PTRL4010

Integrated Oil and Gas Field Evaluation A

Term 1, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Hamid Aghighi	m.a.aghighi@unsw.edu.au	Tuesdays 12:30-14:30, Fridays12:30 to 14:30	MS Teams	02 9385 5196

School Contact Information

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Engineering Student Services
E: mere.teaching@unsw.edu.au
W: www.engineering.unsw.edu.au/minerals-energy-resources

Course Details

Units of Credit 6

Summary of the Course

Students gain hands-on experience of the complete geological modelling and evaluation of a field in off-shore Australia (note that the study field may change).

The subject will start with Geology review. Students will search through the existing body of the literature to make themselves familiar with the overall geology of the area (Regional geology) and then more focus, Field Geology. In the field geology section, you will need to review the geological information available at the field scale and link it to regional geology through detail analysis of different reports provided. One of the main steps in geological modelling involves the seismic interpretation especially to pick up horizons and faults. The videos of interpretation will be provided for students' familiarity with PETREL software. Also a step by step training will be conducted to ensure full familiarity with PETREL software. In the next part of geological modelling, the geological structures (zones, layers, etc) are constructed and petrophsyical modelling is then performed. Finally, students will be given specific individual tasks to include in your PETREL model.

Both individual and team works are required to deliver a successful outcome on time. In particular, team work is an important component of this course. This is essential in industry practices where the success of every project heavily relies on communication between team members. Therefore students are required to form groups at the beginning of the subject. The assessment is based on both team and individual performance.

Course Aims

The aim of this course is to enable students to construct a structural model, distribute the petro-physical properties in the model and assess the oil/gas in-place of an actual oil/gas field.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. To understand and make an evaluation of an oil field up to the stage of estimating its oil-in-place.	PE2.4
2. To understand the underpinning fundamentals as well as maths, analysis, geostatistics and computing required for oil and gas field evaluation	PE1.1, PE1.2
3. To apply the established engineering methods in developing geological and reservoir property models	PE2.1, PE2.2
4. To enhance professional and personal attributes as well as ethical conduct and professional accountability through teamwork	PE3.1, PE3.6
5. To improve effective oral and written communication	PE3.2

Teaching Strategies

Field evaluation is an essential part of oil and gas field development. Students needs to learn how to integrate their understanding of various practices in petroleum engineering including field geology investigation, seismic, reservoir engineering and reservoir characterisation and apply them on a set of real data to develop geological and reservoir property models that is required for oil and gas simulation and production system design.

In the theoretical part of the course students learn about the fundamental theories as well as the mathematical, statistical and computational analyses of oil and gas field evaluation. This is essential for understanding the underpinning fundamentals and practical methods of geological and property modelling.

In the practical part of the course, students work in teams on their projects. They will be provided with real field data such as well logs, petrophysics and seismic data and asked to gather information on the regional geology by searching the literature. Students are demonstrated how to integrate and interpret the data to build variety of models in a stepwise manner using an industry-standard software. This extensive practice develops students' creativity and problem-solving skill and give them confidence in working on real data. The teamwork improves the professional conduct and accountability of students.

Additional Course Information

Students gain hands-on experience of the complete geological modelling and evaluation of an oil and gas field. Both individual and team works are required to deliver a successful outcome on time. In particular, teamwork is an important component of this course. This is essential in industry practices where the success of every project heavily relies on communication between team members. Therefore, students are required to form the groups of four members at the beginning of the subject. All submissions expect the final submission is group submission (final submission is individual). The assessment is based on both team and individual performance. Therefore, students should be very careful with their team member selection.
The subject will start with the geological review. Students will search through the existing body of the literature to make themselves familiar with the overall geology of the area (regional geology) and then more focus on field geology. In the field geology section, students will need to review the geological information available at the field scale and link it to regional geology through detail analysis of different reports provided.
One of the main steps in geological modelling involves the seismic interpretation specially to pick up horizons and faults. As seismic interpretation is part of Geophysics course, the detail of Seismic interpretation will not be discussed, but videos of interpretation will be provided for students' familiarity with PETREL software. In the next part of geological modelling, the geological structures (zones, layers, etc) are constructed and petrophysical modelling is then performed.
Eventually, students will be given a specific individual task to include in their PETREL model. The final report summarising all information and model runs must be submitted on Moodle by specified deadline. All other reports are group reports (each group will submit one report). The maximum of 10-page (excluding references) is allowed for every report. There will be also an individual assessment on geological model.
The step-by-step training will also be conducted to get fully familiar with PETREL software throughout the course and exercises are performed at every session.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Report 1	10%	09/03/2022 12:00 PM	1, 2, 4, 5
2. Structural and Petro-physical model Report	20%	30/03/2022 12:00 PM	1, 2, 3, 4, 5
3. PETREL Model Debate	20%	Not Applicable	1, 2, 3
4. Final Report	50%	03/05/2022 12:00 PM	1, 2, 3, 4, 5

Assessment 1: Report 1

Due date: 09/03/2022 12:00 PM

Report 1

Assessment 2: Structural and Petro-physical model Report

Due date: 30/03/2022 12:00 PM

Structural and Petro-physical model Report (group assessment)

Assessment 3: PETREL Model Debate

PETREL Model Debate (individual assessment)

Assessment 4: Final Report

Due date: 03/05/2022 12:00 PM

Final Report (individual assessment)

Attendance Requirements

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

Course Schedule

Any changes to lecture/tutorial times will be announced on Moodle during the course.

View class timetable

Timetable

Date	Type	Content
Week 1: 14 February - 18 February	Blended	**Lecture** • Project outline • Tasks and deadlines • Overview of geological modelling • Field Geology and Formations stratigraphy **Workshops** • Group selection • Group to assign team leader • Discuss the main task allocations • PETREL environment • PETREL Data import including Well heads, Well deviation survey and Well tops **Away work** • Identification of issues, tasks, and priorities • Allocation of tasks to group members • Start reviewing completion/drilling reports provided • Practice on PETREL Data importing using videos provided
Week 2: 21 February - 25 February	Blended	**Lecture** • Seismic interpretation • Velocity model **Workshops** • Familiarization with Seismic interpretation and visualisation

		• Velocity model selection **Away work** • Familiarization with regional and field geology • Practice on seismic interpretation, visualisation and velocity models
Week 3: 28 February - 4 March	Blended	**Lecture** • Fundamental of well logging and well correlation **Workshops** • Well correlation • Well top analysis **Away work** • Understanding well log requirements • Well correlation analysis for the field under investigation
Week 4: 7 March - 11 March	Blended	**Lecture** • Shaliness and effective porosity **Workshops** • Fault modelling • Pillar gridding **Away work** • Fault modelling analysis for the field under investigation • Pillar gridding for field under investigation • Grid generation
Week 5: 14 March - 18 March	Blended	**Lecture** • Water Saturation **Workshops** • Make horizons/zones/ • Layers **Away work**

		• Make zones and layers for field under investigation
Week 6: 21 March - 25 March	-- Select --	**No lecture** (Q&A)
Week 7: 28 March - 1 April	Blended	**Lecture** • Geo-statistics **Workshops** • Property upscaling (total porosity) • Geostatistical analysis including variogram construction and modelling **Away work** • Geo-statistics recap • Property upscaling for the field under investigation • Variogram construction and modelling
Week 8: 4 April - 8 April	Blended	**Lecture** • DST and permeability **Workshops** • Petrophysical modelling (total porosity) **Away work** • Petrophysical modelling • Working on individual model
Week 9: 11 April - 15 April	Blended	**Lecture** • Mechanical properties **Workshops** • Visualization **Away work** • Continue PETREL model • Working on individual model
Week 10: 18 April - 22 April	Blended	**Lecture** • PETREL Model debates

Resources

Prescribed Resources

Geoscience Australia: http://www.ga.gov.au

In addition to the given references, data on the study area will be found on “Moodle” for this subject.

Well Completion Reports
Several basic and interpretative Well Completion Reports will be available on Moodle for all wells.

Digital Well Logs
Digital well logs (LAS format) for all wells drilled in the field will be available on Moodle.

Others
Temperature and geochemical data will be available from open-files databases. Some of these data can also be found through the Petroleum Information Management System (PIMS) and the National Petroleum Wells Database www.ga.gov.au. Complete SEGY file is also available on Geoscience Australia website.
The lecture note and software training videos as well as initial model can be viewed and downloaded from the UNSW-Moodle http://moodle.telt.unsw.edu.au/

Recommended Resources

Recapping previous lecture notes and their recommended books dealing with petrophysics and well-logging, geology, geostatistics and geophysics are recommended.

Students seeking resources can also obtain assistance from the UNSW Library. One starting point for assistance is: https://www.library.unsw.edu.au/

Society of Petroleum Engineers: http://www.spe.org

Australian Petroleum Production and Exploration Association: http://www.appea.com.au

American Association of Petroleum Geologists: http://www.geobyte.com
Petroleum Exploration Society of Australia: http://www.pesa.com.au
American Petroleum Institute – For Petroleum Standards www.api.org
Society of Petrophysicists & Well Log Analysts www.spwla.org
European Association of Geoscientists & Engineers www.eage.org
The Society of Exploration Geophysicists www.seg.org

Course Evaluation and Development

All students will have the opportunity to complete a course evaluation form. These anonymous surveys help us understand your views of the course, your lecturers and the course materials. We are continuously improving our courses based on student feedback, and your perspective is valuable. Feedback is given via https://student.unsw.edu.au/myexperience and you will be notified when this is available for you to complete.
We also encourage all students to share any feedback they have any time during the course – if you have a concern, please contact us immediately.

Laboratory Workshop Information

UNSW Minerals and Energy Resources Engineering provides blended learning using the online 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.

- Mining Engineering Students: OMB G48/49
- Petroleum Engineering Students: TETB LG34

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.

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. Please note, a competency hurdle of 50% is applied to the final assessment.

Late Submission of an Assignment

Full marks for an assignment are only possible when an assignment is received by the due date.

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.

Late submission will not be accepted and will be considered as no submission.

Special Consideration

You can apply for special consideration through The Nucleus Student Hub 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: www.student.unsw.edu.au/special-consideration

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

- UNSW Learning Centre - www.lc.unsw.edu.au
- Counselling support - 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 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.

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

Report writing guide

The School has a Report Writing Guide (RWG) available. A copy of this is available on the course Moodle site.

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

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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

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	✓