



Faculty of Engineering

School of Minerals and Energy Resources Engineering

Postgraduate Course Outline

MINE8910

Mine Water and Waste Management

Dr Carlito Tabelin

CONTENTS

1. INFORMATION ABOUT THE COURSE	3
2. AIMS, LEARNING OUTCOMES AND GRADUATE ATTRIBUTES	4
3. REFERENCE RESOURCES	5
4. COURSE CONTENT AND LEARNING ACTIVITIES	6
5. COURSE ASSESSMENT	8
6. STUDYING A PG COURSE IN MINING ENGINEERING AT UNSW	9

Document Management:

Filename: CourseOutline_PG_MINE8910_T2_2020_24062020

Date last update: 24 June 2020

Changes made by: Carlito Tabelin

Revision number: V 3.1

1. INFORMATION ABOUT THE COURSE

Course Code:	MINE8910	Semester:	T2B, 2020	Level:	PG	Units/Credits	6 UOC
Course Name:	Mine Water and Waste Management						

Course Convenor:	Carlito Tabelin						
Contact Details	School of Minerals and Energy Resources Engineering Old Main Building - Rm 159C	EMAIL:	c.tabelin@unsw.edu.au ,				
		Phone:	+61 2 9385 7946				
Contact times	Scheduled webinars and discussion forums						

1.1. Course Description

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

How much time is required?

The course is offered as a distance course over 7 weeks of learning modules plus assessments - the major project is due after the completion of learning modules. Several online live webinars are scheduled throughout the course. There are no face to face classes at the campus.

It is recommended that approximately 150 hours is required for satisfactory performance in this course, depending on background and experience. It is the students' responsibility to manage and plan workloads as much as possible to enable a minimum of 8 hours per week, plus time for assessments. Some weeks may require more than 20 hours.

1.2. Course Completion

Course completion requires:

- submission of **all assessment items**; failure to submit all assessment items will result in the award of an Unsatisfactory Failure (UF) grade for the Course.

1.3. Assumed Knowledge

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.

2. AIMS, LEARNING OUTCOMES AND GRADUATE ATTRIBUTES

2.1. 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.

2.2. Learning Outcomes

At the conclusion of this course the student will be able to:

1. Assessment within the course will include a practical competence and understanding in all of the above areas.
2. Demonstrate knowledge of water and waste management practices for mining from feasibility assessment, operations to closure.
3. Identify and assess information requirements for depressurization and pumping operations, sustainable water yields and diversions, and the safe management of waste rock and tailings.
4. Undertake presentations that develop essential communications skills and teamwork.
5. Apply this knowledge to critically review water and waste management practices at a mine.

2.3. Graduate Attributes

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

1. appropriate technical knowledge
2. having advanced problem solving, analysis and synthesis skills with the ability to tolerate ambiguity
3. ability for engineering design and creativity
4. awareness of opportunities to add value through engineering and the need for continuous improvement
5. being able to work and communicate effectively across discipline boundaries
6. being active life-long learners.

3. REFERENCE RESOURCES

3.1. Reference Materials

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)

3.2. 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.

3.3. Online 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.

4. COURSE CONTENT AND LEARNING ACTIVITIES

4.1. Learning Activities Summary

Start Dates	Hours	Week	Activities	Module	Presenter
6 th July	8+	1 Overview of mine water & waste management	<p>Webinar 1 – Overview, Key concepts & Leading Practices Mon 6th July, 5:00-7:00 pm Sydney time</p> <p>View videos, presentations, readings, commence assessments</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 	<p>CT CT</p> <p>WT</p> <p>SB</p>
13 th July	8+	2 Surface water	<p>Webinar 2 – Tutorial for Mix Project, Mon 13th July 5:00–7:00 pm Sydney time</p> <p>View videos, presentations, readings, quiz, continue assessments</p>	<ul style="list-style-type: none"> Surface water hydrology fundamentals Diversion of surface water Mine water management systems Water Balance (Case study) <p>OPTIONAL</p> <ul style="list-style-type: none"> Pipeline fundamentals & hydraulics 	<p>WT</p> <p>WT</p> <p>PB guest</p> <p>Cristal Mining</p> <p>WRL guest</p>
20 th July	8+	3 Groundwater	<p>View videos, presentations, readings, quiz, continue assessments</p>	<ul style="list-style-type: none"> Groundwater fundamentals Dewatering & injection Water supplies, bores & pumps <p>CASE STUDY – managing high-pressure inflows underground</p> <p>OPTIONAL</p> <ul style="list-style-type: none"> Permeability of jointed rocks* 	<p>WT</p> <p>WT WT</p> <p>Glencore guest</p> <p>MZ</p>
27 th July	8+	4 Water quality	<p>Webinar 3 – Major project Q&A, Mon 27th July, 5:00–7:00 pm Sydney time</p> <p>View videos, presentations, readings, continue assessments</p>	<ul style="list-style-type: none"> Turbidity, salinity, and other parameters, discharge guidelines Water quality sampling Acid & metalliferous drainage <p>OPTIONAL</p> <ul style="list-style-type: none"> Pit lakes & long-term seepage 	<p>WT</p> <p>WT</p> <p>TJ</p> <p>WT</p>

3 rd August	8+	5 Tailings & waste rock	View videos, presentations, readings, continue assessments	<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* • Carbon sequestration 	FRN FRN SB FRN SB
10 th August	8+	6 Water treatment	<p>Webinar 4 – Water treatment, Mon 10th August 5:00-7:00 pm Sydney time</p> <p>View videos, presentations, readings, continue assessments</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 	CT CT WT Veolia guest
17 th August	8+	7 Geochemical and Numerical modelling	<p>Webinar 5 – Geochemical modelling, Mon 17th August 5:00-7:00 pm Sydney time</p> <p>View videos, presentations, readings, continue assessments</p>	<ul style="list-style-type: none"> • Geochemical modelling • Numerical modelling of mine water – types of models (rainfall run-off, groundwater, geotechnical etc), steps in modelling 	CT WT

UNSW presenters (current and former team members): WT - Prof Wendy Timms, SB – Dr Steve Bouzalakos, RC – Dr Richard Crane, FRN - Dr Farshad Rashidi-Nejad, MZ – Dr Mahdi Zoorabadi, TJ – Dr Tony Jong

Webinars:

- Check webinars 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.

5. COURSE ASSESSMENT

5.1. Assessment Summary

All assessments are due **10:00am Sydney time on Monday** of the week, unless otherwise indicated in the table below.

Table 2 – Assessments

Assessment task	Due date	Release date	Weight	Assessment	Learning outcomes assessed
1	Weeks 1 to 7	Week 1 ongoing	15%	Participation* in webinars, online-quizzes and general	1, 2, 3, 5
2	Monday 20 th July	Week 1	15%	Mine site water information	1, 2, 5
3	Monday 10 th August	Week 3	20%	Flow and mixing project	1, 2
4	Monday 24 th August	Week 2	50%	Major project	1, 2, 3, 4, 5

Participation* means actively taking part in these activities. For example, online quizzes are provided for learning feedback, with full marks for completion.

For further details see the section on *University Policies* for details on assignment submissions, late submissions and special consideration.

All the course materials and assignments will be available online through Moodle. Access to the Moodle site is via the Moodle icon on the MyUNSW homepage, or at <https://moodle.telt.unsw.edu.au>

Webinar participation

Your participation in live webinars is preferable for learning outcomes, or you may miss opportunities for interactive queries and demonstrations of technical examples. However, 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.

Full participation will be awarded to students by either Option 1 or 2 criteria that follow:

- Option 1
 - Active participate in live webinar with a microphone and webcam
 - And post a brief comment (<50 words) in the post webinar blog.
- Option 2
 - View the recorded webinar or view a live webinar without active participation
 - And post a comment and/or reply (<200 words) in the post webinar blog.

6. STUDYING A PG COURSE IN MINING ENGINEERING AT UNSW

6.1. How We Contact You

At times, the School or your lecturers may need to contact you about your course or your enrolment. Your lecturers 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://student.unsw.edu.au/email-rules>

6.2. 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: postgrad.mining@unsw.edu.au

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

6.3. 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 FireFox
- ability 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-system-requirements.

For distance courses it is also considered essential that you

- Upload a profile picture in Moodle LMS that can be used to verify your identity with your student ID photograph.
- Use a webcam and microphone to actively participate in webinar discussion. Voice participation is essential in webinars, so if you are restricted to text participation only it will not be possible to score full participation grading.

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.

6.4. Accessing Course Materials Through Moodle

Course outlines and support materials are uploaded on a Learning Management System (LMS) - Moodle. All enrolled students are automatically included on the Moodle for each course. To access these documents, please visit: www.moodle.telt.unsw.edu.au

6.5. Assessment Criteria for Postgraduate Programs

The assessment criteria provide a framework for you to assess your own work before formally submitting major assignments to your facilitator. Your facilitator 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. All students are encouraged to take a closer look at this framework before, during and after completing an assignment.

The descriptions in the framework will help you and your facilitator to identify where your assignment is ranked – from excellent to poor achievement. We ask that you don't use the guidelines as a checklist, but as a tool to assess the quality of your work. Your facilitator will also be looking at the quality, creativity and the presentation of your written assignment as they review the framework.

6.6. Assignment Submissions

The School has developed a guideline to help you when submitting a course assignment. Please take a closer look at all these details on our website: www.engineering.unsw.edu.au/mining-engineering/assignment-submission-policy

We encourage you to retain a copy of every assignment submitted for assessment for your own record either in hardcopy or electronic form. On a rare occasion, assignments may be mislaid and we may contact you to re-submit your assignment.

All your assignments will need to have a completed PG coversheet. To access a copy, please visit: http://www.engineering.unsw.edu.au/mining-engineering/sites/mine/files/uploads/Assignmentcoversheetindividual_PG.pdf

6.7. Late Submission of an Assignment

Full marks for an assignment are only possible when an assignment is received by the due date. In fairness to those students who do meet the assignment due date and time, deductions will apply to submissions made after this time. Details on deductions that are automatically applied to late submissions are available on our webpage: <http://www.engineering.unsw.edu.au/mining-engineering/late-submissions>

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 as soon as possible: <https://student.unsw.edu.au/special-consideration>

6.8. Course Results

For details on UNSW assessment policy, please visit: <https://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.

6.9. 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 Convenor 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: <https://www.student.unsw.edu.au/special-consideration>

6.10. 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/

6.11. 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 <https://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: 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.

6.12. Report Writing Guide for Mining Engineers

The School has a report writing guide (RWG) available for all mining engineering students. View this website to download a copy of this guide: https://www.engineering.unsw.edu.au/mining-engineering/sites/mine/files/publications/MEA_ReportWritingGuide_eBook_2018ed.pdf

6.13. 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.

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.