



Faculty of Engineering

**School of Minerals and Energy Resources Engineering**

Undergraduate Course Outline

MINE4250

Hardrock Mine Design and Feasibility Project

Professor Serkan Saydam

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## 1 INFORMATION ABOUT THE COURSE

Course Code:	MINE4250	Term:	T1, 2021	Level:	UG	Units/Credits	6 UOC
Course Name:	<b>Hardrock Mine Design and Feasibility Project</b>						

Course Convenor:	<b>Professor Serkan Saydam</b>						
Contact Details:	School of Minerals and Energy Resources Engineering	Email:	s.saydam@unsw.edu.au				
	Old Main Building, Rm 159H	Phone:	+61 2 9385 4525				
Contact Times:	Wed 13-18 (w1-2,4-5,7-10)						
	Wed 14-18 (w3,6)						
	The course will generally use Computer Lab (OMB 48/49), but communication will mainly be conducted through Teams meetings.						

### 1.1 Course Description

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. Usage of mine design and optimisation software packages.

### 1.2 Course Completion

Course completion requires submission of all assessment items; failure to submit all assessment items can result in the award of an Unsatisfactory Failure (UF) grade for the Course.

### 1.3 Assumed Knowledge

Students should have sufficient knowledge to apply the principles of resource geology, resource estimation, mine planning and design, surface and underground mining methods, minerals economics and equipment selection.

## 2 AIMS, LEARNING OUTCOMES AND GRADUATE ATTRIBUTES

### 2.1 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.

### 2.2 Learning Outcomes

It is intended that students will be able to:

- Assess the feasibility of a mining project with consideration to:
  - Data analysis and interpretation
  - Mine layout
  - Development and production planning/scheduling/Staffing,
  - Equipment selection,
  - Geotechnical, technical, environmental and economic factors
  - Ventilation
  - Economic factors including mining costs, commodity market, etc.

- Social and environmental impact
- Project risk analysis
- Mine closure/rehabilitation
- Learn and apply mine design and optimisation software packages
- Demonstrate team skills in the management of a project work and advanced written and oral communication skills

### 2.3 Graduate Attributes

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

- Appropriate technical knowledge
- Having advanced problem solving, analysis and synthesis skills with the ability to tolerate ambiguity
- Ability for engineering design and creativity
- Being able to think and work individually and in teams
- Having Health, Safety, Environment and Community (HSEC) consciousness.

## 3 REFERENCE RESOURCES

### 3.1 Reference Materials

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)

### 3.2 Other Resources

Links to websites etc.

The University and the Faculty provide a wide range of support services for students, including:

1. UNSW Learning Centre (<http://www.lc.unsw.edu.au>)
2. Counselling support - <http://www.counselling.unsw.edu.au>
3. Library training and support services - <http://www.library.unsw.edu.au/>

### **3.3 Online Resources**

Selected readings as well as other supporting material (e.g. course outline and lecture notes) will be made available on LMS.

Videos are often provided to students as a web stream within the Moodle learning management system. Videos are not available for download by students, unless approved by the Course Convenor and either the Undergraduate Director. Note that UNSW reserves the right to deliver videos as a web stream rather than off-line and cannot provide videos that are copyright from other providers.

### **3.4 Report Writing Guide**

The School has a report writing guide (RWG) available. A copy of this is available on the course Moodle site.

## **4 COURSE CONTENT AND LEARNING ACTIVITIES**

### **4.1 Course Content**

Presentations and reading material are provided to provide students with technical information and examples of how geology and geophysical information is used at various stages of mining. Discussions will be used to encourage students to articulate and defend positions, consider different points of view and evaluate evidence. Case studies will be used to provide practice in identifying potential problems and evaluating alternative courses of actions.

#### 4.2 Learning Activities Summary (Industry Workshops are subject to the mine personnel availability - TBC)

Course Date	Activity	Content	Remarks
1 17 <sup>th</sup> Feb	<p><b>Course Introduction</b></p> <p><b>Project Work - Pit Optimisation</b></p>	<ul style="list-style-type: none"> <li>• Introduction to the Course (Video in Moodle)</li> <li>• Data Checking</li> <li>• Resource Modelling</li> <li>• Pit Optimisation</li> </ul>	<p>Introduction of the project</p> <p>Review of resource model and data manipulation.</p> <p>Pit optimisation and results analysis (ultimate pit limit, reserve estimation, pushback, and production schedule).</p> <p><b>Get Familiarise with Vulcan – use Vulcan online training portal modules.</b></p> <p><b>Finalise your groups</b></p>
2 24 <sup>th</sup> Feb	<p><b>Project Work - Pit Design</b></p> <p><b>Software Training</b></p>	<ul style="list-style-type: none"> <li>• Pit Optimisation &amp; Design and Vulcan software training</li> </ul>	<p><b>Vulcan Training (online) 26<sup>th</sup> Feb 9.30 am – 4 pm</b></p> <p><b>Open Pit Design</b></p>
3 3 <sup>rd</sup> Mar	<p><b>Project Work – UG Design</b></p> <p><b>Software Training</b></p> <p><b>Industry Workshop and Lecture</b></p>	<ul style="list-style-type: none"> <li>• UG Mine Design and Vulcan software training</li> <li>• Industry Workshop (TBC) – Pit Optimisation (Group Discussion and Q&amp;A with an industry expert)</li> </ul>	<p><b>Vulcan Training (online) 5<sup>th</sup> Mar 9.30 am – 4 pm</b></p> <p><b>UG Design</b></p> <p>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.</p> <p>Underground mining strategy, mining method selection, stope sizing, reserve estimation. Selection of mine access and development of mining layout.</p>
4 10 <sup>th</sup> Mar	<p><b>Progress Interview 1</b></p> <p><b>Project Work - Underground Design and Layout</b></p>	<ul style="list-style-type: none"> <li>• Progress Interview 1</li> </ul>	<p>Progress Interview 1 – Pit Optimisation only (Whittle)</p>
5 17 <sup>th</sup> March	<p><b>Project Work - Underground Design and Layout</b></p>	<ul style="list-style-type: none"> <li>• Design Considerations</li> </ul>	<p>Work on the design and layout of open pit &amp; underground design and Layout</p>

		<ul style="list-style-type: none"> <li>• Production scheduling</li> </ul>	
6 24 <sup>th</sup> Mar	<b>Project Work – Mine Design</b>	<ul style="list-style-type: none"> <li>• Underground design and layout</li> <li>• Potential Cadia Mine Visit Industry Workshop (TBC) – Underground Mine Design (Group Discussion and Q&amp;A with an industry expert)</li> </ul>	Work on the design and layout of open pit & underground design and Layout
7 31 <sup>st</sup> Mar	<b>Project Work – Mine Design &amp; Geotech Design</b>	<ul style="list-style-type: none"> <li>• Equipment selection for both open pit and underground mine (Fleet size, capacity, type, etc.).</li> <li>• Ventsim simulation, ground support design, etc.</li> </ul>	TBC – Mine Design Workshop  Finalising the design and layout of open pit & underground design and Layout
8 7 <sup>th</sup> Apr	<b>Progress Interview 2</b>  <b>Project Work – Equipment Selection</b>	<ul style="list-style-type: none"> <li>• Progress Interview 2</li> <li>• Equipment selection for both open pit and underground mine (Fleet size, capacity, type, etc.).</li> <li>• Ventsim simulation, ground support design, etc.</li> </ul>	<b>Progress Interview 2 – Vulcan Design for Underground Design</b>
9 14 <sup>th</sup> Apr	<b>Project Work – Project Evaluation</b>	<ul style="list-style-type: none"> <li>• Cost estimation and economic evaluation</li> <li>• Sustainable development</li> <li>• VR simulation</li> </ul>	Capital and operating costs, production costs, sensitivity analysis, NPV, etc. Risk analysis, environmental and social impacts, mine closure, etc.
10 21 <sup>st</sup> Apr	<b>Project Final Presentation Dry runs</b>		Dry Runs  Max 30-minute presentation by each group with more emphasis on the feasibility study.

Other UNSW Key dates: <https://student.unsw.edu.au/new-calendar-dates>

## 5 COURSE ASSESSMENT

### 5.1 Assessment Summary

Assessment task	Due date / week	Weight	Assessment	Learning outcomes assessed
1	10 <sup>th</sup> March Week 4	10%	<b>Progress Interview 1</b> @ OMB49 In computer with all group members Q&A	1, 2, 4
2	7 <sup>th</sup> April Week 8	15%	<b>Progress Interview 2</b> @ OMB49 In computer with all group members Q&A	1, 2, 4
3	30 <sup>th</sup> April Study Period	25%	<b>Final Presentation</b> ( <i>Date and time to be confirmed</i> ) Presented to the Board	1, 2, 3, 4
4	7 <sup>th</sup> May (5 pm)	50%	<b>Final Report</b>	1, 2, 3, 4

**Assignments:** Assignments related details/submission-box will be available online through Moodle. Access to the Moodle site is via the Moodle icon on the MyUNSW homepage. Only electronic copies will be evaluated. The Final Presentation date may change due to the availability of the Board Members. Progress Interviews will aim to be conducted at the Computer Laboratory in front of a computer to demonstrate the knowledge of using software package, however, depending on the pandemic situation, the interviews can be run online. Final Board Presentations will be conducted at the AVIE facility (TBC). Each group will be responsible to prepare relevant files to demonstrate their design to the board using VR technology available at the school.

**Software trainings and use:** This course requires knowledge of multiple software packages to complete the required tasks. All the software packages can be accessed through myAccess. The following software packages may be needed:

- Whittle – Mine Optimisation software: There will be no training provided. Previous knowledge from Mine Planning course is essential.
- Vulcan – Mine Design software. Online training will be provided. Introductory level of knowledge gained from Resource Estimation course is essential.
- Ventsim – Ventilation design software. There will be no training provided. Previous knowledge from Ventilation course is essential.
- Various Geotechnical software packages - There will be no training provided. Previous knowledge from Mine Geomechanics course is essential.
- Talpac – Equipment selection. There will be no training provided. It is not compulsory to use this software, but can be quite useful. Course Moodle will have training manual.

Students can also use the other available engineering software packages as required.



**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.

**Question/Answer sessions:** Project work will be supported with weekly/bi-weekly Q/A sessions. All students are to attend these sessions.

**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. Further details of peer assessment process will be provided during the class and via Moodle.

**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.

## 6 ASSESSMENT CRITERIA

The assessment criteria provide a framework for you to assess your own work before formally submitting major assignments to your course convenor. Your course convenor will be using this framework to assess your work and as a way to assess whether you have met the listed learning outcomes and the graduate attributes for your program. We ask that you don't use the assessment criteria guidelines as a checklist, but as a tool to assess the quality of your work. Your course convenor will also be looking at the quality, creativity and the presentation of your written assignment as they review the framework. Rubrics, wherever applicable, will be provided at the time of the assignment release.

## 7 STUDYING AN UG COURSE IN UNSW MINERALS AND ENERGY RESOURCES ENGINEERING

### 7.1 How We Contact You

At times, the School or your course conveners may need to contact you about your course or your enrolment. Your course conveners 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 these instructions on how to redirect your UNSW emails: <https://www.it.unsw.edu.au/students/email/index.html>

### 7.2 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:  
<https://unswinsight.microsoftcrmportals.com/web-forms/>

Course inquiries: these should be directed to the Course Convenor.

### 7.3 Computing Resources and Internet Access Requirements

UNSW Minerals and Energy Resources 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.

Mining Engineering Students: OMB G48/49

Petroleum Engineering Students: TETB

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)

## 7.4 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)

## 7.5 Assignment Submissions

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.

## 7.6 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 following section.

## 7.7 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 Convener 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)

## 7.8 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:

- 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.

### **7.9 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: [www.studentequity.unsw.edu.au/](http://www.studentequity.unsw.edu.au/)

### **7.10 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 [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: <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.

### **7.11 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.

Feedback is given via <https://student.unsw.edu.au/myexperience> and you will be notified when this is available for you to complete.

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.



# School of Minerals and Energy Resources Engineering Assessment Cover Sheet

Course Code: \_\_\_\_\_ Course Title: \_\_\_\_\_  
 Assignment: \_\_\_\_\_  
 Due Date: \_\_\_\_\_  
 Student Name: \_\_\_\_\_ Student ID: \_\_\_\_\_

## ACADEMIC REQUIREMENTS

Before submitting this assignment, the student is advised to review:

- the assessment requirements contained in the briefing document for the assignment;
- the various matters related to assessment in the relevant Course Outline; and
- the *Plagiarism and Academic Integrity* website at < <http://www.lc.unsw.edu.au/plagiarism/pintro.html> > to ensure they are familiar with the requirements to provide appropriate acknowledgement of source materials.

If after reviewing this material there is any doubt about assessment requirements, then in the first instance the student should consult with the Course Convenor and then if necessary with the Director – Undergraduate Studies.

While students are generally encouraged to work with other students to enhance learning, all assignments submitted for assessment must be their entire own work and duly acknowledge the use of other person's work or material. The student may be required to explain any or all parts of the assignment to the Course Convenor or other authorised persons. *Plagiarism* is using the work of others in whole or part without appropriate acknowledgement within the assignment in the required form. *Collusion* is where another person(s) assists in the preparation of a student's assignment without the consent or knowledge of the Course Convenor.

*Plagiarism* and *Collusion* are considered as Academic Misconduct and will be dealt with according to University Policy.

## STUDENT DECLARATION OF ACADEMIC INTEGRITY

I declare that:

- This assessment item is entirely my own original work, except where I have acknowledged use of source material [such as books, journal articles, other published material, the Internet, and the work of other student/s or any other person/s].
- This assessment item has not been submitted for assessment for academic credit in this, or any other course, at UNSW or elsewhere.

I understand that:

1. The assessor of this assessment item may, for the purpose of assessing this item, reproduce this assessment item and provide a copy to another member of the University.
2. The assessor may communicate a copy of this assessment item to a plagiarism checking service (which may then retain a copy of the assessment item on its database for the purpose of future plagiarism checking).

Student Signature: \_\_\_\_\_

Date: \_\_\_\_\_

**Students are advised to retain a copy of this assessment for their records and submission should be made in accordance to the assessment details available on the course Moodle site.**