

MINE8910

Mine Water and Waste Management

Term 2, 2023



Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Ghislain Bournival	g.bournival@unsw.edu.au	Tuesdays 12:00-13:00 (TBC)	School of Minerals and Energy Resources Engineering	(2) 9065 2036

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](#)

Course Details

Units of Credit 6

Summary of the Course

Mine water and waste management are critical issues for safe and efficient underground and pit mining operations and to minimise environmental impacts at all stages from feasibility assessment to mine closure. Leading practices for mine site water accounting and assessment will include depressurization and dewatering, geotechnical stability, sustainable water supplies and surface diversions, discharge and pump system management. Fundamentals of hydrogeology and hydrogeochemistry for mining will include monitoring and management of groundwater storage, salinity and acid mine drainage; potential contaminant migration processes; geochemical reactive transport modelling and tracing methods. The course will focus on aqueous aspects of mine water including engineered seepage barriers, water recycling and treatment options, with an overview of waste rock and tailings management.

Course Aims

The course aims to provide mining engineers, geologists and other industry professionals, with leading practice knowledge for water and waste management for all stages of mining operations.

It will cover the major water and waste assessment methodologies in use and new developments in leading practice, with the aim of safe and efficient mining operations that minimise environmental impacts.

Technical content will include aspects of surface water and groundwater management, water quality and treatment, waste rock and tailings management, geotechnical and hydrogeochemical fundamentals, and modelling of water-rock reactions and flow.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Demonstrate knowledge of water and waste management practices for mining from feasibility assessment, operations to closure. This knowledge is to demonstrate ethical practice and social responsibility in an international context.	PE1.1, PE1.2, PE1.6, PE2.2, PE3.1
2. Identify and assess information requirements for depressurization and pumping operations, sustainable water yields and diversions, and the safe management of waste rock and tailings. Skills to locate, critically evaluate and use information are to be developed in an interdisciplinary context.	PE1.3, PE1.5, PE3.2, PE3.4
3. Undertake presentations that develop essential communications skills and collaborative team work. Team work	PE3.2, PE3.5, PE3.6

Learning Outcome	EA Stage 1 Competencies
skills are to recognise diversity and the importance of working within an international community.	
4. Apply this knowledge to critically review water and waste management practices at a mine and to creatively solve problems in a manner that is responsive to change.	PE1.6, PE2.4, PE3.2, PE3.4

Teaching Strategies

Strategies and rationale in this course will ensure that learning outcomes develop graduate attributes. The following outcomes and graduate attributes are closely linked.

Outcome no. 1 develops graduate attributes no.4, 6, 7, 8, 11

Outcome no. 2 develops graduate attributes no. 1, 2, 3, 4, 12

Outcome no. 3 develops graduate attributes no. 6, 7, 8, 9, 12

Outcome no. 4 develops graduate attributes no. 1, 3, 4, 5, 6, 10

Additional Course Information

This course assumes a student has knowledge of:

- basic geological terms and descriptions are assumed; a basic understanding of mining would be beneficial.
- as this is a technical course in a postgraduate program, a fundamental understanding of chemistry is required; fundamental understanding of basic mathematics, physics would be beneficial.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Participation (Online quizzes & discussion board)	15%	Not Applicable	1, 2
2. Mine Site Water Information	20%	16/07/2023 11:55 PM	1, 2
3. Flow and Mixing Project	25%	06/08/2023 11:55 PM	1, 2
4. Major Project	40%	13/08/2023 11:55 PM	1, 2, 3, 4

Assessment 1: Participation (Online quizzes & discussion board)

The online discussion board is an important avenue for students to share their reflections, questions and inner thoughts about the various topics discussed during the week. They will also have the opportunity to comment on their classmates' ideas and points of view. The goal of this activity is to encourage the sharing of ideas, develop critical thinking, flexibility and open-mindedness.

These tasks will take place over the duration of the term.

Assessment criteria

Marking will be based on participation and content. A rubric is made available to students, which will be used for marking.

Assessment 2: Mine Site Water Information

Due date: 16/07/2023 11:55 PM

A case study report showing water management in a selected mine site in Australia.

Assessment criteria

Marking will be according to the completeness of the information against set criteria.

Assessment 3: Flow and Mixing Project

Due date: 06/08/2023 11:55 PM

This project includes exercises to test the student's understanding of both groundwater flow and water quality calculations and concepts.

Assessment criteria

The assessment task will be marked against the criteria and feedback will be provided through the LMS.

Assessment 4: Major Project

Due date: 13/08/2023 11:55 PM

A report providing a review of the geological setting, mining methods, and milling to establish the overall geological setting and mining process which forms the context of mine water and waste in a selected mine site.

Assessment criteria

Marking will be done using a rubric, which will be made available to students. Feedback will be provided through LMS.

Attendance Requirements

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

Course Schedule

[View class timetable](#)

Timetable

Date/Module	Type	Content
Week 2	Module	<p>Module 1 Activities:</p> <ul style="list-style-type: none">• View videos,• presentations,• readings,• online discussion board, and• commence assessments. <p>Contents:</p> <ul style="list-style-type: none">• Overview• Key concepts – drivers for mine water & waste management, regulatory requirements• Leading practices & water accounting• Waste rock & tailings fundamentals
Week 3	Module	<p>Module 2 Activities:</p> <ul style="list-style-type: none">• View videos and presentations,• readings,• online quiz,• online discussion board,• continue assessments. <p>Content:</p> <ul style="list-style-type: none">• Surface water hydrology fundamentals• Diversion of surface water• Mine water management systems• Water Balance (Case study)• Geochemical modelling with PHREEQC <p>OPTIONAL</p> <ul style="list-style-type: none">• Pipeline fundamentals & hydraulics
Week 4	Module	<p>Module 3 Activities:</p>

		<ul style="list-style-type: none"> • View videos, • presentations, • readings, • online quiz • online discussion board, and • continue assessments. <p>Content:</p> <ul style="list-style-type: none"> • Groundwater fundamentals • Dewatering & injection • Water supplies, bores & pumps • CASE STUDY – managing high-pressure inflows underground <p>OPTIONAL</p> <ul style="list-style-type: none"> • Permeability of jointed rocks
Week 5	Module	<p>Module 4 Activities:</p> <ul style="list-style-type: none"> • Attend Webinar (Major project Q&A) • View videos and presentations, • online quiz, • online discussion board, • readings, and • continue assessments. <p>Content:</p> <ul style="list-style-type: none"> • Turbidity, salinity, and other parameters, • discharge guidelines • Water quality sampling • Acid & metalliferous drainage
Week 6	Module	<p>Module 5 Activities:</p> <ul style="list-style-type: none"> • View videos and presentations, • readings, • online quiz, • online discussion board, and • continue assessments. <p>Content:</p> <ul style="list-style-type: none"> • Tailings treatment & storage design • Tailings thickening & dewatering • Coal mining wastes <p>OPTIONAL</p> <ul style="list-style-type: none"> • Tailings options study

		<ul style="list-style-type: none"> • Carbon sequestration
Week 7	Module	<p>Module 6 Activities:</p> <ul style="list-style-type: none"> • View videos and presentations, • readings, • online quiz, • online discussion board, and • continue assessments. <p>Content:</p> <ul style="list-style-type: none"> • Water treatment fundamentals • Passive and active mine water treatment • Low permeability & reactive barriers <p>OPTIONAL</p> <ul style="list-style-type: none"> • Advanced water treatment technologies
Week 8	Module	<p>Module 7 Activities:</p> <ul style="list-style-type: none"> • View videos and presentations, • readings, • online quiz, • online discussion board, and • continue assessments. <p>Content:</p> <ul style="list-style-type: none"> • Geochemical modelling of acid mine drainage formation and treatment • Numerical modelling of mine water – types of models (rainfall run-off, groundwater, geotechnical etc), steps in modelling

Resources

Prescribed Resources

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

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 or Postgraduate Coursework Director. Special consideration can be provided for students to access videos off-line (eg. working remotely). Please contact the Course Convenor for more information. 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

Webinars:

- Check webinar(s) times for your time zone here (<http://www.timeanddate.com/worldclock/meeting.html>) and ensure you complete the setup and
- Testing before the first webinar, as indicated on the LMS (Moodle online). Webinar times are listed as Sydney local time (+10:00 hours UTC which for most of the year is equivalent to AEST - Australian Eastern Standard Time).
- If you are unable to join the live webinar or would like to view part of it again, webinars are generally recorded, and are automatically available from the same online link, usually within about 24 hours of the webinar.

Total student effort hours: Approx. 150

(Note: The above indication of “student effort hours” is indicative only – It reflects the anticipated level of total student involvement with the course – either through accessing or participating in online materials and activities; private research; preparation of assignments. Individual students may find their level of involvement differs from this schedule.

Computing Resources and Internet Access Requirements

UNSW Mining 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.

You can access the School’s computer laboratory in-line with the School laboratory access guidelines and Class bookings.

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)
- Chrome browser or FireFoxability to view streaming video (high or low definition UNSW The Box options)

More information about system requirements is available at www.student.unsw.edu.au/moodle-systemrequirements.

Use a webcam and microphone to actively participate in webinar discussion.

If you have concerns about your web access for a course presented in distance mode, we would encourage you to contact the course convenor before the course commences, to discuss whether it will be possible for you to complete a distance course.

Recommended Resources

There are no required textbooks for this course. The recommended references include:

- Mine Water: Hydrology, Pollution, Remediation, Paul L. Younger, S.A. Banwart, Robert S. Hedin (2002). This book is available to order through UNSW bookshop and it usually takes roughly 4 weeks to arrive from the supplier. After a ~10 % discount, the soft cover book will cost approximately \$200. Contact details: www.bookshop.unsw.edu.au
- Hydrogeology Field Manual, Willis D. Weight (2008). Available on-line to UNSW students through the library website, or on Amazon as Kindle electronic edition, or Hardcover.
- Mine wastes : characterization, treatment, and environmental impacts, Bernd G. Lottermoser, New York : Springer (2003). Hard copy available to borrow by UNSW students by visiting the UNSW library, or on Amazon as Kindle electronic edition, or Hardcover.
- 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)
- The Complete Idiot's Guide to Project Management. G Campbell and S Baker (Alpha: New York) or its equivalent.
- Style Manual for Authors, Editors and Printers, 2002. 6th edition (John Wiley & Sons)
- The Research Project – How to Write It, 2000. R Berry, 4th edition (Routledge: London)
- How to Write a Better Thesis, 2002. D Evans and P Gruba (Melbourne University Press: Melbourne)

Other Resources

- EndNote, software package available to UNSW students
- ELISE, the on-line study skills tutorial and ELISE Plus. Both tutorials will be useful to students when preparing the Annotated Bibliography and Project Progress Report assignment submissions. The latter in particular includes a tutorial on EndNote and Refworks. The tutorials can be accessed at <https://www.library.unsw.edu.au/study>.
- The Learning Centre. A number of resources are available at the UNSW Learning Centre website to assist students in preparing the various assessment tasks.

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.

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.

Laboratory Workshop Information

This course has no laboratory component to it.

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	✓