



Faculty of Engineering

**School of Minerals and Energy Resources Engineering**

Postgraduate Course Outline

MINE5030

Mining Excavations in Rock

Dr Joung Oh

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## 1. INFORMATION ABOUT THE COURSE

Course Code:	MINE5030	Semester:	T3	Level:	PG	Units/Credits	6 UOC
Course Name:	Mining Excavations in Rock						

Course Convenor:	<b>Dr Joung Oh</b>		
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Contact times	Contact times are by appointment		

### 1.1. Course Description

Stress in rock and the effect of depth on pre-mining stress state; other factors influencing stress in rock; mining-induced stress and the rock mass response to excavation process; stress distributions around different excavation shapes and sizes - elastic and inelastic rock materials; excavation stability and potential failure modes; interaction between different excavations (horizontal and vertical interaction); regional stability considerations; effect of time on rock behaviour around excavations. Activities include course presentations, student presentations and numerical modelling demonstration responsibility to manage and plan workloads as much as possible to enable a minimum of 8 hours per week, plus time for assessments. Some weeks may require more than 20 hours.

MINE5030 is part of the Graduate Diploma in Coal Mine Strata Control. It is offered as a specialist postgraduate coursework qualification for people who currently, or stream in the future to, work within the underground coal mining industry with particular responsibilities in the field of strata control. The program has been designed to cater for people with different backgrounds, including either engineering or scientific tertiary qualifications and/or relevant experience. The program may be undertaken on either a part-time or full-time basis.

The overall program content provides an initial grounding in fundamental principles of rock mechanics and geotechnical engineering, followed by a comprehensive coverage of practical strata control applications, from the point of view of both the technologies involved, together with their implementation and management. The learning outcomes of this program will therefore provide a student with both the fundamental and practical knowledge base to be able to fulfil the role of a mine Strata Control Professional.

The program is particularly designed for people working at mine sites, or those who have access to a mine site for practical assignments. The program is offered in a flexible delivery format, with a large component available in a distance format, plus a limited number of face-to-face workshops/sessions. Assessments will include a number of practical, site-based assignments, including group and interactive work and presentations.

The program consists of the following eight courses:

1. MNNG5010 Fundamentals of Rock Behaviour
2. MNNG5020 Geotechnical Assessment
3. MINE8680 Geotechnical Data Collection and Analysis
4. MNNG5030 Mining Excavations in Rock
5. MNNG5040 Applied Geomechanics (coal)
6. MNNG5050 Ground Control Principles (coal)
7. MNNG5060 Operational Geotechnical Management
8. MINE8690 Mining Geotechnical Project (Research specific to Coal Mine Strata Control)

MINE8690 is a 6UOC mini research project for 1 semester for Graduate Diploma students who may articulate to Masters - See more at: <https://www.engineering.unsw.edu.au/mining-engineering/study-with-us/postgraduate-degrees/postgraduate-coursework-programs/masters-of-mine-geotechnical-2>

## 1.2. Course Completion

Course completion requires:

- submission of **all assessment items**; failure to submit all assessment items will result in the award of an Unsatisfactory Failure (UF) grade for the Course.
- achievement of at least a 50%+ pass in the exam that is part of MNNG5060.

## 1.3. Assumed Knowledge

This program assumes a student has knowledge of:

- geological terms and descriptions are assumed and an understanding of mining process
- fundamental understanding of basic mathematics, physics would be beneficial.
- to register for this program significant industry experience in underground mining is strongly recommended. Those with at least two years of experience may also gain entry with permission, based on the portfolio and interview.

## 2. AIMS, LEARNING OUTCOMES AND GRADUATE ATTRIBUTES

### 2.1. Course Aims

The program aims to provide mining engineers, geologists and other industry professionals, with leading practice knowledge for geotechnical engineering for all stages of mining operations. It will cover the major geotechnical design methodologies in use and new developments in leading practice, with the aim of safe and efficient mining operations.

### 2.2. Learning Outcomes

At the conclusion of this program the student will learn:

1. A practical competence and understanding in all areas presented in course description.
2. Knowledge of geotechnical engineering practices for mining from feasibility assessment to operations.
3. Laboratory testing.
4. Principles of effective operational geotechnical management
5. Understanding of elements of geotechnical engineering designs, including pillar design, ground support design, subsidence assessment and design, wind-blasts and pillar extraction.
6. Practical hazard plan development and assessment.
7. Geotechnical instrumentation.
8. Fundamentals and application of numerical modelling.
9. Longwall geomechanics and interaction of support and rock mass.
10. Undertake presentations that develop essential communications skills and teamwork.
11. How to conduct research to achieve the outcomes of a project.

### 2.3. Graduate Attributes

This program 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

## 3. REFERENCE RESOURCES

### 3.1. Reference Materials

There are no required textbooks for this program. The recommended references include:

- Galvin, J.M. (2016). *Ground Engineering Principles and Practices for Underground Coal Mining*. Springer International Publishing. ISBN 978-3-319-25003-8. DOI 10.1007/978-3-319-25005-2.
- Bieniawski, Z.T. (1984). *Rock mechanics design in mining and tunnelling*, A.A. Balkema, Rotterdam.
- Bieniawski, Z.T. (1987). *Strata control in mineral engineering*, John Wiley and Sons. pp. 29-37.
- Bieniawski, Z.T. (1989). *Engineering rock mass classifications*. Wiley, NY, 251 pp.
- Brady, B. H. G., and Brown, E. T. (2006). *Rock Mechanics for Underground Mining*. (Third ed.). Cordrecht: Springer.
- Brown, E.T. (1980). *Rock Characterisation testing and monitoring – ISRM Suggested Methods*. Published for the Commission on testing methods. International Society for Rock Mechanics by Pergamon Press Oxford, 211 pp.
- Deep Mines Coal Industry Advisory Committee (DMCIDC), (1996). *Guidance on the use of rockbolts to support roadways in coal mines*. HSE Books, UK.

- Deep Mines Coal Industry Advisory Committee, Health and Safety Commission. (1996). Guidance on the use of rockbolts to support roadways in coal mines.
- Galvin, J. (2015). Ground Engineering and Management in Coal Mining. Springer. In press.
- Hoek, E. (2007). Practical Rock Engineering. Rocscience Hoek's corner. <http://www.rocscience.com/hoek/Hoek.asp>.
- Hoek, E. and Brown, E. T. (1980). Underground excavations in rock. Institution of Mining and Metallurgy.
- Hoek, E., Kaiser, P. K., and Bawden, W. F. (1995). Support of Underground Excavations in Hard Rock. Rotterdam: A.A. Balkema.
- Hutchinson, D. J., and Diederichs, M. S. (1996). Cablebolting in Underground Mines. Richmond, BC: BiTech Publishers.
- Jaeger, J. C., and Cook, N. G. W. (1979). Fundamentals of Rock Mechanics (Third ed.). London: Chapman and Hall.
- Mark, C. (1990). Pillar Design Methods for Longwall Mining. Information Circular IC 9247. U.S Bureau of Mines.
- Mark, C. (2007). Multiple-seam Mining in the United States. Design Based on Case Histories. Paper presented at the New Technology for Ground Control in Multiple-seam Mining, 15-27. NIOSH.
- Mark, C., and Chase, F. E. (1997). Analysis of Retreat Mining Pillar Stability (ARMPS). Paper presented at the New Technology for Ground Control in Retreat Mining. , Pittsburgh, 17-34. U.S. Bur. Mines.
- Peng, S. S., and Chiang, H. S. (1984). Longwall Mining (First ed.). New York: John Wiley and Sons.
- Peng, S.S. (1986). Coal mine ground control, 2nd edition, John Wiley and Sons, Inc. U.S.A.
- Van der Merwe, J.N. and Madden, B.J. (2002). Rock engineering for coal mining. Safety in Mines Research Advisory Committee (SIMRAC). SAIMM Special Publications Series 7. April.

During the program many other publications and papers will be available in Moodle.

### 3.2. Other Resource Materials

- *Report Writing Guide for Mining Engineers*, 2011. P Hagan & P Mort (Mining Education Australia (MEA) ISBN 978 0 7334 3032 9. Available on-line on course homepage.
- *Guide to Authors*, 2008. (Australasian Institute of Mining and Metallurgy; Melbourne).

### 3.3. Online Resources

- Ground Control in Mining Conference Proceedings (University of West Virginia)
- Coal Operators' Conference (University of Wollongong)

## 4. COURSE CONTENT AND LEARNING ACTIVITIES

### 4.1. Learning Activities Summary

#### Monday, October 26, 2020

TIME	Content/Activities	Presenter
0900 – 0930	Course Introduction	JO
0930 – 1030	Rock Excavation Overview	JO
1030 – 1100	Morning Tea	
1100 – 1230	Rock Cutting Models	JO
1230 – 1330	Lunch	
1330 - 1500	Rock Cutting Performance_Picks	JO
1500 – 1530	Afternoon Tea	
1530 – 1630	Rock Cutting Performance_CM	JO

#### Tuesday, October 27, 2020

0900 – 1030	Numerical Methods in Rock Excavation	JO
1030 – 1100	Morning Tea	
1100 – 1230	Closed Form Solutions	JO
1230 – 1330	Lunch	
1330 – 1630	Computer Lab Class – Tutorial/Exercise	JO/CZ

#### Wednesday, October 28, 2020

0900 – 1030	Surface Blast Design	MFH
1030 – 1100	Morning Tea	
1100 – 1230	Underground Blast Design	MFH
1230 – 1330	Lunch	
1330 – 1500	Excavation Stability and Span	CZ
1500 – 1530	Afternoon Tea	
1530 – 1630	Computer Lab Class – Tutorial/Exercise	JO/CZ

#### Thursday, October 29, 2020

0900 – 1030	Excavation in hard/crystalline rock masses	DM
1030 – 1100	Morning Tea	
1100 – 1230	DEM analysis in softrock excavation	CZ
1230 – 1330	Lunch	
1330 – 1500	Computer Lab Class – Assignments	JO/CZ

#### **Total student effort hours: 150 hours for each course**

(Note: The above indication of “student effort hours” is indicative only – It reflects the anticipated level of total student involvement with the course – either through accessing or participating in online materials and activities; private research; preparation of assignments. Individual students may find their level of involvement differs from this schedule.

## 5. COURSE ASSESSMENT

### 5.1. Assessment Summary

- In-house session will be comprised of four scheduled days (August 13th – 16th, 2018).
- Numerical modelling assignment and presentation/discussion will take place during the in-house session.
- All assignments must be submitted no later than Monday, September 3rd, 2018.

Assessment task	Due date	Weight	Assessment	Learning outcomes assessed
A1.0	27 Nov	60%	Report-Factor of Safety of a coal pillar	1,5,8
A2.0	27 Nov	40%	Report-Rock cutting performance of CM	1,5,8

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>

Please bring smartphone, tablet or notebook computer with wi-fi connection to all classes for calculations and modelling purposes.

## 6. STUDYING A UG/PG COURSE IN MINING ENGINEERING AT UNSW

### 6.1. How We Contact You

At times, the School or your lecturers may need to contact you about your course or your enrolment. Your lecturers will use the email function through 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 these instructions on how to redirect your UNSW emails: <https://student.unsw.edu.au/email-rules>

### 6.2. 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: [mining@unsw.edu.au](mailto:mining@unsw.edu.au)  
Course inquiries: these should be directed to the course convenor.

### 6.3. Computing Resources and Internet Access Requirements

UNSW Mining Engineering provides blended learning using the on-line Moodle LMS (Learning Management System).

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.

You can access the School's computer laboratory in-line with the [School laboratory access guidelines](#) and [Class bookings](#).

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)
- Chrome browser or FireFox
- ability to view streaming video (high or low definition UNSW The Box 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).

### 6.4. Accessing Course Materials through Moodle

Course outlines and support materials are uploaded on a Learning Management System (LMS) - Moodle. All enrolled students are automatically included on the Moodle for each course. To access these documents, please visit: [www.moodle.telt.unsw.edu.au](http://www.moodle.telt.unsw.edu.au)

### 6.5. Assignment Submissions

The School has developed a guideline to help you when submitting a course assignment. Please take a closer look at all these details on our website: [www.engineering.unsw.edu.au/mining-engineering/assignment-submission-policy](http://www.engineering.unsw.edu.au/mining-engineering/assignment-submission-policy)

We encourage you to retain a copy of every assignment submitted for assessment for your own record either in hardcopy or electronic form. On a rare occasion, assignments may be mislaid and we may contact you to re-submit your assignment.

## 6.6. Late Submission of an Assignment

Full marks for an assignment are only possible when an assignment is received by the due date. In fairness to those students who do meet the assignment due date and time, deductions will apply to submissions made after this time. Details on deductions that are automatically applied to late submissions are available on our webpage: <http://www.engineering.unsw.edu.au/mining-engineering/late-submissions>

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 as soon as possible: <https://student.unsw.edu.au/special-consideration>

## 6.7. Course Results

For details on UNSW assessment policy, please visit: <https://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:

- WD – which usually indicates you have not completed one or more items of assessment or 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.

## 6.8. Special Consideration

You can apply for special consideration through [UNSW Student Central](#) 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: <https://student.unsw.edu.au/special-consideration>

## 6.9. Students Needing Additional Support

The Student Equity and Disabilities Unit (SEADU) aims to provide all students with support and professional advice when circumstances may prevent students from achieving a successful university education. Take a look at their webpage: <http://www.studentequity.unsw.edu.au/>

## 6.10. 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 <https://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: <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.

### **6.11. Report Writing Guide for Mining Engineers**

The School has a report writing guide (RWG) available for all mining engineering students.

View this website to download a copy of this guide:

[https://www.engineering.unsw.edu.au/mining-engineering/sites/mine/files/publications/MEA\\_ReportWritingGuide\\_eBook\\_2018ed.pdf](https://www.engineering.unsw.edu.au/mining-engineering/sites/mine/files/publications/MEA_ReportWritingGuide_eBook_2018ed.pdf)

### **6.12. Continual Course Improvement**

At the end of each course, all students will have the opportunity to complete a course evaluation form. These anonymous surveys help us understand your views of the course, your lecturers and the course materials. We are continuously improving our courses based on student feedback, and your perspective is valuable.

We also encourage all students to share any feedback they have any time during the course – if you have a concern, please contact us immediately.