

# MINE4250

Hardrock Mine Design and Feasibility Project

Term 1, 2022



## Course Overview

### Staff Contact Details

#### Convenors

Name	Email	Availability	Location	Phone
Serkan Saydam	<a href="mailto:s.saydam@unsw.edu.au">s.saydam@unsw.edu.au</a>	Doing the class session times	Kensington	93854525

### 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](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

Development of a pre-feasibility study for a metalliferous mining project. Activities include: assessment of reserves, method selection, layout and optimisation of surface and underground operations, geotechnical design, ventilation design, project risk assessment, mine scheduling, equipment selection, cost estimation, economics/finance and sustainability. Use of mine design and optimisation software packages.

This course covers the following topics:

- Introduction of mine planning software tools
- Review and preparation of a resource block model
- Open pit design and optimisation procedures
- Underground mine layout and design
- Equipment selection
- Production and equipment scheduling
- Cost estimation
- Economic evaluation
- Ventilation design
- Geotechnical design
- Project evaluation
- Sustainable development (Risk, social, environmental, mine closure, legislations, etc.)

### Course Aims

The aim of this course is to introduce students to the principles of mine feasibility studies for metalliferous mine deposit. In this course students should be able to develop skills for optimal mine design, scheduling and preparation of a pre-feasibility study document.

### Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Assess the feasibility of a mining project with consideration to data analysis and interpretation; mine layout; development and production planning/scheduling; equipment selection; geotechnical, technical, environmental and economic factors; ventilation; economic factors including mining costs, commodity market, etc.; social and environmental impact; project risk analysis; and mine closure/rehabilitation.	PE1.5, PE1.6, PE2.1, PE2.3
2. Learn and apply mine design and optimisation software packages	PE1.1, PE1.3, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4
3. Demonstrate team skills in the management of mining projects	PE1.5, PE3.1, PE3.2, PE3.3,

Learning Outcome	EA Stage 1 Competencies
and advanced written and oral communication skills	PE3.4, PE3.5, PE3.6

## Teaching Strategies

1. Project-based learning: This course utilises project-based learning methods. Students will be given comprehensive group projects to work on. Students are required to work in groups, share the project workload, and have weekly meetings and discussions.
2. Question/Answer sessions: Project work will be supported with weekly Q/A sessions. All students are to attend these sessions.
3. Group work: Groups will be established by instructions from the course convenor. Each project will have a number of topics of emphasis. Each member of the group can elect to work on a topic of the project but all members must report their work to the group on weekly basis. A peer review will have to be submitted by each team, indicating the proportion of each individual group member's contribution to the project. Some marks will be taken from the underperforming students to others. If a student makes no contribution to the project, he/she will receive zero for that project.
4. Effective Communication: One of the most effective means of learning is to effectively communicate what has been learned. Part of the assessment in this course will be determined by how effectively the results are communicated. The process of writing reports, brainstorming within a group, peer assessment, preparation and presentation of report, requires clarity of thinking, defending and revising a design and analysing the risks inherent in a project.

## Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Progress Interview 1	10%	08/03/2022 01:00 PM	1, 2, 3
2. Progress Interview 2	15%	05/04/2022 01:00 PM	1, 2, 3
3. Final Presentation	25%	25/04/2022 10:00 AM	1, 2, 3
4. Final Hard Rock Mine Design Report	50%	06/05/2022 05:00 PM	1, 2, 3

### Assessment 1: Progress Interview 1

**Start date:** 15/02/2022 01:00 PM

**Submission notes:** No submission is required, Teams meeting is required

**Due date:** 08/03/2022 01:00 PM

This is a group interview. All the group members must be present and answer the questions relevant to the project task. The project task is mine optimisation. Students must provide demonstration of their final decision on pit optimisation by using Whittle Software. This interview may take 30 min. Each student should be capable of demonstrating Whittle Software. No additional documentation is required. This assessment can be done through Teams or face to face depending on the situation.

#### Assessment criteria

Able to demonstrate the use of Whittle Software

Providing a sufficient number of scenarios for decision making

Generating grade-tonnage curves

Generating economic pits through pit-by-pit graphs

Generating push back schedules using different algorithms

Provide initial reserves

Provide initial costing and NPV

### Assessment 2: Progress Interview 2

**Start date:** 15/02/2022 01:00 PM

**Submission notes:** No submission is required, Teams meeting is required

**Due date:** 05/04/2022 01:00 PM

This is a group interview. All the group members must be present and answer the questions relevant to the project task. The project task is mine design. Students must provide a demonstration of their final open pit and underground mine design decisions by using Vulcan Software. This interview may take 30 min. Each student should be capable of demonstrating Vulcan Software. No additional documentation is required. This assessment can be done through Teams or face to face depending on the situation.

### **Assessment criteria**

Able to demonstrate the ability to use Vulcan software

Achieve Pit Optimisation outcomes to be transferred to Vulcan

Provide final reserves for both open pit and underground

Completed Pit Design with Schedules

Demonstrate cross section views for Pushbacks

Provide LOM information

Complete surface infrastructure with waster dump design

### **Assessment 3: Final Presentation**

**Submission notes:** Students need to present to the Board (30 min presentation by each group followed by Q&A).

**Due date:** 25/04/2022 10:00 AM

The Final Presentation will be conducted either face to face or via Teams, depending on the situation. Each group will present their findings to the Board comprised of industry reps. The board members will be introduced to the students in Week 10. Each group will have 30 min presentation followed by Q&A session 10-15 min.

### **Assessment criteria**

Provide all the required assumptions for the project in a slide

Provide an executive summary slide

Cover all the necessary task outcomes in slides

Present formally

Answer the questions in an expected way

### **Assessment 4: Final Hard Rock Mine Design Report**

**Submission notes:** Report submission is required (no page or word limit)

**Due date:** 06/05/2022 05:00 PM

This assessment will include submitting a comprehensive pre-feasibility report in pdf or word doc. There is no page or word limit provided.

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

**Assessment criteria**

Provide all necessary task outcomes in a typical pre-feasibility report

Provide a high quality report

Provide all required calculations and models in appendix

Provide FTM model as in xls file and submit sperately

## Attendance Requirements

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

## Course Schedule

There will be no specific lectures for this course. However, there will be group meetings, software training sessions and industry workshops.

[View class timetable](#)

## Timetable

Date	Type	Content
Week 1: 14 February - 18 February	Presentation	Course Introduction
	Project	Review of resource model and data manipulation.  Pit optimisation and results analysis (ultimate pit limit, reserve estimation, pushback, and production schedule).
	Seminar	Industry Presentation
Week 2: 21 February - 25 February	Project	Pit Optimisation work continues  Pit Design work commences
	Tutorial	Vulcan Training
Week 3: 28 February - 4 March	Project	Open Pit Design work continues - Based on optimised pit model, estimate reserves and waste. Assess production rates and stripping ratios. Design progressive pits and haul roads. Ultimate pit design and waste dump design.  UG design work commences - Underground mining strategy, mining method selection, stope sizing, reserve estimation. Selection of mine access and development of mining layout.
	Tutorial	Vulcan Training
	Workshop	Industry Workshop - Cadia Mine Engineers to review pit optimisation
Week 4: 7 March - 11 March	Assessment	Progress Interview 1
Week 5: 14 March - 18	Project	Open Pit and Underground Mine Design - Work



March		on the design and layout of open pit & underground design and layout
Week 6: 21 March - 25 March	Project	Continue Work on the design and layout of open pit & underground design and layout
Week 7: 28 March - 1 April	Project	Equipment selection for both open pit and underground mine (Fleet size, capacity, type, etc.).  Ventsim simulation, ground support design, etc.  Finalising the design and layout of open pit & underground design and Layout.
	Workshop	Industry Workshop - Cadia Mine Engineers to review on mine designs
Week 8: 4 April - 8 April	Assessment	Progress Interview 2
Week 9: 11 April - 15 April	Project	Cost estimation and economic evaluation  Sustainable development  Capital and operating costs, production costs, sensitivity analysis, NPV, etc.  Risk analysis, environmental and social impacts, mine closure, etc.
Week 10: 18 April - 22 April	Project	Finalise the project work
	Presentation	Dry Run

## Resources

### Recommended Resources

[Support material for this course including, whenever available, copies of lecture notes, recommended readings, assignments and results for assignments etc can be found on Moodle. All correspondence with students and any information regarding changes in the lecture schedule and assignment dates will be done through Moodle. All assignments must be submitted through Moodle. It is important that students regularly check Moodle for changes in calendar events and for messages.](#)

- Darling, P (ed.), 2011. Mining Engineers Handbook, 3rd edition, SME, Littleton, USA
- Hartman, HL, 2002. Introductory Mining Engineering, 2nd edition. Wiley, New York.
- Hustrulid, W and Kuchta, M, 2006. Open Pit Mine Planning & Design, Balkema, Rotterdam.
- Kennedy, BA (ed.), 1990. Surface Mining, 2nd edition, SME, Littleton, Colorado, USA. ISBN 0-87335-102-9.
- Noakes, M and Lanz, T. 1993. Cost Estimation Handbook for the Australian Mining Industry, Monograph No: 20/ Australasian Institute of Mining and Metallurgy.
- Hustrulid, WA, and Bullock, R. (eds.), 2001. Underground Mining Methods: Engineering Fundamentals and International Case Studies, SME, Littleton, USA.
- Gertsch, RE and Bullock, RL (eds.), 1998. Techniques in Underground Mining, SME, Littleton, USA.
- Malone, E. 2011 The Cadia Valley Mines – A Mining Success Story. The AusIMM Spectrum Series 19.
- Kennedy, BA., Editor, 1990. Surface Mining, 2nd edition, Society for Mining, Metallurgy, and Exploration, Littleton, Colorado. ISBN 0-87335-102-9
- 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)
- Guide to Authors. (Australasian Institute of Mining and Metallurgy: Melbourne) (Available for download from the AusIMM website)

### Course Evaluation and Development

Weekly meetings will be organised for each group during the course time

Each assessment will have peer review

### Laboratory Workshop Information

Series of Software tutorials will be arranged with Maptek - Vulcan

Maptek will also organise online training videos

Series industry workshop will be organised.

## 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	✓