MERE5002

Seismic Imaging

Term 2, 2023

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
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Tutors

Name	Email	Availability	Location	Phone
Liam Brunton	l.brunton@student.unsw.edu.au			

School Contact Information

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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

Seismic imaging is a key to determining the properties and structures in the Earth and important for mapping faults, the interface between bedrock and sediment and structures within rocks. In this course, you will engage in activities that align with what would be expected of a seismic geophysicist in industry. The topics covered take students from introductory seismology to advanced concepts in seismic attributes and inversion. A number of the concepts are taught using python without requiring prerequisite knowledge: as a result you will also gain programming skills, which are of growing demand in industry. Finally, the course will focus on communicating geophysical methods and results to an interdisciplinary audience. The main topics are:

- Seismic data
- Seismic waves and acquisition
- 3D seismic interpretation
- Well-ties and depth conversion
- Seismic inversion

Course Aims

The aims are:

- To study how seismic data can be acquired and stored digitally and transformed into images
- To understand how seismic energy reflects off interfaces and how it relates to subsurface structures
- To calculate seismic processing steps that enhance seismic images and make them truer representations of the subsurface geology
- To focus on communicating geophysical results to an interdisciplinary audience.

The course is part of the various postgraduate degrees in Engineering. The course helps develop skills in mapping and imaging the subsurface and understanding how subsurface reservoirs evolve through time.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Explain seismic wave propagation and image processing using wave theory	PE1.1, PE1.3
2. Interpret and analyse geological features in seismic images	PE1.3, PE1.2
3. Enhance seismic images with computer algorithms and industry software	PE1.2, PE2.1
4. Demonstrate strong oral and written communication skills	PE3.2

Learning Outcome	EA Stage 1 Competencies
through clear explanations of geophysical concepts appropriate for an interdisciplinary industry audience.	

Teaching Strategies

Teaching Strategies

The course uses the following main strategies:

- Team-based learning with small groups in a flipped classroom setting
- Just-in-time teaching based on real-time feedback from students in class
- Active learning - via online moodle activities and quizzes
- Project based-learning with take-home assignments encouraging industry-related thinking.
- Case studies looking at the use of techniques in real industry cases and the outcomes and benefits.

Rationale

The idea is to increase the alignment of the course with the UNSW Scientia Education Experience by enhancing the component of professional skills development, increased online activities and provide increased opportunities for feedback to students. In addition, to change the assessment structure for postgraduates to include an individual research project and team-based learning components which are more industry authentic assessments.

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Topic Quizzes	10%	Week 1, Week 2, Week 4, Week 7, Week 9	1, 2
2. Take-home Assessments	30%		2, 3, 4
3. Application Exercises and Team Quizzes	30%	Week 1, Week 2, Week 3, Week 4, Week 5, Week 7, Week 8, Week 9, Week 10	1, 2, 3, 4
4. Final Exam	30%	During scheduled exam time	1, 2

Assessment 1: Topic Quizzes

Due date: Week 1, Week 2, Week 4, Week 7, Week 9

Individual multiple-choice quizzes covering each of the modules for the course. Feedback will be given via lectures and through the quiz itself. A self-evaluation quiz is also provided prior to the topic quiz.

Assessment 2: Take-home Assessments

Individual take-home assignments with comments feedback provided directly to the assignment.

Assessment 3: Application Exercises and Team Quizzes (Group)

Due date: Week 1, Week 2, Week 3, Week 4, Week 5, Week 7, Week 8, Week 9, Week 10

Students undertake application exercises consisting of submitting written material, computer code or online presentations. Students work in groups throughout the term. Written solutions and model answers will be given after the submission deadline and provided in lecture recordings.

Assessment 4: Final Exam

Due date: During scheduled exam time

Final course exam covering all course content.

Attendance Requirements

Students are expected to attend all classes and tutorials to participate in team work, class quizzes and discussions. Note that **many assessments are conducted in-class, including individual quizzes, application exercises and team quizzes.**

Course Schedule

View class timetable

Timetable

Date	Type	Content
O-Week: 22 May - 26 May	Homework	Preparation work for Module 1 starting next week. Read the lecture notes and watch the introductory video accessible via the Microsoft Team (linked on the Moodle page for the course).
Week 1: 29 May - 2 June	Lecture	**Module 1 Begins (M1. Introduction to Seismic Data)** • Lecture 9-11am UNSW Business School 119 (K-E12-119) • There will be an in class quiz (2%) on pre-readings • Application Exercise 1 (AE1) released
	Tutorial	**Module 1 Ends (M1. Introduction to Seismic Data)** • In person tutorial Friday 10 am - 12 pm, Quadrangle 1043 (K-E15-1043) • Application exercise 1 (AE1) due • AE1 gallery walk and feedback
	Assessment	Topic Quizzes
	Assessment	Application Exercises and Team Quizzes
Week 2: 5 June - 9 June	Lecture	**Module 2 Begins (M2. Seismic Waves)** • There will be an in class quiz (2%) on pre-readings • Quiz feedback and discussion
	Tutorial	**Module 2 Continues (M2. Seismic Waves)** • Application Exercise 2 (AE2) starts
	Assessment	Topic Quizzes
	Assessment	Application Exercises and Team Quizzes

Week 3: 12 June - 16 June	Lecture	**Module 2 Continues (M2. Seismic Waves)** • Application Exercise 2 Part 1 due • AE2 Part 1 Gallery Walk and Feedback
	Tutorial	**Module 2 Ends (M2. Seismic Waves)** • AE2 Part 2 due • AE2 Part 2 Gallery Walk and Feedback
	Assessment	**Take-home 1 released (due Wednesday Week 5)**
	Assessment	Application Exercises and Team Quizzes
Week 4: 19 June - 23 June	Lecture	**Module 3 (Seismic Interpretation)** • There will be an in-class quiz (2%) on pre-readings • Quiz feedback and discussion
	Tutorial	Application Exercise for Module 3 (AE3) starts
	Assessment	Topic Quizzes
	Assessment	Application Exercises and Team Quizzes
Week 5: 26 June - 30 June	Lecture	**Module 3 (Seismic Interpretation) Continues** • AE3 Part 1 due • AE 3 Part 1 - Gallery Walk and Feedback
	Tutorial	• AE3 Part 2 due • AE3 Part 2 Gallery Walk and Feedback
	Assessment	**Take-home 1 (10%) due Wednesday**
	Assessment	Application Exercises and Team Quizzes
Week 7: 10 July - 14 July	Lecture	**Module 4 (Reflection Seismology)** • There will be an in-class quiz (2%) on pre-readings • Quiz feedback and discussion
	Tutorial	Application Exercise for Module 4 starts
	Assessment	Topic Quizzes
	Assessment	Application Exercises and Team Quizzes
Week 8: 17 July - 21 July	Lecture	**Module 4 (Reflection Seismology) Continues** • AE4 - part 1 due • AE4 - Gallery Walk and Feedback

	Tutorial	AE4 - part 2 due AE4 - part 2 gallery walk and feedback
	Assessment	Application Exercises and Team Quizzes
Week 9: 24 July - 28 July	Lecture	**Module 5 (Subsurface Models)** • There will be an in-class quiz (2%) on pre-readings • Quiz feedback and discussion
	Tutorial	Application Exercise for Module 5 (AE5) starts
	Assessment	Topic Quizzes
	Assessment	Application Exercises and Team Quizzes
Week 10: 31 July - 4 August	Lecture	**Module 5 (Subsurface Models) Continues** • AE5 Part 1 due • Application Exercise for Module 5 - Gallery Walk and Feedback
	Tutorial	• AE5 Part 2 due • AE5 - Gallery Walk and Feedback
	Assessment	**Take-home 2 due Wednesday (30% of total)**
	Assessment	Application Exercises and Team Quizzes

Resources

Prescribed Resources

The readings for each module are provided via Leganto Online System

The main reading for the course is Gadallah and Fisher's Exploration Geophysics

Course Evaluation and Development

Feedback from students is obtained after each module and used to improve future modules in the course as well as the course in later years. This year, many assessments have been streamlined and the modules reorganised for a more streamlined learning experience.

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

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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	