



## UNSW Course Outline

# MINE3220 Resource Estimation - 2024

Published on the 28 Jan 2024

## General Course Information

**Course Code :** MINE3220

**Year :** 2024

**Term :** Term 1

**Teaching Period :** T1

**Is a multi-term course? :** No

**Faculty :** Faculty of Engineering

**Academic Unit :** School of Minerals & Energy Resources Engineering

**Delivery Mode :** In Person

**Delivery Format :** Standard

**Delivery Location :** Kensington

**Campus :** Sydney

**Study Level :** Undergraduate

**Units of Credit :** 6

### Useful Links

[Handbook Class Timetable](#)

## Course Details & Outcomes

### Course Description

Discover the captivating world of Mineral Resource Estimation. A Resource Estimation underpins the practicality and economics of a mining operation. Gain a comprehensive understanding of the geological influences on resource and reserve estimations. Delve into resource and reserve

reporting with a specific focus on the JORC code and navigate the essential elements of layer and block modelling, feasibility studies, mining economics, and fundamental financial concepts for mining operations.

This course offers specialised software training, linking the theories learned in lectures with real-world practices. You will have hands-on experience with industry mining software that enhances your understanding of resource estimation and provides you with the practical skills necessary to excel in the mining industry.

This course will develop the expertise needed to excel in resource estimation for coal and metalliferous deposits and open doors to a rewarding career in the mining industry.

## Course Aims

The aim of this course is to introduce students to the principles of resource and reserve estimation for metalliferous and coal deposits, as well as the fundamental concepts of the mine planning process.

# Course Learning Outcomes

Course Learning Outcomes
CLO1 : Discuss the mine planning process and the impact of the economic environment on mining
CLO2 : Create coal and metalliferous resource models from exploration datasets
CLO3 : Evaluate various estimation methods relevant to specific mineral deposit types
CLO4 : Create resources reports using the JORC code
CLO5 : Demonstrate an appreciation of the time value of money

Course Learning Outcomes	Assessment Item
CLO1 : Discuss the mine planning process and the impact of the economic environment on mining	<ul style="list-style-type: none"><li>• Project 1</li><li>• Project 2</li><li>• Topic Quizzes</li><li>• Final Exam</li></ul>
CLO2 : Create coal and metalliferous resource models from exploration datasets	<ul style="list-style-type: none"><li>• Project 1</li><li>• Project 2</li><li>• Topic Quizzes</li><li>• Final Exam</li></ul>
CLO3 : Evaluate various estimation methods relevant to specific mineral deposit types	<ul style="list-style-type: none"><li>• Project 1</li><li>• Project 2</li><li>• Topic Quizzes</li><li>• Final Exam</li></ul>
CLO4 : Create resources reports using the JORC code	<ul style="list-style-type: none"><li>• Project 1</li><li>• Project 2</li><li>• Topic Quizzes</li><li>• Final Exam</li></ul>
CLO5 : Demonstrate an appreciation of the time value of money	<ul style="list-style-type: none"><li>• Project 1</li><li>• Project 2</li><li>• Topic Quizzes</li><li>• Final Exam</li></ul>

## Learning and Teaching Technologies

Moodle - Learning Management System | Blackboard Collaborate | Microsoft Teams

## Learning and Teaching in this course

As the course lectures are provided via Moodle.

# Additional Course Information

This course assumes that a student:

1. is currently enrolled in the Mining Engineering single degree program or a Mining Engineering double degree program at UNSW;
2. has satisfactorily completed all the courses in Stages 1 to 2 of the Mining Engineering single degree program or equivalent in the Mining Engineering double degree program and is in the Stage/Year of the program;
3. a basic knowledge of mining, geology and statistics; and
4. a basic knowledge of MS EXCEL with ability to carry out regressions & sumproduct functions.

## Assessments

### Assessment Structure

Assessment Item	Weight	Relevant Dates
Project 1 Assessment Format: Individual	25%	Start Date: Week 1 Due Date: 11/04/2024 11:55 PM
Project 2 Assessment Format: Group	25%	Start Date: Week 1 Due Date: 22/04/2024 11:55 PM
Topic Quizzes Assessment Format: Individual	10%	Start Date: Week 1 Due Date: Immediately
Final Exam Assessment Format: Individual	40%	Start Date: Exam Period Due Date: Exam Period

### Assessment Details

#### Project 1

##### Assessment Overview

The first project is individual and includes using a software tool (MS Excel) on a real case study to understand the structure of exploration data files, create, validate and composite a borehole database, create contour plots of coal quality by using a simple surface modelling package, carry out resource estimation and reporting of a coal deposit according to the JORC Code, and become familiar with the process of converting coal resources to reserve status and the associated cost.

The output of this task will be a report, which will be marked by the course instructor(s), and

feedback will be provided.

#### **Course Learning Outcomes**

- CLO1 : Discuss the mine planning process and the impact of the economic environment on mining
- CLO2 : Create coal and metalliferous resource models from exploration datasets
- CLO3 : Evaluate various estimation methods relevant to specific mineral deposit types
- CLO4 : Create resources reports using the JORC code
- CLO5 : Demonstrate an appreciation of the time value of money

#### **Assignment submission Turnitin type**

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

## **Project 2**

#### **Assessment Overview**

The second project is a group project and includes the process of orebody resource estimation using a software tool (Maptek Vulcan) on a real case study to understand the structure of exploration data files, create, validate and composite a drillhole database, build a block model, estimate grades to blocks using Inverse Distance Technique, generate the reserves, and become familiar with an orebody modelling and resource estimation software package. Groups must present their result as a technical report and presentation. The report and presentation will be marked by the instructor(s), and feedback will be provided.

#### **Course Learning Outcomes**

- CLO1 : Discuss the mine planning process and the impact of the economic environment on mining
- CLO2 : Create coal and metalliferous resource models from exploration datasets
- CLO3 : Evaluate various estimation methods relevant to specific mineral deposit types
- CLO4 : Create resources reports using the JORC code
- CLO5 : Demonstrate an appreciation of the time value of money

#### **Assignment submission Turnitin type**

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

## **Topic Quizzes**

#### **Assessment Overview**

This assessment includes short answer and multiple choice quizzes that evaluate students' knowledge and understanding of specific topics delivered in the lectures and tutorials. The results will be recorded for evaluation and feedback will be provided promptly.

## Course Learning Outcomes

- CLO1 : Discuss the mine planning process and the impact of the economic environment on mining
- CLO2 : Create coal and metalliferous resource models from exploration datasets
- CLO3 : Evaluate various estimation methods relevant to specific mineral deposit types
- CLO4 : Create resources reports using the JORC code
- CLO5 : Demonstrate an appreciation of the time value of money

## Assessment information

You must sit and submit at least 5 of the 8 quizzes

### Assignment submission Turnitin type

Not Applicable

## **Final Exam**

### Assessment Overview

The final exam covers all topics delivered in the course. It will be marked by the instructor. The mark will be released alongside the course's final grade, and students can request feedback upon their request.

## Course Learning Outcomes

- CLO1 : Discuss the mine planning process and the impact of the economic environment on mining
- CLO2 : Create coal and metalliferous resource models from exploration datasets
- CLO3 : Evaluate various estimation methods relevant to specific mineral deposit types
- CLO4 : Create resources reports using the JORC code
- CLO5 : Demonstrate an appreciation of the time value of money

### Assignment submission Turnitin type

Not Applicable

### Hurdle rules

To pass this course students must achieve a pass mark (above 50%) in the final exam.

## **General Assessment Information**

### Grading Basis

Standard

### Requirements to pass course

To pass this course students must:

1. Submit both assignments (projects);
2. Sit for and submit answers to the final exam;
3. Achieve a pass mark (above 50%) in the final exam;
4. Sit for and submit at least 5 of the 8 quizzes; and
5. In aggregate terms pass the course with a mark above 50%.

## Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 12 February - 18 February	Lecture	<ul style="list-style-type: none"> <li>- Introduction to the Course (Video 32 mins)</li> <li>- Coal Lectures (Videos – 56 min, 52 min, 42 min) (Quiz in Week 2)</li> <li>- Excel work – Submit in Week 2 G48 lab or on email (not examined)</li> <li>- ChatGPT</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Introduction to Project 1 – Coal Project (Video 32mins)</li> <li>- Introduction to Project 2 – Gold. MyAccess and Vulcan</li> <li>- Discussion on MyAccess, Vulcan Training (Video – 20 minutes)</li> </ul>
Week 2 : 19 February - 25 February	Lecture	<ul style="list-style-type: none"> <li>- Data Collection and Sampling Theory (Video) (Quiz in Week 3)</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> </ul>
Week 3 : 26 February - 3 March	Lecture	<ul style="list-style-type: none"> <li>- Global resource estimation (Video -75 minutes) (Quiz in Week 4)</li> <li>- Domain Model concepts (Video - 31 minutes) (Quiz in Week 4)</li> <li>- Grade Tonnage Curve (Video - 6 minutes) (Quiz in Week 4)</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> </ul>
Week 4 : 4 March - 10 March	Lecture	<ul style="list-style-type: none"> <li>- Mine Planning Process.</li> <li>- Role of Feasibility Studies (Video - 48 min) (Quiz in Week 5)</li> <li>- Coal Mine Planning (Video - 45 min) (Quiz in Week 5)</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> </ul>
Week 5 : 11 March - 17 March	Lecture	<ul style="list-style-type: none"> <li>- JORC 2012 lectures (Videos – 45 min, 20 min &amp; 15 min) (Quiz in Week 7)</li> <li>- Review Project 2</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> </ul>
Week 6 : 18 March - 24 March	Fieldwork	Mine tour. Wednesday 20 March 7am at UNSW
Week 7 : 25 March - 31 March	Lecture	<ul style="list-style-type: none"> <li>- Geostatistics 2 (Video A &amp; B – 33 min &amp; 41 min) (Quiz in Week 8)</li> <li>- Kriging (Video 37 min) (Quiz in Week 8)</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> <li>- Review progress on Project 1 &amp; 2</li> </ul>
Week 8 : 1 April - 7 April	Lecture	<ul style="list-style-type: none"> <li>- Financial Concepts (Video A, B, C – 30, 17, 35 min) (Quiz in Week 9)</li> <li>- @Risk Software &amp; Concept (Video 8 min)</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> </ul>
Week 9 : 8 April - 14 April	Lecture	<ul style="list-style-type: none"> <li>- Cost Estimation (Video 50 min) (Quiz in Week 10)</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Project 1 and 2</li> <li>- Project 2 progress review. This is a feedback session and will not be marked.</li> </ul>
Week 10 : 15 April - 21 April	Lecture	<ul style="list-style-type: none"> <li>- Mineral Economics (Video 39 min)</li> </ul>
	Laboratory	Revision of Course Materials
Week 11 : 22 April - 28 April	Lecture	<ul style="list-style-type: none"> <li>- Introduction to the Course (Video 32 mins)</li> <li>- Coal Lectures (Videos – 56 min, 52 min, 42 min) (Quiz in Week 2)</li> <li>- Excel work – Submit in Week 2 G48 lab or on email (not examined)</li> <li>- ChatGPT</li> </ul>
	Laboratory	<ul style="list-style-type: none"> <li>- Introduction to Project 1 – Coal Project (Video 32mins)</li> <li>- Introduction to Project 2 – Gold. MyAccess and Vulcan</li> <li>- Discussion on MyAccess, Vulcan Training (Video – 20 minutes)</li> </ul>
	Lecture	<ul style="list-style-type: none"> <li>- Data Collection and Sampling Theory (Video) (Quiz in Week 3)</li> </ul>

# **Attendance Requirements**

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

## **General Schedule Information**

Class time schedule:

Lecture - Mon 14:00 - 16:00 (Weeks:1-5,7,9-10)

Laboratory - Tue 15:00 - 17:00 (Weeks:1-5,7-10)

The lectures will be provided online on moodle. There will be unstructured QA-orientated sessions on Mondays covering lecture materials. If there are no students in attendance by the first 15mins, the session will be abandoned for that day.

The tutorial (laboratory) will be face-to-face on campus.

The detail of the sessions will be announced on Moodle.

# **Course Resources**

## **Prescribed Resources**

### **Reference Materials**

Support material for this course including, whenever available, course reader, lecture and tutorial materials, 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. The lecture notes may be viewed and downloaded from Moodle.

### **Text**

1. SME Mining Engineers Handbook, 1992. USA
2. Course reader (available on Moodle)
3. Camus J. Management of Mineral Resources (available in UNSW library)

#### 4. Lecture slides and supporting readings (available on Moodle)

### Other Resources

The Learning Centre. A number of resources are available at the UNSW Learning Centre website to assist students in preparing the various assessment tasks including:

1. 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)
2. Microsoft Excel
3. Vulcan Manual on Moodle.

## Recommended Resources

### Report Writing Guide

The School has a report writing guide (RWG) available. A copy of this is available on the course Moodle site. *MEA Report Writing Guide for Mining Engineers*.

## Course Evaluation and Development

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.

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Hamed Lamei Ramandi		Room 156, OMB, UNSW Kensington Campus	+61 (2) 9065 7310		No	Yes
	Jon Barber			0412163460		No	No

# Other Useful Information

## Academic Information

### I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's [Special Consideration page](#).

### II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)
- [Equitable Learning Services](#)

### III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

### IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: <https://www.unsw.edu.au/engineering/student-life/student-resources/program-design>.

*Note: This course outline sets out the 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 or your primary learning management system (LMS) 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/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.*

## Academic Honesty and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off 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. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: <student.unsw.edu.au/plagiarism>. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

[www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf](http://www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf)

## **Submission of Assessment Tasks**

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, per calendar day.

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 clearly 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;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

### **Faculty-specific Information**

[Engineering Student Support Services](#) – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

[Engineering Industrial Training](#) – Industrial training questions

[UNSW Study Abroad](#) – study abroad student enquiries (for inbound students)

[UNSW Exchange](#) – student exchange enquiries (for inbound students)

[UNSW Future Students](#) – potential student enquiries e.g. admissions, fees, programs, credit transfer

### **Phone**

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

## School-specific Information

### 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.

### Submission of Assessment Tasks

We encourage you to retain a copy of every assignment submitted for your own record, either in hardcopy or electronic form. All assessments must have an assessment cover sheet attached.

### Student Resources

The School has [student resources](#) section, containing 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 online Moodle LMS (Learning Management System). Also see - Transitioning to Online Learning: [www.covid19studyonline.unsw.edu.au](http://www.covid19studyonline.unsw.edu.au)

Note that some specialist engineering software is not available for Mac computers.

- Mining Engineering Students: OMB G48
- Petroleum Engineering Students: TETB LG34 & LG35

For 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)

## 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](#)