

# PTRL4012

Enhanced Oil and Gas Recovery

Term 1, 2022



## Course Overview

### Staff Contact Details

#### Convenors

Name	Email	Availability	Location	Phone
Ryan Armstrong	<a href="mailto:ryan.armstrong@unsw.edu.au">ryan.armstrong@unsw.edu.au</a>	via email	Tyree 243	NA

### School Contact Information

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[Engineering Student Services](#)

E: [mere.teaching@unsw.edu.au](mailto:mere.teaching@unsw.edu.au)

W: [www.engineering.unsw.edu.au/minerals-energy-resources](http://www.engineering.unsw.edu.au/minerals-energy-resources)

## Course Details

### Units of Credit 6

### Summary of the Course

This course introduces the background knowledge in enhanced oil and gas recovery (EOR/EGR) techniques that have been widely applied in petroleum industry and research. The learning outcomes are for the student to (1) gain knowledge and skills needed to solve reservoir engineering problems, (2) apply integrated knowledge of math and basic sciences including physics, chemistry, and microbiology to the solution of problems related to EOR/EGR performance and predictions.

### Course Aims

The aim of this course is to provide insight on enhanced oil recovery; to introduce you to important rock and fluid characteristics; and to assist you in answering key questions related to enhanced oil recovery technologies.

### Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Display the knowledge and skills needed to solve reservoir engineering problems related to enhanced oil recovery.	PE1.2, PE1.3
2. Apply integrated knowledge of math and basic sciences including geosciences to the solution of problems related to EOR/EGR performance predictions.	PE2.1, PE2.2
3. Evaluate and apply the fundamental equations used for modelling EOR/EGR applications.	PE2.3, PE2.4, PE3.2, PE3.4
4. Analyse and apply the basic physics behind EOR/EGR processes and apply frontal advancement models for common EOR techniques.	PE1.1

### Teaching Strategies

UNSW Minerals and Energy Resources Engineering provides blended learning using the on-line Moodle LMS (Learning Management System), tutorials and lectures. It is recommended that you have regular internet access to participate in forum discussion and group work.

## Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Final Exam	50%	Not Applicable	1, 2, 3, 4
2. Homework Problems	16%	Week 11	1, 2, 3, 4
3. Presentation Summary	10%	Week 11	1
4. Quiz 1	24%	Week 7	2, 3, 4

### Assessment 1: Final Exam

The final exam will be administered by the UNSW exam unit. The exam will cover all materials from the course with a focus on materials from Weeks 8 through 10.

### Assessment 2: Homework Problems

**Due date:** Week 11

Engineering problems related to EOR and reservoir engineering skills. Each week there is one problem related to the materials covered in class.

HW1: 2 questions per week for weeks 1-5 (Total 6% of marks)

HW2: 2 questions per week for weeks 6-10 (Total 10% of marks)

### Assessment 3: Presentation Summary

**Due date:** Week 11

Under-graduate students (PTRL 4012 only) are expected to attend all of the post-graduate presentations. Each student will need to select a given presentation and provide a one-page summary. The summary is expected to outline the topic covered during the presentation and highlight how the given technology facilitates the recovery of additional hydrocarbon.

### Assessment 4: Quiz 1

**Due date:** Week 7

One in-class quiz will be conducted during Week 7.

## Attendance Requirements

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

## Course Schedule

UNSW Wk	Activity	Content
1	Lecture + In class activities	<ul style="list-style-type: none"><li>• Course Introduction and Expectations</li><li>• Introduction to EOR</li><li>• <b>Decline Curve Analysis</b></li><li>• <b>Selection Criteria</b></li></ul>
2	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>EOR related Petrophysics</b></li><li>• <b>EOR related Phase Behavior</b></li><li>• <b>Capillary Desaturation Curve</b></li><li>• <b>Ternary Phase Diagrams</b></li></ul>
3	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>Multi-Component and Multi-Phase Systems</b></li><li>• <b>Conservation of Mass</b></li></ul>
4	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>Fractional Flow Theory</b></li><li>• <b>Immiscible and Miscible Displacements</b></li></ul>
5	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>Displacement Efficiency</b></li><li>• <b>Sweep Efficiency</b></li><li>• <b>Mobilization Efficiency</b></li></ul>
6	Flexibility Week	<ul style="list-style-type: none"><li>• <b>Review Sessions</b></li><li>• <b>Help with Homework</b></li></ul>
7	Exam Week	<ul style="list-style-type: none"><li>• <b>Exam covering materials from W1-W5.</b></li></ul>
8	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>Chemical EOR</b></li><li>• <b>Miscibility and Interfacial Tension</b></li><li>• <b>Minimum Miscibility Pressure</b></li><li>• <b>PG Presentations</b></li></ul>
9	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>Polymer EOR</b></li><li>• <b>Mobility number</b></li><li>• <b>Displacement Efficiency</b></li><li>• <b>PG Presentations</b></li></ul>
10	Lecture + In class activities	<ul style="list-style-type: none"><li>• <b>Thermal EOR</b></li><li>• <b>PG Presentations</b></li><li>• <b>Review of Materials</b></li></ul>

## Resources

### Prescribed Resources

All expected resources will be provided on Moodle.

### Recommended Resources

Following are the recommended books for this course.

- Enhanced Oil Recovery, Larry W. Lake, Prentice Hall, 1996, ISBN 978- 01328160143.
- Fundamentals of Reservoir Engineering, L.P. Dake, Developments in Petroleum Science 8, 1978, Elsevier Science, ISBN 0-444-41830.
- Thermal Recovery, Michael Prats, SPE Henry L. Doherty Textbook Series Vol.7, 1985, ISBN 978-0-89520-325-0.
- Other readings will be posted on Moodle.

### Course Evaluation and Development

At the end of each course, all students will have the opportunity to complete a course evaluation form. These anonymous surveys help us understand your views of the course, your lecturers and the course materials. We are continuously improving our courses based on student feedback, and your perspective is valuable.

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

## 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](http://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](http://www.library.unsw.edu.au)

- UNSW Learning Centre - [www.lc.unsw.edu.au](http://www.lc.unsw.edu.au)
- Counselling support - [www.counselling.unsw.edu.au](http://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](http://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](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.

## Academic Information

### Course Results

For details on UNSW assessment policy, please visit: [www.student.unsw.edu.au/assessment](http://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](http://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](http://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](http://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

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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	