UNSW Course Outline

MINE2820 Minerals Processing - 2024

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General Course Information

Course Code : MINE2820
Year : 2024
Term : Term 3
Teaching Period : T3
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

Most minerals must be processed before they are used. In this course, students will be introduced to the various key unit operations and the corresponding physical and chemical processing principles required to achieve mineral recovery from ores. Topics covered include ore

handling, comminution, classification, physical separation, flotation, thickening and filtration, leaching, CIP and solvent extraction, and waste management. Some basic analytical tools for processing cost estimates and metallurgical mass balancing are covered. Key sustainability issues are also examined briefly, including the integration of mine to mill, the drive to reduce energy use in crushing and grinding, reduce water usage across all areas of processing, and minimise environmental damage. Some examples of processing routes including critical minerals are provided.

Course Aims

This course aims to equip students with knowledge of mineral processing unit operations that are typically associated with the production of metal and non-metallic minerals, as well as coal preparation. Additionally, knowledge of hydrometallurgy unit operations commonly used in the production of major metals like copper and gold will be provided. The course also includes the development of practical laboratory skills, which complement the theoretical knowledge of mineral processing through hands-on experience with various unit operations.This practical approach enhances the students' understanding of mineral processing concepts and their application in real-world scenarios.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Evaluate mineral liberation methods using comminution principles involved in particle size reduction
CLO2 : Evaluate the different methods used to classify particles according to their size.
CLO3 : Analyse physical separation methods and hydrometallurgical extraction processes used to upgrade and recover minerals and metals from ores
CLO4 : Analyse basic metallurgical process flow diagram, including mass balancing and basic processing cost and revenue estimates
CLO5 : Identify strategies for ore handling and waste management

Course Learning Outcomes	Assessment Item
CLO1 : Evaluate mineral liberation methods using comminution principles involved in particle size reduction	• Application exercise • Grinding and Sieving • Final Exam
CLO2 : Evaluate the different methods used to classify particles according to their size.	• Application exercise • Grinding and Sieving • Final Exam
CLO3 : Analyse physical separation methods and hydrometallurgical extraction processes used to upgrade and recover minerals and metals from ores	• Flotation • Application exercise • Final Exam
CLO4 : Analyse basic metallurgical process flow diagram, including mass balancing and basic processing cost and revenue estimates	• Application exercise • Final Exam
CLO5 : Identify strategies for ore handling and waste management	• Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Application exercise Assessment Format: Group	20%	Start Date: Not Applicable Due Date: Not Applicable
Grinding and Sieving Assessment Format: Individual Short Extension: Yes (7 days)	15%	Start Date: 02/10/2024 12:00 AM Due Date: 23/10/2024 12:00 AM
Flotation Assessment Format: Individual Short Extension: Yes (7 days)	15%	Start Date: 03/10/2024 12:00 AM Due Date: 24/10/2024 12:00 AM
Final Exam Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: Not Applicable

Assessment Details

Application exercise

Assessment Overview

This is a group assignment involving mass balancing of comminution using commonly used software. There will be a training session where students will have the opportunity to learn how to simulate comminution circuits. At the end of the assignment, a report must be prepared to reflect the activities undertaken. The marking for this assignment will also include participation in these activities, including in-class tasks. Peer assessment is applied to determine the individual's contribution to the team report. Marking will be done with a rubric. Feedback will be provided after the oral presentation.

Course Learning Outcomes

- CLO1 : Evaluate mineral liberation methods using comminution principles involved in particle size reduction
- CLO2 : Evaluate the different methods used to classify particles according to their size.
- CLO3 : Analyse physical separation methods and hydrometallurgical extraction processes used to upgrade and recover minerals and metals from ores
- CLO4 : Analyse basic metallurgical process flow diagram, including mass balancing and basic processing cost and revenue estimates

Detailed Assessment Description

This is a group assignment involving mass balancing of comminution using commonly used software. There will be a training session where students will have the opportunity to learn how to simulate comminution circuits. At the end of the assignment, a report must be prepared to

reflect the activities undertaken. The marking for this assignment will also include participation in these activities, including in-class tasks. Peer assessment is applied to determine the individual's contribution to the team report. Marking will be done with a rubric. Feedback will be provided after the oral presentation.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

Generative AI is not considered to be of assistance to you in completing this assessment. If you do use generative AI in completing this assessment, you should attribute its use.
For more information on Generative AI and permitted use please see here.

Grinding and Sieving

Assessment Overview

The purpose of the assignment is to strengthen students' understanding of size reduction and classification principles by providing a hands-on experience that links the theory presented in lectures with practical application. The lab experiment involves grinding a mineral using two distinct mills, followed by an analysis of the particle size distribution of the mill products to compare the mills' performance. This experiment will be conducted as a team effort, with each student required to prepare and submit an individual report based on detailed marking criteria provided along with the lab manual and a comprehensive learning guideline. Work will be marked against assessment criteria. Feedback will be provided on line and in class during assignment reviews.

Course Learning Outcomes

- CLO1 : Evaluate mineral liberation methods using comminution principles involved in particle size reduction
- CLO2 : Evaluate the different methods used to classify particles according to their size.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing

functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

Flotation

Assessment Overview

This assignment is designed to foster a deeper comprehension of the froth flotation process among students. Through hands-on batch scale flotation experiments, students will have the opportunity to test the impact of various parameters, such as collector dosage and particle size, on flotation kinetics and recovery. Similar to Assignment 1, the experiments will be conducted in teams, and students will be required to prepare and submit individual reports adhering to detailed marking criteria provided along with the lab manual and a comprehensive learning guideline. This assignment will provide not only practical experience in froth flotation but also promote critical thinking and analytical skills as students analyse and interpret their experimental results. Feedback will be provided on line and in class during assignment reviews.

Course Learning Outcomes

- CLO3 : Analyse physical separation methods and hydrometallurgical extraction processes used to upgrade and recover minerals and metals from ores

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily

demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
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Final Exam

Assessment Overview

The final exam is designed to comprehensively assess students' understanding of all the topics covered throughout the course. The exam may include a variety of question formats, such as short answers, multiple choice, numerical, and matching questions. It will test students' knowledge, critical thinking skills, and ability to apply the concepts learned in the course.

Course Learning Outcomes

- CLO1 : Evaluate mineral liberation methods using comminution principles involved in particle size reduction
- CLO2 : Evaluate the different methods used to classify particles according to their size.
- CLO3 : Analyse physical separation methods and hydrometallurgical extraction processes used to upgrade and recover minerals and metals from ores
- CLO4 : Analyse basic metallurgical process flow diagram, including mass balancing and basic processing cost and revenue estimates
- CLO5 : Identify strategies for ore handling and waste management

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

Not Applicable

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General Assessment Information

General information including assesement critera will be given in the course Moodle.

Grading Basis

Standard

Requirements to pass course

at least 50 out of 100.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 0 : 2 September - 8 September	Lecture	Lecture and in-class activity Brief history of mineral processing, common terminologies used in processing
	Blended	
Week 1 : 9 September - 15 September	Lecture	Lecture and in-activity Concept of mineral liberation, industrial minerals size reduction, crushing, grinding, and breakage laws. Milling equipment and comminution circuits
Week 2 : 16 September - 22 September	Other	Lecture and Software training
Week 3 : 23 September - 29 September	Lecture	Lecture and in-class activity Classification and physical separation
Week 4 : 30 September - 6 October	Laboratory	Two lab sesions
Week 5 : 7 October - 13 October	Lecture	Lecture and in-class activity Physical separation and flotation
Week 6 : 14 October - 20 October	Other	Flexible week
Week 7 : 21 October - 27 October	Lecture	Lecture and in-class activity Chemical processing and dewatering
Week 8 : 28 October - 3 November	Blended	Ore handling and mass balance
Week 9 : 4 November - 10 November	Blended	Cost estimation and AVIE
Week 10 : 11 November - 17 November	Lecture	Tailings disposable and sustainable processing

Attendance Requirements

Please note that lecture recordings are not available for this course. Students are strongly encouraged to attend all classes and contact the Course Authority to make alternative arrangements for classes missed.

General Schedule Information

Students must attend application exercises.

Course Resources

Recommended Resources

- Wills BA &Napier-Munn T J, 2006. Mineral Processing Technology, Butterworth-Heinemann, Oxford.
- Morrell S, Morrison R D & Kojovic T, 1996. Mineral Comminution Circuits: Their Operation and Optimisation. (Series: JKMRC Monograph Series in Mining and Mineral Processing No. 2). Series Editor, T J Napier-Munn, published by Julius Kruttschnitt Mineral Research Centre, University of Queensland.
- Hayes P C, 2003. Process Principles In Minerals & Materials Production, Hayes Publishing Co.
- Noakes M & Lanz T (Ed). Cost estimation handbook for the Australian mining industry Published Parkville, Vic.: Australasian Institute of Mining and Metallurgy, 1993 Monograph 20.

- Robert W Bartlett,1998. Solution Mining: Leaching and Recovery of Materials.
- Sutherland K L & Wark I W, 1955. Principles of Flotation, Australasian Institute of Mining and Metallurgy, 489 pages.
- Publications from Suppliers and Original Equipment Manufacturers.
- Gupta A &Yan DS, 2006. Mineral Processing Design and Operations, An Introduction, Amsterdam: Elsevier.
- Rhodes M,1998. Introduction to Particle Technology, Wiley, West Sussex.
- Ritcey GM, 2006. Solvent Extraction – Principles and Applications to Process Metallurgy, (2nd ed.). Ottawa, Canada: Gordon M.
- Habashi F, 1969. Principles of Extractive Metallurgy, Volume 1. General Principles, Gordon & Breach, New York – London – Paris 1969 (reprinted 1980), 413 pages.
- Weiss N L, 1985. SME Mineral Processing Handbook, SME American Institute of Mining, metallurgy, and Petroleum Engineers, New York.

Other Sources

- Laboratory Experiments Learning Guidelines (available on the course Moodle).
- 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).
- The Complete Idiot's Guide to Project Management. G Campbell and S Baker (Alpha: New York) or its equivalent.
- Guide to Authors. (Australasian Institute of Mining and Metallurgy: Melbourne) (Available for download from the AusIMM website).
- Style Manual for Authors, Editors and Printers, 2002. 6th edition (John Wiley & Sons)
- EndNote, software package available to UNSW students.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Seher Ata		School of Minerals and Energy Resources Engineering Old Main Building - Rm 159D		if in person, Wednesday and Thursday only	No	Yes

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 Plagarism

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

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 (if required).

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: https://www.student.unsw.edu.au/transitioning-online-learning

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

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

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