessment 2: Individual report – Crandall Canyon – pillar design calculations**

**Due date:** 17/07/2022 11:59 PM

Use the UNSW Pillar Design Procedures to calculate the strength and likely stability conditions for the pillars in the panel associated with the Crandall Canyon disaster. Consider the pillar loading both on development and on extraction. Make assumptions, as appropriate, and justify them.

This should be a ~10-page assignment and will require additional reading beyond the lecture material provided.

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

**Assessment criteria**

See assessment criteria (rubric) under assessment tab on Moodle.

**Assessment 3: Pillar design exercise**

**Due date:** 31/07/2022 11:59 PM

- You are to design a system of longwall chain pillars for the first 10 adjacent LW panels of a mine
(with respect to geotechnical design criteria).

- The following parameters exist at the mine:
  - Longwalls 1 – 3, depths range from 200m to 300m, variable across the panels.
  - Longwalls 4 – 10, outbye depths, variable in the 200m – 300m range, inbye depths up to 375m.
  - Seam dip <5º toward the inbye end of the panels.
  - Longwalls 1 – 3 are located under prime rural/partial residential land, with subsidence restrictions applied, such that face length is limited to 120m, such that long term surface subsidence is restricted to below a certain limiting value.
  - Longwalls 4 – 10 will have a face length of 300m.
  - Seam thickness is 4m, all potentially minable by the longwall.
  - Gateroads are to be mined at 3.2m height and 5.2m width – maingate in the bottom of the seam; tailgate in the top of the seam.
  - On the tailgate end of the face, it is planned to cut the floor of the tailgate out at full seam thickness.

- Geological conditions:
  - Assume an immediate strong siltstone floor, from 1m to 2.0m in thickness, overlying 3.0m thick claystone, overlying a competent, massive sandstone floor for 5m – 10m below the seam.
  - Assume a weak laminated mudstone/shale roof for 5m, overlain by interbedded massive sandstones and shales.
  - Other geological detail – make your own assumptions, as you deem necessary.

- Stress conditions:
  - Assume a 2.5:1 ratio of major horizontal to vertical stress (with intermediate stress equal to vertical stress). Major principal stress oriented at right angles to gateroad direction.

1. Carry out a chain pillar design exercise, for each set of gateroad pillars for the first 10 LW blocks using ALTS design methodology.
2. Conduct the calculations using another design methodology (e.g., ALPS or UNSW), providing a clear explanation of (i) how you have carried out the designs, and (ii) where any assumptions have been made and why
3. Compare and discuss the results of the two design methodologies, their applicability and limitations of them.

Assignment should be ~15 pages long, plus plans, sketches etc where necessary.

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

**Assessment criteria**

See assessment criteria (rubric) under assessment tab on Moodle.
Attendance Requirements

To pass this course it is expected that you will attend 100% of lectures. If you have misadventure or ill-health, please contact your course coordinator as soon as possible. The attendance requirement is not meant to be punitive. It is included because participation is an important part of achieving the course outcomes.
Resources

Recommended 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)
- There are also a range of additional information uploaded on to Moodle.

Course Evaluation and Development

The student feedback will be collated through myExperience. The students are strongly encouraged to complete myExperience.

Students' honest, constructive feedback is valued. Results from this survey help enhance courses and teaching at UNSW. Your feedback makes a difference for the next group of students taking your courses, just as feedback from students taking courses you plan to take makes a difference for you.

myExperience is confidential, your identity is not included in reports. Results of the survey are not made available until your course results are released.
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.

Late Submission of an Assessment

Full marks for an assessment are only possible when an assessment is received by the due date. 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. 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 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, or
- Online quizzes where answers are released to students on completion, or Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or Pass/Fail assessment tasks.

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.

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
- UNSW Learning Centre - www.lc.unsw.edu.au
- Counselling support - www.counselling.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](http://www.student.unsw.edu.au/plagiarism).

All MERE 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](http://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](http://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)](http://www.student.unsw.edu.au/assessment) 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](http://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

This course outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies.

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.microsoftcrmportals.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.
## Appendix: Engineers Australia (EA) Professional Engineer Competency Standard

### Program Intended Learning Outcomes

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

<table>
<thead>
<tr>
<th>Engineering application ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE2.1 Application of established engineering methods to complex engineering problem solving</td>
</tr>
<tr>
<td>PE2.2 Fluent application of engineering techniques, tools and resources</td>
</tr>
<tr>
<td>PE2.3 Application of systematic engineering synthesis and design processes</td>
</tr>
<tr>
<td>PE2.4 Application of systematic approaches to the conduct and management of engineering projects</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional and personal attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>PE3.1 Ethical conduct and professional accountability</td>
</tr>
<tr>
<td>PE3.2 Effective oral and written communication in professional and lay domains</td>
</tr>
<tr>
<td>PE3.3 Creative, innovative and pro-active demeanour</td>
</tr>
<tr>
<td>PE3.4 Professional use and management of information</td>
</tr>
<tr>
<td>PE3.5 Orderly management of self, and professional conduct</td>
</tr>
<tr>
<td>PE3.6 Effective team membership and team leadership</td>
</tr>
</tbody>
</table>