MINE8860

Drilling, Blasting and Machine Excavation

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Joung Oh	joung.oh@unsw.edu.au		OMB, Room#159k	02) 9385 5002

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

The course will address the mechanics and practical applications and current technologies in rock fragmentation; theories of rock breakage and fragmentation; rock mass properties; structure and discontinuities and their impact on blast behaviour. Blasting theories and types of explosives and blast initiation procedures; blast designs for both underground and surface mining applications; blast hazard management; blast vibration and impact on structures and mining excavations; state-of-the-art blasting practices and technologies; and alternatives to conventional blasting for rock fragmentation.

Production drilling methods and equipment, bits and drilling accessories.

Principles of coal and rock cutting mechanics; the performance of picks and free rolling cutters; cutting tool interaction; the design of cutting arrays for machine mining and tunnelling; impact breakage of rock; drill bit design and breakage mechanics; cutting tool materials and the effects of wear; methods of assessing rock cuttability; water jet cutting and water jet assisted drilling and cutting. Applications including full face and partial mining machines, drilling technologies and tunnel boring machines will be reviewed.

Course Aims

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

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Explain the contribution and influence of rock breakage to the stream of mining processes and in particular the mine-to-mill concept.	PE1.6
2. Describe the various methods of rock breakage.	PE1.3
3. Select appropriate methods of drilling and rock breakage for given in-situ rock conditions.	PE2.1, PE2.2
4. Apply fundamental principles to the design and selection of safe and efficient blasting and machine mining to: design blasts to achieve particular outcomes manage and control blast damage and environmental impacts optimise design of cutterheads evaluate productivity and economics	PE2.3
5. Identify relevant requirements for the security, storage and handling of explosives.	PE2.4, PE3.4

Teaching Strategies

The course will delivered in two parts, these being:

- Machine Excavation: Joung Oh
- Drilling and Blasting: Peter Duniam

Contact Hours per Week: The course is offered as a one week short course
Assessments for the course comprise an assignment due during the short course and a major assignment. The major assignment is due no later than six weeks after completion of the short course.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Major Assignment	80%	14/10/2022 12:00 AM	1, 2, 3, 4, 5
2. Machine Excavation Assignment	20%	14/10/2022 12:00 AM	4

Assessment 1: Major Assignment

Due date: 14/10/2022 12:00 AM
Marks returned: Within two weeks after submission.

20 quizzes (16%) and 4 Assignments (64%) for D&B module.

Assessment criteria

Will be provided to students during lecturing time.

Assessment 2: Machine Excavation Assignment

Due date: 14/10/2022 12:00 AM
Marks returned: Within a week after submission

Quiz for machine excavation.

Assessment criteria

Multiple-choise questions.

Attendance Requirements

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

Course Schedule

Day	Theme	Content/Activities	Presenter
1	Course Introduction Blasting	Course introduction Introduction of drilling and blasting Drilling Blast Management	JO/PD
2	Blasting	Theory of rock breakage using explosives Surface blast design Underground blast design	PD
3	Blasting	Initiation systems design Ground vibration Wall control Blast optimisation Blast economics and cost optimisation	PD
3	Blasting	Misfires and disposal Restricted void fringes Regulations Drilling	PD
4	Machine Mining	Forms of rock breakage Models of rock breakage of pick & disc cutters Performance of pick & disc cutting tools Machine analysis • pick cutting machines • disc cutting machines	JO

View class timetable

Timetable

Date/Module	Type	Content

Resources

Prescribed Resources

- William Hustrulid. Blasting principles for open pit mining and theoretical foundations, Rotterdam : A.A. Balkema, 1999.

- *Practical Blasting Fundamentals*, International Society of Explosives Engineers
- Carlos Lopez Jimeno, Emilio Lopezn Jimeno, Francisco Javier Ayala Carcedo. *Drilling and blasting of rocks,* Rotterdam, Ne.: A.A. Balkema, c1995.
- *Open Pit Blast Design – analysis and optimisation*, JKMRC Monograph 1, University of Queensland, 1996.
- *Rock Excavation Handbook*, Sandvik Tamrock Corporation, 1999
- Per-Anders Persson, Roger Holmberg, Jaimin Lee. *Rock blasting and explosives engineering,* Boca Raton, Fla.: CRC Press, 1994.

- Hustrulid, WA, Bullock, R. (Editors), 2001*. Underground Mining Methods: Engineering Fundamentals and International Case Studies.* (Society for Mining Metallurgy & Exploration: Littleton), 728p.
- *SME Mining Engineering Handbook*, 2011, editor, Howard L Hartman
- Cost Estimation Handbook for the Australian Mining Industry, AusIMM
- www.austlii.edu.au – for all Acts & Regulations for all states and territories
- Australian Standard AS2187. Terminology, use and storage of explosives

Recommended Resources

Other material that should be referred to in conjunction with this Course Outline include:

- *Elements of Machine Mining*, the Course Reader by FF Roxborough
- *Report Writing Guide for 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*)*
- *Guide to Authors.* (Australasian Institute of Mining and Metallurgy: Melbourne) (Available for download from the AusIMM website)

Course Evaluation and Development

Online Forum will be utilised to get the studnets feedback.

School Assessment Committee will review studnets feedback and the implemented feedback will be anounced to the studnets during the introduction section.

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 Assignment

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.

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. 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

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

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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	