

# MINE4310

Mine Geotechnical Engineering

Term 1, 2022



## Course Overview

### Staff Contact Details

#### Convenors

| Name           | Email                                                                      | Availability | Location                                                      | Phone           |
|----------------|----------------------------------------------------------------------------|--------------|---------------------------------------------------------------|-----------------|
| Chengguo Zhang | <a href="mailto:chengguo.zhang@unsw.edu.au">chengguo.zhang@unsw.edu.au</a> |              | School of Minerals and Energy Resources Engineering OMB, 159E | +61 2 9385 4035 |

#### School Contact Information

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[Engineering Student Services](#)

E: [mere.teaching@unsw.edu.au](mailto:mere.teaching@unsw.edu.au)

W: [www.engineering.unsw.edu.au/minerals-energy-resources](http://www.engineering.unsw.edu.au/minerals-energy-resources)

## Course Details

### Units of Credit 6

### Summary of the Course

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 opencut mining systems.

The course is intended to develop the capability and requisite skills of an engineer to build the foundation of knowledge related to the mining and tunnelling industry geotechnical problems. This foundation provides a basis on which to design a solution that is robust and safe, cost effective and appropriate to the end-user. 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

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.

### Course Learning Outcomes

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

| Learning Outcome                                                                                                                                                                                      | EA Stage 1 Competencies    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| 1. Recognise the major geotechnical applications and their significance within the mainstream mining systems and conditions                                                                           | PE1.3, PE2.1, PE3.4        |
| 2. Have a sound working knowledge of fundamental mechanisms and geotechnical principles within the context of practical mining applications                                                           | PE1.1, PE1.2, PE2.1        |
| 3. Recognise the role and importance of these principles in a comprehensive range of mining applications, both from a technical perspective, and from the risk and operational management perspective | PE1.3, PE2.2, PE2.3, PE3.3 |

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

1. appropriate technical knowledge
2. having advanced problem solving, analysis and synthesis skills with the ability to tolerate ambiguity
3. ability for engineering design and creativity
4. awareness of opportunities to add value through engineering and the need for continuous improvement
5. being able to work and communicate effectively across discipline boundaries
6. having HSEC consciousness

7. being active life-long learners.

## **Teaching Strategies**

Please refer to the information in Moodle

## **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.

## Assessment

| Assessment task      | Weight | Due Date            | Course Learning Outcomes Assessed |
|----------------------|--------|---------------------|-----------------------------------|
| 1. Individual report | 15%    | 28/03/2022 10:00 AM | 1, 2, 3                           |
| 2. Individual report | 15%    | 04/04/2022 10:00 AM | 1, 2, 3                           |
| 3. Individual effort | 20%    | 24/04/2022 10:00 AM | 1, 2, 3                           |
| 4. Final Exam        | 50%    | Not Applicable      | 1, 2, 3                           |

### Assessment 1: Individual report

**Due date:** 28/03/2022 10:00 AM

Assignment 1 will cover the assessment of pillar stability.

### Assessment 2: Individual report

**Due date:** 04/04/2022 10:00 AM

Assignment 2 will cover mining method and longwall geomechanics.

### Assessment 3: Individual effort

**Due date:** 24/04/2022 10:00 AM

The assessment will cover the excavation stability and application of numerical methods.

### Assessment 4: Final Exam

Final exam

## Attendance Requirements

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

## Course Schedule

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

[View class timetable](#)

### Timetable

| Date                              | Type    | Content                                                                                                                                           |
|-----------------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| O-Week: 7 February - 11 February  |         |                                                                                                                                                   |
| Week 1: 14 February - 18 February | Lecture | Wed: Course introduction, Geotechnical exploration, data collection, and analysis for mine design<br>Thu: Ground reaction curve/ Tunnel behaviour |
| Week 2: 21 February - 25 February | Lecture | Wed: Excavation stability and spans<br>Thu: Rock reinforcement and support                                                                        |
| Week 3: 28 February - 4 March     | Lecture | Wed: Mining methods selection criteria and geotechnical risks<br>Thu: Mine subsidence, mine fill design and application                           |
| Week 4: 7 March - 11 March        | Lecture | Wed: Hard Rock Pillar Design<br>Thu: Coal pillar mechanics                                                                                        |
| Week 5: 14 March - 18 March       | Lecture | Wed: Longwall Geomechanics<br>Thu: Tutorial - Pillar stability                                                                                    |
| Week 6: 21 March - 25 March       |         | Feedback on previous sessions                                                                                                                     |
| Week 7: 28 March - 1 April        | Lecture | Wed: Application of numerical methods to mine design<br>Thu: Tutorial – Stope design using numerical modelling                                    |

|                              |         |                                                                                                                |
|------------------------------|---------|----------------------------------------------------------------------------------------------------------------|
| Week 8: 4 April - 8 April    | Lecture | Wed: Hard rock caving mechanics<br>Thu: Dynamic rock failures                                                  |
| Week 9: 11 April - 15 April  | Lecture | Wed: Tailing dam design fundamental principle;<br>Slope stability<br>Thu: Tutorial - Rock mass classifications |
| Week 10: 18 April - 22 April | Lecture | Wed: Instrumentation and monitoring<br>Thu: Smart sensing in mines; Course review                              |

# 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)



## 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](http://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](http://www.library.unsw.edu.au)

- UNSW Learning Centre - [www.lc.unsw.edu.au](http://www.lc.unsw.edu.au)
- Counselling support - [www.counselling.unsw.edu.au](http://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 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](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 \(RWG\)](#) 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](http://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](http://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.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                                                                                                                                          |   |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 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                                                                                                                         |   |