UNSW Course Outline

ENGG9741 Introduction to Nuclear Engineering - 2024

Published on the 04 Sep 2024

General Course Information

Course Code : ENGG9741
Year : 2024
Term : Term 3
Teaching Period : T3
Is a multi-term course? : No
Faculty : Faculty of Engineering
Academic Unit : School of Mechanical and Manufacturing 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

This course provides students with an introduction to the key elements of nuclear engineering. It is aimed at giving students a sufficient background knowledge, understanding and vocabulary to demonstrate what differentiates nuclear engineering from other engineering disciplines, and to

understand later courses on the Nuclear Engineering MEngSci stream.

The course will introduce a wide breadth of topics. These include nuclear fission, reactor physics and engineering, the historical context of nuclear engineering, the impact of radiation on matter, fuel fabrication and the fuel cycle, radioactive wastes and storage methods, reactor accidents, and nuclear safety and licensing.

Students taking this course must have the skills of an Honours level graduate engineer such that they are capable of undertaking self-directed reading and learning in engineering systems, performing individual research, and have the required maths and engineering skills.

Course Aims

The course aims to give students a firm grounding in subjects from radioactivity and nuclear fission to nuclear reactors, fuel production and processing through to nuclear materials, nuclear safety, socio-economic factors and future developments in nuclear engineering.

Course Learning Outcomes

Course Learning Outcomes
CLO1 : Solve simple engineering problems relating to operation of nuclear technologies using nuclear-specific concepts, quantities, units and nomenclature.
CLO2 : Describe the physical processes that govern nuclear fissions, fusion, activation, radioactive decay and radiation-matter interaction.
CLO3 : Identify the key steps in the nuclear fuel cycles and waste management.
CLO4 : Differentiate reactor designs by their features and major components.
CLO5 : Distinguish approaches to nuclear safety and their principles.
CLO6 : Analyse the root cause of historical nuclear accidents using principles of reactor physics, reactor engineering and nuclear safety

Course Learning Outcomes	Assessment Item
CLO1 : Solve simple engineering problems relating to operation of nuclear technologies using nuclear-specific concepts, quantities, units and nomenclature.	• Final written examination
CLO2 : Describe the physical processes that govern nuclear fissions, fusion, activation, radioactive decay and radiation-matter interaction.	• Formative quizzes • Final written examination
CLO3 : Identify the key steps in the nuclear fuel cycles and waste management.	• Formative quizzes • Final written examination
CLO4 : Differentiate reactor designs by their features and major components.	• Essay
CLO5 : Distinguish approaches to nuclear safety and their principles.	• Formative quizzes • Final written examination
CLO6 : Analyse the root cause of historical nuclear accidents using principles of reactor physics, reactor engineering and nuclear safety	• Final written examination

Learning and Teaching Technologies

Moodle - Learning Management System

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Final written examination Assessment Format: Individual	55%	Start Date: Not Applicable Due Date: Not Applicable
Essay Assessment Format: Individual	15%	Start Date: Not Applicable Due Date: Week 9: 04 November - 10 November
Formative quizzes Assessment Format: Individual	30%	Due Date: Week 4: 30 September - 06 October, Week 8: 28 October - 03 November

Assessment Details

Final written examination

Assessment Overview

A final written exam. 2 hour long, pen-and-paper, and closed-book.

The exam will contain a mix of short answer questions, numerical calculations, and questions requiring longer descriptive answer. The paper contains two parts: in part one all questions must be answered correctly to attain full marks. In part two, the students will have the choice of answering only some of the available questions.

Marks will be provided for completeness and correctness of answers.

Course Learning Outcomes

- CLO1 : Solve simple engineering problems relating to operation of nuclear technologies using nuclear-specific concepts, quantities, units and nomenclature.
- CLO2 : Describe the physical processes that govern nuclear fissions, fusion, activation, radioactive decay and radiation-matter interaction.
- CLO3 : Identify the key steps in the nuclear fuel cycles and waste management.
- CLO5 : Distinguish approaches to nuclear safety and their principles.
- CLO6 : Analyse the root cause of historical nuclear accidents using principles of reactor physics, reactor engineering and nuclear safety

Detailed Assessment Description

Demonstrated mastery of learning outcomens 1-6. This will be assessed through an examination of both depth and breadth of understanding of the content delivered in this course, in it's entirety. The criteria includes completness, directness and correctness of the response to both focussed and open eneded questions.

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

Essay

Assessment Overview

A technical essay providing a critical discussion on specific advanced and historical reactor designs. The topics change every year and are released in week 6. Sometimes these are timely and topical to the wider discourse in the international nuclear community, other times these re-assess events or designs from the past.

The essays will be less than 4 A4 pages length. A marking rubric, guide and detailed specifications, including word count, are issued together with the topics.

Course Learning Outcomes

- CLO4 : Differentiate reactor designs by their features and major components.

Detailed Assessment Description

A technical essay providing a critical discussion on a nuclear process, a historical nuclear accident, or recent developments in nuclear technology designs.

Assessment Length

4 pages of A4

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students do not see Turnitin similarity reports.

Generative AI Permission Level

Simple Editing Assistance

In completing this assessment, you are permitted to use standard editing and referencing

functions in the software you use to complete your assessment. These functions are described below. You must not use any functions that generate or paraphrase passages of text or other media, whether based on your own work or not.
If your Convenor has concerns that your submission contains passages of AI-generated text or media, you may be asked to account for your work. If you are unable to satisfactorily demonstrate your understanding of your submission you may be referred to UNSW Conduct & Integrity Office for investigation for academic misconduct and possible penalties.
For more information on Generative AI and permitted use please see here.

Formative quizzes

Assessment Overview

Two online formative quizzes, of 1 hour duration, or less.

Question types will include multiple-choice questions, numerical calculations, and short text answers. Quizzes typically contain 20-30 questions, and students may consult their notes, however the timing of the quiz is designed such that extensive consultation of resources is ill-advised.

Quiz 1 takes place in week 4 and covers the content of weeks 1-4. Quiz 2 takes place in week 7 or 8 (depending on public holidays and guest speaker availability) and covers the content of weeks 4-7.

Course Learning Outcomes

- CLO2 : Describe the physical processes that govern nuclear fissions, fusion, activation, radioactive decay and radiation-matter interaction.
- CLO3 : Identify the key steps in the nuclear fuel cycles and waste management.
- CLO5 : Distinguish approaches to nuclear safety and their principles.

Detailed Assessment Description

Two online quizzes, requiring both descriptive and technical calculations. They will assess on all the material up to the week prior to the assessment, unless otherwise specified by the course convenor.

Each quiz consist of a selection of multiple choice questions, numerical calculations, and short answer questions.

You will be marked on the completeness and correctness of your answers. This is an individual assessment.

Assessment Length

~ 1 hr

Assignment submission Turnitin type

Not Applicable

Generative AI Permission Level

No Assistance

This assessment is designed for you to complete without the use of any generative AI. You are not permitted to use any generative AI tools, software or service to search for or generate information or answers.
For more information on Generative AI and permitted use please see here.

General Assessment Information

Grading Basis

Standard

Course Schedule

Attendance Requirements

Please note that lecture recordings are not available for this course. Students are strongly encouraged to attend all classes and contact the Course Authority to make alternative arrangements for classes missed.

Course Resources

Recommended Resources

either (or both) of these texts:

Introduction to Nuclear Engineering Author: Lamarsh and Baratta
ISBN: 978-0201824988
Publisher: Prentice Hall

Basic Nuclear Engineering
Author: Foster and Wright
ISBN: 978-0205078868
Publisher: Allyn and Bacon

Course Evaluation and Development

Feedback on the course is gathered periodically using various means, including the UNSW myExperience process, informal discussion in the final class for the course, and the School's Student/Staff meetings. Your feedback is taken seriously, and continual improvements are made to the course based, in part, on such feedback.

In this course, recent improvements resulting from student feedback include rescheduling classes to avoid 3-hour blocks ending at 9 pm and increasing the number of questions and examples throughout the course. In-class quizzes (with no marks) have been retained and increased given the exceptionally positive student reception.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Patrick Burr					No	Yes
Lecturer	Edward Obbard					No	No

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

Short Extensions

Short extensions are not currently applicable to Mechanical and Manufacturing Engineering Courses.

Review of Results

If you believe that there has been a marking error, you can request a review of results. Review of results cannot be used to get feedback.

If you would like feedback for assessments, you are welcome to contact the course convenor directly.

Use of AI

The use of AI is prohibited unless explicitly permitted by the course convenor. Please respect this and be aware that penalties will apply when unauthorised use is detected, such as through Turnitin. If the use of generative AI, such as ChatGPT, is allowed in a specific assessment, they must be properly credited, and your submissions must be substantially your own work.

Final Exam in Exam Period

For courses with a centrally timetabled final exam, students must be available for the entire exam period from Mon-Sat until your exact exam date is confirmed.

School Contact Information

Location

UNSW Mechanical and Manufacturing Engineering

Ainsworth building J17, Level 1

Above Coffee on Campus

Hours

9:00–5:00pm, Monday–Friday*

*Closed on public holidays, School scheduled events and University Shutdown

Web

School of Mechanical and Manufacturing Engineering

Engineering Student Support Services

Engineering Industrial Training

UNSW Study Abroad and Exchange (for inbound students)

UNSW Future Students

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)

(+61 2) 9385 4097 – School Office**

**Please note that the School Office will not know when/if your course convenor is on campus or available

Email

Engineering Student Support Services – current student enquiries

- e.g. enrolment, progression, 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

School Office – School general office administration enquiries

- NB: the relevant teams listed above must be contacted for all student enquiries. The School will only be able to refer students on to the relevant team if contacted

Important Links

- Student Wellbeing
- Urgent Mental Health & Support
- Equitable Learning Services
- Faculty Transitional Arrangements for COVID-19
- Moodle
- Lab Access
- Computing Facilities
- Student Resources
- Course Outlines
- Makerspace
- UNSW Timetable
- UNSW Handbook