Faculty of Engineering

School of Minerals and Energy Resources Engineering

Postgraduate Course Outline

MINE8790
Advanced Mineral Economics and Project Evaluation

Dr Carlos Tapia

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Document Management: (This section to remain on all saved versions)
***Filename**: CourseOutline_MINE8790_S2_20160728_V.1.1*
***Date last update:** 06 Dec 2019*
***Changes made by:** Dr Carlos Tapia*
***Revision number:** V1.1*

1. INFORMATION ABOUT THE COURSE

Course Code:	MINE8790	Semester:	T1, 2020	Level:	PG	Units/Credits	6 UOC
Course Name:	Advanced Mineral Economics and Project Evaluation						

Course Convenor:	***Dr Carlos Tapia***		
Contact Details	School of Mining Engineering Old Main Building, Rm 159J	EMAIL:	***@unsw.edu.au***
		Phone:	
Contact times	Contact times are scheduled for: • **20th to 24th of April as a short course**		

1.1. Course Description

The course essentially includes two distinct components:

- **Mineral Economics** - Review of the mineral economics theory and its relevance for economic, social and technological development supported by the study of the fundamentals of the economic theory, both Macro- and Micro-Economics including - but not limited to - monetary policy, supply and demand, elasticity, market agents, markets structures and competitive strategies, business cycles and their relevance for mineral commodity markets.
  A detailed review of the main characteristics of the mineral extraction industry encompassing their markets and production features, and their relevance for global and local economies. An analysis of mineral commodity markets (energy, metallic and non-metallic) encompassing the study of the evolution of the economic environment and geopolitical scenario, markets behaviour and key drivers, technology and production costs, uncertainties, costumer's behaviour, pricing schemes and market power, entry barriers, trading features and the role of governments. A relevant in-class case study is used to assess the effects of the economic environment, market structure and economic agents (government, companies and society) on the performance, risk level and feasibility of mineral extraction and processing projects and operations.
- **Project evaluation and risk analysis** –Review of project evaluation techniques for mineral projects including an overview of financial maths, cash flow structure, EBITDA, NPV, relevant regulations, uncertainties, risks management and sensitivity analysis. Review of Valuation techniques applied to the mineral extraction sector - technical and market based – and review of relevant stock exchange valuation regulations and guidelines (i.e. VALMIN)

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 mining and geological terms and descriptions;
- basic knowledge on the economic theory and financial maths
- as this is a technical course in a postgraduate program, a fundamental understanding of mathematics and physics is required.

2. AIMS, LEARNING OUTCOMES AND GRADUATE ATTRIBUTES

2.1. Course Aims

The course aims to provide mining engineers, and other industry professionals, with leading practice knowledge on mineral economics and project evaluation.

2.2. Learning Outcomes

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

1. Demonstrate a practical competence and understanding in mineral economic, and project valuation and evaluation.
2. Demonstrate knowledge of mineral commodity markets and price behaviour and strategic decision making.
3. Demonstrated knowledge on mineral commodity price forecasting techniques
4. Practical application of knowledge to understand and assess mineral commodity price forecasting and use it for mining projects evaluation.
5. Identify and assess financial information for investment decision making purposes
6. Demonstrate knowledge on the financial techniques and indexes used in the industry to valuate and evaluate mining projects, and assess risks & uncertainties

2.3. Graduate Attributes

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

1. The skills involved in scholarly enquiry
2. An in-depth engagement with the relevant disciplinary knowledge in its interdisciplinary context
3. The ability to engage in independent and reflective learning
4. The skills required for collaborative and multidisciplinary work
5. The skills of effective communication

3. REFERENCE RESOURCES

3.1. Reference Materials

- *AusIMM, 2012. The JORC Code 2012 Edition*
- *AusIMM and AIG, 2015. THE VALMIN CODE 2015 Edition*
- *Darling, P., 2011. SME mining engineering handbook. SME*
- *Monograph 29 - Mineral Economics - Second Edition, 2013*
- *Pindyck, R.S. and Rubinfeld, D.L., 2015. Microeconomics. Boston: Pearson*
- *Radetzki, M. and Wårell, L., 2016. A handbook of primary commodities in the global economy. Cambridge University Press Runge, I.C., 1998. Mining economics and strategy. SME.*
- *Ricardo, D., 1821. On the Principles of Political Economy and Taxation. London, John Murray, Albemarle - Street.*
- *Smith, A., 1776. The wealth of nations. London, Methuen & Co.*
- *Tilton, J.E. and Guzmán, J.I., 2016. Mineral economics and policy. Routledge*

3.2. Other Resources

- *Report Writing Guide for Mining Engineers,* 2014. P Hagan & P Mort (Mining Education Australia (MEA)
- *Guide to Authors, 2008. (Australasian Institute of Mining and Metallurgy; Melbourne).*
- *Style Manual for authors, editors and printers. 6th edition, (John Wiley & Sons).*

Further reading recommendations, including conference papers, will be provided on commencement of the course

3.3. Online Resources

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

UNSW Mining and Petroleum subject guide (including a link to ACARP and how to find the reports in the catalogue) http://subjectguides.library.unsw.edu.au/content.php?pid=7632&sid=52212

UNSW Library services for Postgraduate students http://library.unsw.edu.au/servicesfor/PGandH.html

New postgraduate course students are strongly advised to visit the above website and complete the ELISE and ELISE Plus tutorials. These will help develop skills in finding, using and evaluating scholarly information.

4. COURSE CONTENT AND LEARNING ACTIVITIES

4.1. Learning Activities Summary

The learning activities for MINE8790 are summarised in the following table

Table 1 – Daily schedule of topics and activities

Day	Date	Time	Topic or Activity	Presenter
1	*Monday 20th Apr*	*8:30 – 10:30 am*	**Fundamentals of Economics – Macroeconomics** • The Circular Flow of the Economy • Consumption, Savings, and Investment • National Accounting	Dr Tapia
		10:30 – 11:00	*Morning Tea*	
		11:00 – 12:00 pm	**Fundamentals of Economics – Macroeconomics** • Economic Grow (GDP and Investment) • Monetary Policy, Exchange Rate and Inflation	
		12:30 – 1:30	*Lunch*	
		1:30 – 3:00	**Fundamentals of Economics – Microeconomics** • The Basics of Supply and Demand • Elasticity	
		3:00 – 3:30	*Afternoon Tea*	
		3:30- 5:30	**Fundamentals of Economics** • Production • The Cost of Production	

Day	Date	Time	Topic or Activity	Presenter
2	*Tuesday 21st Apr*	*8:30 – 9:30 am*	**Quiz (A01)** Microeconomics in mining projects	Dr Tapia
		9:30 – 10:30 am	**Introduction to Mineral Economics** • History and Definition	
		10:30 – 11:00	*Morning Tea*	
		11:00 – 12:00 pm	**Introduction to Mineral Economics** • Factors Affecting Markets • Market Balance	
		12:30 – 1:30	*Lunch*	
		1:30 – 3:00	**Mineral Commodity Markets** • Configurations, Agents and Drivers	
		3:00 – 3:30	*Afternoon Tea*	
		3:30- 5:30	**Markets Behaviour** • Energy Commodities • Metallic Commodities – Iron Ore	
Day	**Date**	**Time**	**Topic or Activity**	**Presenter**
3	*Wednesday 22nd Apr*	*8:30 – 10:30 am*	**Markets Behaviour** • Metallic Commodities – Light, Precious and Base Metals	Dr Tapia
		10:30 – 11:00	*Morning Tea*	
		11:00 – 12:00 pm	**Price Forecasting** • Techniques	
		12:30 – 1:30	*Lunch*	
		1:30 – 3:00	**Price Forecasting** • Modelling **Individual Exercise (A02)**	
		3:00 – 3:30	*Afternoon Tea*	
		3:30- 5pm latest	**Group Exercise (A03)** • Investment strategy	
Day	**Date**	**Time**	**Topic or Activity**	**Presenter**
4	*Thursday 23rd Apr*	*8:30 – 10:30 am*	**Strategic Management** • Project Evaluation vs Valuation	Steve Gemell
		10:30 – 11am	*Morning Tea*	
		11:00 – 12:00 pm	**Strategic Management** • Project Evaluation vs Valuation	
		12:30 – 1:30	*Lunch*	
		1:30 – 3:00	**Estimating Revenue** • The Mine as Economic Unit	
		3:00 – 3:30	*Afternoon Tea*	
		3:30- 5:30	**Estimating Revenue** The Mine as Economic Unit	
Day	**Date**	**Time**	**Topic or Activity**	**Presenter**
5	*Friday 24th Apr*	*8:30 – 10:30 am*	**Risks & Uncertainties** • Known Unknowns and Unknown Unknowns	Dr Tapia
		10:30 – 11:00	*Morning Tea*	
		11:00 – 12:00 pm	**Risks & Uncertainties** • Assessment & Management	
		12:30 – 1:30	*Lunch*	
		1:30 – 3:00	**Group exercise – Case Study** (unassessed)	
		3:00 – 3:30	*Afternoon Tea*	
		3:30- 5:30	**Test**	

5. COURSE ASSESSMENT

Completion of this course usually requires around 150 hours of work. Course delivery accounts for around 40 hours, hence 110 hours of additional online and assessment work is required. The formal lectures and laboratory classes are delivered in a Short Course at UNSW. (see course overview for schedule). **Attendance at all Short Course sessions is compulsory**. Prior to the short course you should log into Moodle where teaching and related material is available. There will be no hard copy notes provided.

5.1. Assessment Summary

All assessments are due 12 noon Sydney time on Monday of the week, unless otherwise indicated in the table below.

Assessment task	Due date	Weight	Assessment	Learning outcomes assessed
A01	21st Apr	15%	**Quiz:** Determine Microeconomic components in the mining business	1, 2, 5
A02	22nd Apr	15%	**Individual Exercise:** Prices Forecasting – Technique Selection, Modelling and Application	1, 2, 3, 4
A03	22nd Apr	20%	**Group Exercise:** Investment strategy. To be presented in-class	2, 5,6
A04	15th May	25%	**Groups**: Mining Project Valuation. Submit UNSW Moodle Dropbox	1, 4, 5, 6
A4.0	29th May	25%	**Individual Report:** Mining Project Investment. Financial Evaluation, Financing strategy and Risk Assessment. Submit UNSW Moodle Dropbox	1, 2, 3, 4, 5, 6

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

5.2. Assessment Requirements

Compliance with School Policy on assignment submissions

- Prior to submission of an assignment, students are advised to read the School Policy on *Assignment Submissions* which can be viewed at: http://www.engineering.unsw.edu.au/mining-engineering/assignment-submission-policy

- In particular, students should make sure they have read and understood the:
  - Declaration of Academic Integrity;
  - Assignment Submission requirements detailed in the *University Policies* section of the Course Outline; and
  - School Policy on *Assignment Submission* available on the School's website (the web address is given in the Course Outline). In particular note the requirement that only PDF documents should be uploaded and the required file naming convention.

- A submission that is non-compliant with the Policy *may not be marked* or *penalties applied*. Examples of a non-compliant assignment include the assignment submission:
    - is not a PDF document or a zip file [*not marked*];
    - does not contain a completed copy of the ***Student Declaration Statement*** [*not marked*];
    - does not use the required file naming convention – Item #6 in the Policy on electronic submission. A file name such as < ManagementAssignment.pdf > is NOT compliant. [*minimum 10% penalty*]

5.3. Form of assignment for submission

- The submission must be presented in the form of a formal technical report.
- The report must be prepared in accordance with the report writing standards of the School as contained in the ***Report Writing Guide for Mining Engineers***. A copy can be obtained from the School webpage at http://www.mea.edu.au/asset/52df6e0042c1b/mea-report-writing-guide-e-book.pdf
- It is strongly recommended when preparing the major assignment, that a student use the official School ***Report Style Template*** , a copy of which is available for download from LTMS. The template has embedded in it a copy of the Student Declaration Form and hence the student need not attach a copy of coversheet to their assignment. If the template is not used then the student must incorporate the Student Declaration Form in their report.

5.4. Method of submission

- All assessments for this course are to be submitted in electronic format through the *Learning & Management System* (LMS) for this course at https://moodle.telt.unsw.edu.au/login/index.php
- The student must use the following file naming convention for the assignment:
  < **StudentFamilyNameInitial_CourseCode_AssignmentNumber** >.

  A typical filename would be < SmithP_MINE8790_A1> which corresponds to:
    - Student Family Name: Smith
    - Student First Initial: P
    - Course Code: MINE8790

Assignment number: A1...as defined in the table in the section on Assessment Summary

6. ASSESSMENT CRITERIA

The student should be cognisant that a range of factors is often being assessed in any one assignment; not just whether the final results are numerically correct. Consideration is given to other relevant elements that contribute to the *Learning Outcomes* of the course as well as the *Graduate Attributes* of the overall degree program.

Assignments and examination	**% MARK**
Answers may be numerical, graphical or descriptive.	
Numerical	
Answer is correct and substantiated by complete mathematical working	100%
Deduct for incorrect or unspecified units	20%
Deduct for excessive round off error	10%
Answer is correct but not substantiated by complete, correct working.	up to 30% depending upon how much of the correct working is given
Answer is incorrect but principles of mathematical working are correct	60%
Add if the answer is of reasonable Magnitude	20%
Add if incorrect only because of an error of transcription of numerical data	10%
Mathematical working is incomplete or incorrect	up to 50% depending upon how much of the correct working is given
Graphical answers	
Accuracy with which the data are presented	60%
Layout	20%
Tidiness	20%
Descriptive answers	
Completeness and accuracy of answer	70%
Clarity of expression	30%
Deduct for irrelevant material	up to 40%

7. STUDYING A PG COURSE IN MINING ENGINEERING AT UNSW

7.1. 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 through 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: www.it.unsw.edu.au/students/zmail/redirect_external.html

7.2. How You Can Contact Us

We are always ready to assist you with your inquiries. To ensure your question is directed to the correct person, please use the email address below for:

Enrolment or other admin questions regarding your program: mere.teaching@unsw.edu.au
Course inquiries: these should be directed to the course convenor.

7.3. 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.

7.4. 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

7.5. 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.

7.6. 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. Refer to last page of outline.

7.7. 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

7.8. 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-enrol in the course.

7.9. 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

7.10. 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: http://www.studentequity.unsw.edu.au/

7.11. 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://www.student.unsw.edu.au/plagiarism.

All Mining Engineering students are required to complete a student declaration for academic integrity which is outlined in the assignment cover sheets. By signing this declaration, you agree that your work is your own original work.

If you need some additional support with your writing skills, please contact the Learning Centre or view some of the resources on their website: http://www.lc.unsw.edu.au/. The Learning Centre is designed to help you improve your academic writing and communication skills. Some students use the Centre services because they are finding their assignments a challenge, others because they want to improve an already successful academic performance.

7.12. 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: http://www.engineering.unsw.edu.au/mining-engineering//mining-engineering/sites/mine/files/uploads/MEA_ReportWritingGuide_2014_eBook.pdf

7.13. 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.

8. SCHOOL ASSESSMENT COVER SHEET

School of Minerals and Energy Resources Engineering

Assessment Cover Sheet

Course Convenor: _____

Course Code: _____ Course Title: _____

Assignment: _____

Due Date: _____

Student Name: _____ Student ID: _____

ACADEMIC REQUIREMENTS

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

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

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

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

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

STUDENT DECLARATION OF ACADEMIC INTEGRITY

I declare that:

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

I understand that:

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

Student Signature: Date:

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