UNSW Course Outline

PTRL5010 Natural Gas Engineering - 2024

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General Course Information

Course Code : PTRL5010
Year : 2024
Term : Term 1
Teaching Period : T1
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Minerals & Energy Resources Engineering
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : Kensington
Campus : Sydney
Study Level : Postgraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

In the midst of all the concerted efforts to decarbonise industries, reduce emissions and enhance the use of renewable energy, natural gas still has a major role to play in providing (i) cleaner energy compared to coal and coke, (ii) cheaper source of hydrogen and (iii) building

blocks for petrochemicals critical to our modern economies. This course focusses on three key areas in the development of natural gas and hydrogen projects. First, the course provides an introduction to hydrogen and various types of natural gas resources including conventional and unconventional gas resources. Secondly, the majority of the course examines the thermodynamics of hydrogen and natural gases and the estimation of their behaviour using cubic equations of state. Thirdly, the course explores methods of processing produced gas and getting it to market.

Course Aims

Natural gas and hydrogen are becoming an increasingly important part of Australia's and the world's energy supply. Further, natural gas is put forward as a low emission alternative to other fossil fuels, while hydrogen is seen as the ultimate source of fuel to reduce GHG emissions. An extreme surge in research aiming at producing hydrogen at a competitive cost and the development of technologies to allow the development of unconventional gas resources has further added to the likelihood of having H2 commercially as a fuel and also to the expansion in the supply and demand for natural gas. It is important that Petroleum Engineering graduates understand the technical, economic and social issues at play in the development of hydrogen generation and natural gas resources.

The technical aspects of natural gas developments are covered throughout the Petroleum Engineering Program as part of other reservoir engineering, geology, drilling and production courses. This course complements these other courses by aiming to:

1. Combine students existing knowledge of fluid flow with a thorough grounding in the analysis and prediction of the PVT behaviour of hydrogen and natural gases through the application of the thermodynamic concepts and equations of state by applying these concepts to selected unit operations,
2. Introduce students to the types of natural gas resources and the economic and social context of their development and also to the latest in the race to produce and use hydrogen on a commercial level.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Apply thermodynamic theory to predict & explain the properties and PVT behaviour of hydrogen and natural gases.
CLO2 : Analyse, evaluate and apply preliminary design/analysis calculations for common unit operations in hydrogen and natural gas handling.
CLO3 : Recognise contemporary debates around the development of the various types of hydrogen production and natural gas resources and the role of these resources in the global drive for decarbonisation.
CLO4 : Analyse, evaluate and apply knowledge gained in the course to new contexts including design of gas pipelines, with required compressors, heaters, coolers and separators.

Course Learning Outcomes	Assessment Item
CLO1 : Apply thermodynamic theory to predict & explain the properties and PVT behaviour of hydrogen and natural gases.	• Quiz 1 • Quiz 2 • Final Exam
CLO2 : Analyse, evaluate and apply preliminary design/analysis calculations for common unit operations in hydrogen and natural gas handling.	• Quiz 2 • Final Exam
CLO3 : Recognise contemporary debates around the development of the various types of hydrogen production and natural gas resources and the role of these resources in the global drive for decarbonisation.	• Quiz 1 • Final Exam
CLO4 : Analyse, evaluate and apply knowledge gained in the course to new contexts including design of gas pipelines, with required compressors, heaters, coolers and separators.	• Quiz 2 • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quiz 1 Assessment Format: Individual	25%	Start Date: 06/03/2024 06:00 PM Due Date: 06/03/2024 08:10 PM
Quiz 2 Assessment Format: Individual	25%	Start Date: 10/04/2024 06:00 PM Due Date: 10/04/2024 08:10 PM
Final Exam Assessment Format: Individual	50%	Start Date: Date and time will be set by central exam unit Due Date: Date and time will be set by central exam unit

Assessment Details

Quiz 1

Assessment Overview

A 2-hour mid-term covering material discussed in week 1-4.

The quiz will be marked against given criteria and detailed feedback will be provided to each student within 7-10 days.

Course Learning Outcomes

- CLO1 : Apply thermodynamic theory to predict & explain the properties and PVT behaviour of hydrogen and natural gases.
- CLO3 : Recognise contemporary debates around the development of the various types of hydrogen production and natural gas resources and the role of these resources in the global drive for decarbonisation.

Assessment Length

2 hours

Assignment submission Turnitin type

Not Applicable

Quiz 2

Assessment Overview

A 2-hour test covering material covered in week 5-9.

Quiz will be marked against given criteria and detailed feedback will be provided to each student within 7-10 days.

Course Learning Outcomes

- CLO1 : Apply thermodynamic theory to predict & explain the properties and PVT behaviour of hydrogen and natural gases.
- CLO2 : Analyse, evaluate and apply preliminary design/analysis calculations for common unit operations in hydrogen and natural gas handling.
- CLO4 : Analyse, evaluate and apply knowledge gained in the course to new contexts including design of gas pipelines, with required compressors, heaters, coolers and separators.

Assessment Length

2 hours

Final Exam

Assessment Overview

A final exam covering all material covered throughout the Term.

It will be assessed against given criteria.

Course Learning Outcomes

- CLO1 : Apply thermodynamic theory to predict & explain the properties and PVT behaviour of hydrogen and natural gases.
- CLO2 : Analyse, evaluate and apply preliminary design/analysis calculations for common unit operations in hydrogen and natural gas handling.
- CLO3 : Recognise contemporary debates around the development of the various types of hydrogen production and natural gas resources and the role of these resources in the global drive for decarbonisation.
- CLO4 : Analyse, evaluate and apply knowledge gained in the course to new contexts including design of gas pipelines, with required compressors, heaters, coolers and separators.

Assessment Length

2 hours

Submission notes

The date and time will be set by the Exams central unit

Assignment submission Turnitin type

Not Applicable

General Assessment Information

Grading Basis

Standard

Course Schedule

Attendance Requirements

To pass this course it is expected that you will attend at least 80% of tutorials and lectures.

Failure to meet the specified attendance requirements of the course may result in in the award of an Unsatisfactory Failure (UF) grade for the Course.

Attendance will be recorded when applicable. Normally, there is no make-up work for poor attendance. If you have misadventure or ill-health, please contact your course coordinator soon as possible. The attendance requirement is not meant to be punitive. It is included because participation is an important part of achieving the course outcomes.

General Schedule Information

UNSW Week Activity Content

1. 13th Feb 1x3h lecture, 2x1 h tutorial Course introduction; hydrogen generation and natural gas resources; energy, heat & work. Getting gas to market (gas specifications and processing)
2. 20th Feb 1x3h lecture, 2x1 h tutorial The first law; state functions & reversible processes; heat effects; heating values; greenhouse gases
3. 27th Feb 1x3h lecture, 2x1 h tutorial The second law; entropy; ideal & lost work; material, energy and entropy balances
4. 6th Mar 1x3h lecture, 2x1 h tutorial PVT behaviour of ideal and real gases; reversible cycles for processes
5. 13th Mar 1x3h lecture, 2x1 h tutorial Real equations of state; residual properties and real processes
6. 20th Mar 1x3h lecture, 2x1 h tutorial Flexibility week, 5x1 Consultation-Optional
7. 27th Mar 1x3h lecture, 2x1 h tutorial Onshore transport of natural gas: compressors, turbines and pipelines Transport of hydrogen, examples.
8. 3rd Apr 1x3h lecture, 2x1 h tutorial Vapour-liquid equilibrium and the phase behaviour of natural gases and hydrogen
9. 10th Apr 1x3h lecture, 2x1 h tutorial Water vapour in natural gases; dehydration and hydrate inhibition
10. 17th Apr 1x3h lecture, 2x1 h tutorial Hydrogen generation technologies and possibly valves,

nozzles and chokes in natural gas operations

Course Resources

Recommended Resources

1. Fundamentals of Engineering Thermodynamics by Moran & Shappiro provides a good introduction to thermodynamics and covers much but not all the content covered in this course. The library has 9 copies (621.4021/66).

2. Fundamentals of Natural Gas Processing by Kidnay & Parrish gives a good introduction to the natural gas industry and is available online through the UNSW Library website (http://www.crcnetbase.com/isbn/978-0-8493-3406-1).

3. Students will be suggested additional handbooks and texts related to particular topics covered in the course.

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 have any time during the course – if you have a concern, please contact us immediately.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Hamid Roshan		TBA			No	No
Lecturer	Habib Zughbi		TBA	431746278	M-F 5-6 pm	No	Yes

Other Useful Information

Academic Information

I. Special consideration and supplementary assessment

If you have experienced an illness or misadventure beyond your control that will interfere with your assessment performance, you are eligible to apply for Special Consideration prior to, or within 3 working days of, submitting an assessment or sitting an exam.

Please note that UNSW has a Fit to Sit rule, which means that if you sit an exam, you are declaring yourself fit enough to do so and cannot later apply for Special Consideration.

For details of applying for Special Consideration and conditions for the award of supplementary assessment, please see the information on UNSW's Special Consideration page.

II. Administrative matters and links

All students are expected to read and be familiar with UNSW guidelines and polices. In particular, students should be familiar with the following:

- Attendance
- UNSW Email Address
- Special Consideration
- Exams
- Approved Calculators
- Academic Honesty and Plagiarism
- Equitable Learning Services

III. Equity and diversity

Those students who have a disability that requires some adjustment in their teaching or learning environment are encouraged to discuss their study needs with the course convener prior to, or at the commencement of, their course, or with the Equity Officer (Disability) in the Equitable Learning Services. Issues to be discussed may include access to materials, signers or note-takers, the provision of services and additional exam and assessment arrangements. Early notification is essential to enable any necessary adjustments to be made.

IV. Professional Outcomes and Program Design

Students are able to review the relevant professional outcomes and program designs for their streams by going to the following link: https://www.unsw.edu.au/engineering/student-life/student-resources/program-design.

Note: This course outline sets out the 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 or your primary learning management system (LMS) 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/Moodle/LMS, the description in the Course Outline/Moodle/LMS applies.

Academic Honesty and Plagarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off 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. UNSW has produced a website with a wealth of resources to support students to understand and avoid plagiarism, visit: student.unsw.edu.au/plagiarism. The Learning Centre assists students with understanding academic integrity and how not to plagiarise. They also hold workshops and can help students one-on-one.

You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.

Repeated plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matters (like plagiarism in an honours thesis or contract cheating) even suspension from the university. The Student Misconduct Procedures are available here:

www.gs.unsw.edu.au/policy/documents/studentmisconductprocedures.pdf

Submission of Assessment Tasks

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, per calendar day.

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 clearly 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;
- Exams, peer feedback and team evaluation surveys;
- Online quizzes where answers are released to students on completion;
- Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date; and,
- Pass/Fail assessment tasks.

Faculty-specific Information

Engineering Student Support Services – The Nucleus - enrolment, progression checks, clash requests, course issues or program-related queries

Engineering Industrial Training – Industrial training questions

UNSW Study Abroad – study abroad student enquiries (for inbound students)

UNSW Exchange – student exchange enquiries (for inbound students)

UNSW Future Students – potential student enquiries e.g. admissions, fees, programs, credit transfer

Phone

(+61 2) 9385 8500 – Nucleus Student Hub

(+61 2) 9385 7661 – Engineering Industrial Training

(+61 2) 9385 3179 – UNSW Study Abroad and UNSW Exchange (for inbound students)

School-specific Information

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.

Submission of Assessment Tasks

We encourage you to retain a copy of every assignment submitted for your own record, either in hardcopy or electronic form. All assessments must have an assessment cover sheet attached.

Student Resources

The School has student resources section, containing 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 online Moodle LMS (Learning Management System). Also see - Transitioning to Online Learning: www.covid19studyonline.unsw.edu.au

Note that some specialist engineering software is not available for Mac computers.

- Mining Engineering Students: OMB G48
- Petroleum Engineering Students: TETB LG34 & LG35

For 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

School Contact Information

School of Minerals and Energy Resources
Old Main Building, Level 1, 159 (K15)
UNSW SYDNEY NSW 2052 AUSTRALIA

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