

MINE4250

Hardrock Mine Design and Feasibility Project

Term 1, 2023



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Serkan Saydam	s.saydam@unsw.edu.au	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

For current students, all enquiries and assistance relating to enrolment, class registration, progression checks and other administrative matters, please see [The Nucleus: Student Hub](#).

Web & Important Links:

[School of Minerals and Energy Resources](#)

[The Nucleus Student Hub](#)

[Moodle](#)

[UNSW Handbook](#)

[UNSW Timetable](#)

[Student Wellbeing](#)

[Urgent Mental Health & Support](#)

[Equitable Learning Services](#)

[Faculty Transitional Arrangements for COVID-19](#)

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. Design a mine using mine planning and design software for a real dataset	PE1.1, PE1.2, PE1.3, PE1.5, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.3, PE3.5, PE3.6
2. Evaluate the main design outcomes using financial evaluation models to assess the economics viability of the project	PE1.2, PE1.3, PE1.4, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4, PE3.1, PE3.4, PE3.5, PE3.6
3. Employ team skills and advanced written and oral communication skills	PE1.1, PE1.3, PE1.6, PE2.1, PE2.2, PE2.3, PE2.4

Learning Outcome	EA Stage 1 Competencies
4. Present a mine pre-feasibility study based on planning and design knowledge with the consideration of sustainability criteria	PE1.5, PE3.1, PE3.2, PE3.3, PE3.4, PE3.5, PE3.6

Teaching Strategies

1. Project-based learning: This course utilises project-based learning methods. Students will be given a 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/bi-weekly Q/A sessions. All students are to attend these sessions.
3. Individual work: Students will be working with the group to complete certain tasks individually.
4. 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.
5. 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, 4
2. Progress Interview 2	20%	05/04/2022 01:00 PM	1, 2, 3, 4
3. Final Presentation	30%	25/04/2022 10:00 AM	1, 2, 3, 4
4. Final Hard Rock Mine Design Report	40%	06/05/2022 05:00 PM	1, 2, 3, 4

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

The students will use the mine design software package to conduct mine optimisation tasks for open pit mine. Students (individually and in group) will demonstrate their knowledge of conducting the relevant tasks in front of a computer by running the software package. Questions will be asked by the Course Coordinator to the students individually. A Peer Assessment will be conducted for this assessment.

Assessment criteria

Whittle optimisation tasks must be completed to get the full mark. Multiple scenarios should be done to select the most optimum production scheduling. The input parameters must be placed accordingly and the relevant assumptions to be explained during the PI1.

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

The students will use the mine design software package to design both surface and underground mine. Students (individually and in group) will demonstrate their knowledge of conducting the relevant tasks in front of a computer by running the software package. Questions will be asked by the Course Coordinator to the students individually. A Peer Assessment will be conducted for this assessment.

Assessment criteria

Both surface and underground design must be completed using the mine design software package.

Surface mine design must contain the overall pit design, including haul roads and progressive pits with selected pushbacks. The group must also report resources and reserves according to the JORC. Surface infrastructure should also be completed. This will typically include tailings dam, waste dump/s, offices, roads etc.

Groups should justify the selection optimum underground mining method.

Underground mine design must contain the whole underground design, including tunnels, declines, shafts, orepass, and all the levels depending on the mining method selected. The group must also report resources and reserves according to the JORC.

Even though the final decision of the group is not favourable to surface or underground mining methods, the groups must still design the surface and underground mines and demonstrate their knowledge.

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 students will present their findings to the External Board members comprised of industry experts. A 30 min presentation will be done by each group. Each member of the group must present a section. The Board will ask questions based on the presentation. A Peer Assessment will be conducted for this assessment.

Assessment criteria

As per the course requirement, each group member must present on the day of the presentation.

Presentations will be 20-30 minutes (TBC) long.

All students are required to attend and take part in the presentations for the whole seminar session.

Every student in the group is required to be present during the progress and the final presentations. Absence from these presentations will only be allowed because of medical or extenuating circumstances. This will require documented evidence, e.g. Medical Certificate, etc.

The room is equipped with projection facilities and students may use PowerPoint or PDF if they wish. However, it is the individual's responsibility to ensure that the presentation is loaded up and functioning beforehand.

Each student must present equally (in terms of time allocated).

Slides must be easy to read with appropriately sized graphs, wording etc and no errors slides.

Clear presentation is essential, the slides must be presented with confidence and enthusiasm, and well structured so that they flowed.

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

The students will write a report at the level of a pre-feasibility project. Each group member must involve in writing section/s in the report. Group Report must also include the student names written in each section. A Peer Assessment will be conducted for this assessment.

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

Assessment criteria

Groups must provide a comprehensive, well-written technical report with very good logical structure, physical layout and attention to detail. The work must be presented in an accurate and coherent fashion. Scientific and technical style must be used all the time. The report should have no spelling mistakes or grammatical errors and must include appropriate referencing.

This should include sections of:

Executive summary (1-2 pages max) - Comprehensive summary of the findings of the work done: project parameters, selection of mining methods, resources and reserves reporting (JORC), mine optimisation outcomes, surface and underground mine design decisions and important details. Financial and technical modelling outcomes and reporting the life of mine, average grade, costing and NPV as well ROR with payback period. The summary should also include any ESG reporting outcomes.

Mine Planning and Design Section (no page limit) - Provided an excellent investigation and evaluation of the mine planning and design aspects of the project.

Project Evaluation (no page limit) - Provided comprehensive cost estimates of capital, operating and total production costs, including NPV estimates and sensitivity analysis. This activity must be supported by the relevant required graphs. The final FTM model should be demonstrated in the appendix and also excel model must be submitted through Moodle along with the report.

Conclusions (1- 2 pages) - The analysis of the work conducted highlights your comprehension and shows insight into the significance of the results. The report concludes with a clear concise summary of the outcomes and includes qualification.

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: 13 February - 17 February	Presentation	14 Feb 1 PM Course Introduction - Serkan Saydam to provide a course introduction and project information
	Group Work	Review of resource model and data manipulation. Conduct pit optimisation and scenario development - results analysis (ultimate pit limit, reserve estimation, pushback, and production schedule).
	Seminar	14 Feb 2 PM Industry Presentation on the expectations from a pre-feasibility study - RPM Global
	Laboratory	COMPULSORY Vulcan Training - 17 Feb (10 am to 5 pm) Vulcan Training - 24 Feb (10 am to 5 pm)
Week 2: 20 February - 24 February	Group Work	Pit Optimisation work continues Pit Design work commences
	Workshop	21 Feb 3 pm (TEAMS) Catch up with a CEO : You will have the opportunity to hear from a CEO about preparing a pre-feasibility study - the expectations, ESG, business risks etc. (Q&A Session)
Week 3: 27 February - 3 March	Group Work	Open Pit Design work continues - Based on optimised pit model, estimate reserves and waste. Assess production rates and stripping

		<p>ratios. Design progressive pits and haul roads. Ultimate pit design and waste dump design.</p> <p>UG design work commences - Underground mining strategy, mining method selection, stope sizing, reserve estimation. Selection of mine access and development of mining layout.</p>
	Workshop	<p>28 Feb</p> <p>1 pm to 2 pm-----Industry Workshop - Cadia Mine Engineers to review pit optimisation (TEAMS)</p> <p>3 pm to 4 pm-----Industry Workshop - RPM Global to review pit optimisation (TEAMS)</p>
Week 4: 6 March - 10 March	Assessment	Progress Interview 1
Week 5: 13 March - 17 March	Group Work	Open Pit and Underground Mine Design - Work on the design and layout of open pit & underground design and layout
Week 6: 20 March - 24 March	Group Work	Continue Work on the design and layout of open pit & underground design and layout
	Workshop	<p>21 March</p> <p>3 pm to 4 pm-----Industry Workshop - RPM Global to review Surface Mine Design (TEAMS)</p>
Week 7: 27 March - 31 March	Group Work	<p>Equipment selection for both open pit and underground mine (Fleet size, capacity, type, etc.).</p> <p>Ventsim simulation, ground support design, etc.</p> <p>Finalising the design and layout of open pit & underground design and Layout.</p>
	Workshop	<p>28 March</p> <p>1 PM - Industry Workshop - Cadia Mine Engineers to review mine designs</p> <p>3 PM - Industry Workshop - RPM Global to review mine designs</p>
Week 8: 3 April - 7 April	Assessment	Progress Interview 2
Week 9: 10 April - 14 April	Group Work	<p>Cost estimation and economic evaluation</p> <p>Sustainable development</p>

		Capital and operating costs, production costs, sensitivity analysis, NPV, etc. Risk analysis, environmental and social impacts, mine closure, etc.
Week 10: 17 April - 21 April	Group Work	Finalise the project work
	Presentation	Dry Run
Stuvac: 22 April - 27 April	Assessment	Board Presentation 26 April (TBC)

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.

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 may be eligible for special consideration, when an illness or other short-term events beyond your control (exceptional circumstances) affect your assessment performance. More details on special consideration can be found at: www.student.unsw.edu.au/special-consideration

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.

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
- Academic Skills Support - <https://www.student.unsw.edu.au/skills>
- Psychology and Wellness - 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 academic skills, please contact the Academic Skills Support or view some of the resources on their website: <https://www.student.unsw.edu.au/skills>. The Academic Skills Team can provide resources, support and assistance to help you improve your academic 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

Student Resources

This engineering [student resources](#) section collates useful advice and information to ensure you're able to focus on your studies.

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

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	✓