UNSW Course Outline

ZEIT3507 Applied Thermodynamics and Propulsion - 2024

Published on the 30 Jun 2024

General Course Information

Course Code : ZEIT3507
Year : 2024
Term : Semester 2
Teaching Period : Z2
Is a multi-term course? : No
Faculty : UNSW Canberra
Academic Unit : School of Engineering and Technology
Delivery Mode : In Person
Delivery Format : Standard
Delivery Location : UNSW Canberra at ADFA
Campus : UNSW Canberra
Study Level : Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

Most people understand aircrafts fly due to the lift generated by the wings. But do you know that without thrust producing devices, wings are of no use? In this course, we will use thermodynamic analysis to study power generation cycles that produce thrust. Analysis of ideal and real engines

will be carried out using cold-air-standard and air-standard approaches, respectively.

A second compelling question is whether a single propulsion system is sufficient to propel an aircraft at a range of speeds. To answer this question, the course will delve deeply into propellers and gas turbine engines and provide an introduction to supersonic and hypersonic propulsion systems.

Within the context of engineering, this course will study the design considerations of individual components of a gas turbine engine, namely, the inlet, the compressor, the combustor, the turbine, and the nozzle.

Course Aims

The primary aim of this course is to understand the operation of different types of gas turbine engines and being able to estimate their performance parameters.

Relationship to Other Courses

Prerequisite: ZEIT2500 and ZEIT2503

This course builds upon the knowledge and learning developed in **ZEIT2500 Thermofluids, ZEIT2503 Fluid Mechanics and ZEIT3503 Aerodynamics.**

Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Understand the principles of operation of the different types of propulsive engines, select the range of applications for different engines and provide a technical justification for their selection.	• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline • PEE1.5 : Knowledge of engineering design practice and contextual factors impacting the engineering discipline
CLO2 : Apply principles of fluid dynamics and thermodynamics to solve a range of isolated and integrated propulsion problems.	• PEE2.1 : Application of established engineering methods to complex engineering problem solving • PEE2.2 : Fluent application of engineering techniques, tools and resources
CLO3 : Analyse ideal and real thermodynamic cycles of gas turbine engines.	• PEE1.2 : Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline • PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline
CLO4 : Evaluate the performance of engines, and engine components for a variety of design and operating parameters.	• PEE2.3 : Application of systematic engineering synthesis and design processes • PEE3.2 : Effective oral and written communication in professional and lay domains

Course Learning Outcomes	Assessment Item
CLO1 : Understand the principles of operation of the different types of propulsive engines, select the range of applications for different engines and provide a technical justification for their selection.	• Quiz 1 • Final Exam
CLO2 : Apply principles of fluid dynamics and thermodynamics to solve a range of isolated and integrated propulsion problems.	• Quiz 2 • Final Exam
CLO3 : Analyse ideal and real thermodynamic cycles of gas turbine engines.	• Assignment • Quiz 2 • Final Exam
CLO4 : Evaluate the performance of engines, and engine components for a variety of design and operating parameters.	• Assignment • Final Exam

Learning and Teaching Technologies

Moodle - Learning Management System | Echo 360

Learning and Teaching in this course

The teaching in this unit is based around integrating theory with practice via a series of lectures, tutorials, and real-world assignments.

The following strategies will be employed:

- *Weekly lecture sessions to present main theoretical concepts. These sessions will involve in-class activities. There will be some live demonstrations of simple engines.*
- *Formative quizzes during the tutorial sessions to track class and individual performance.*
- *Weekly guided and interactive tutorial sessions where students will practice applying knowledge, develop an engineering approach to problem solving and teaching others.*

The Learning Management System

Moodle is the Learning Management System used at UNSW Canberra. All courses have a Moodle site which will become available to students at least one week before the start of semester. Please find all help and documentation (including Blackboard Collaborate) at the Moodle Support page.

UNSW Moodle supports the following web browsers:

» Google Chrome 50+
» Safari 10+
** Internet Explorer is not recommended

** Addons and Toolbars can affect any browser's performance.

Operating systems recommended are:

Windows 7, 10, Mac OSX Sierra, iPad IOS10

For further details about system requirements click here.

Log in to Moodle here.

If you need further assistance with Moodle:

For enrolment and login issues please contact:

IT Service Centre

Email: itservicecentre@unsw.edu.au

Phone: (02) 9385-1333

International: +61 2 9385 1333

For all other Moodle issues please contact:

External TELT Support

Email: externalteltsupport@unsw.edu.au

Phone: (02) 9385-3331

International: +61 2 938 53331

Opening hours:

Monday – Friday 7:30am – 9:30 pm

Saturday & Sunday 8:30 am – 4:30pm

Other Professional Outcomes

Not applicable.

Additional Course Information

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. All students are expected to adhere to UNSW's Student Code of Conduct https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Plagiarism undermines academic integrity and is not tolerated at UNSW. *It is defined as using the words or ideas of others and passing them off as your own, and* can take many forms, from deliberate cheating to accidental copying from a source without acknowledgement.

For more information, please refer to the following:

https://student.unsw.edu.au/plagiarism

Referencing

In this course, students are required to reference following the APA 7 / Chicago NB referencing

style. Information about referencing styles is available at: https://guides.lib.unsw.adfa.edu.au/c.php?g=472948&p=3246720

Study at UNSW Canberra

https://www.unsw.adfa.edu.au/study

Study at UNSW Canberra has lots of useful information regarding:

- Where to get help
- Administrative matters
- Getting your passwords set up
- How to log on to Moodle
- Accessing the Library and other areas.

Additional Information as required

CRICOS Provider no. 00098G

The University of New South Wales Canberra.

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quiz 1 Assessment Format: Individual	15%	Start Date: 30/07/2024 12:00 PM Due Date: 30/07/2024 01:00 PM
Final Exam Assessment Format: Individual	50%	Start Date: Not Applicable Due Date: Not Applicable
Quiz 2 Assessment Format: Individual	15%	Start Date: 24/09/2024 12:00 PM Due Date: 24/09/2024 01:00 PM
Assignment Assessment Format: Group	20%	Start Date: 27/09/2024 05:00 PM Due Date: 18/10/2024 11:59 PM

Assessment Details

Quiz 1

Assessment Overview

In-class quiz aims to evaluate CLO1.

Course Learning Outcomes

- CLO1 : Understand the principles of operation of the different types of propulsive engines, select the range of applications for different engines and provide a technical justification for their selection.

Detailed Assessment Description

Class Quiz 1 will be held in week 3. Grades and Individual feedback will be provided to the students on their test papers while group feedback will be given during the lecture in Week 4.

Assessment Length

50 minutes

Submission notes

Paper based quiz

Assessment information

Please read the announcement on Moodle.

Assignment submission Turnitin type

Not Applicable

Final Exam

Assessment Overview

Final exam to evaluate all CLOs of the course.

Course Learning Outcomes

- CLO1 : Understand the principles of operation of the different types of propulsive engines, select the range of applications for different engines and provide a technical justification for their selection.
- CLO2 : Apply principles of fluid dynamics and thermodynamics to solve a range of isolated and integrated propulsion problems.
- CLO3 : Analyse ideal and real thermodynamic cycles of gas turbine engines.
- CLO4 : Evaluate the performance of engines, and engine components for a variety of design and operating parameters.

Detailed Assessment Description

To obtain a passing grade in this course, you must achieve and overall mark of 50% and a minimum mark of 40% on the final exam.

Assessment Length

120 minutes

Submission notes

Paper based exam.

Assessment information

Please read the announcement about the final exam on the course Moodle page.

Assignment submission Turnitin type

Not Applicable

Hurdle rules

To obtain a passing grade in this course, you must achieve a minimum mark of 40% on the final exam.

Quiz 2

Assessment Overview

In-class quiz aims to evaluate CLO2 and CLO3.

Course Learning Outcomes

- CLO2 : Apply principles of fluid dynamics and thermodynamics to solve a range of isolated and integrated propulsion problems.
- CLO3 : Analyse ideal and real thermodynamic cycles of gas turbine engines.

Detailed Assessment Description

Class Quiz 2 will be held in week 9. Grades and Individual feedback will be provided to the students on their test papers while group feedback will be given during the lecture in Week 10.

Assessment Length

50 minutes

Submission notes

Paper based quiz

Assessment information

Please read the announcement on Moodle.

Assignment submission Turnitin type

Not Applicable

Assignment

Assessment Overview

A Group Assessment to evaluate CLO3 and CLO4.

Course Learning Outcomes

- CLO3 : Analyse ideal and real thermodynamic cycles of gas turbine engines.
- CLO4 : Evaluate the performance of engines, and engine components for a variety of design and operating parameters.

Detailed Assessment Description

Students will work collaboratively in groups of 3 or 4 on this assignment and same grades will be awarded to all the group members.

Submission notes

Group Assignment

Assessment information

For this assessment task, you may use standard editing and referencing software, but not Generative AI. You are permitted to use the full capabilities of the standard software to answer the question (e.g., you may wish to specify software such as Microsoft Office suite, Grammarly, etc.).

If the use of generative AI such as ChatGPT is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

Assignment submission Turnitin type

This assignment is submitted through Turnitin and students can see Turnitin similarity reports.

General Assessment Information

All marks obtained for assessment items during the session are provisional. The final mark as published by the university following the assessment review group meeting is **the only official mark.**

Detailed descriptions of assessment items, including submission requirements and grading criteria will be released on Moodle.

Late Submission of assessment

Unless prior arrangement is made with the course convener or a formal application for special consideration is submitted, a penalty of 5% of the total available mark for the assessment will apply for each day that an assessment item is late up to a maximum of 5 days (120 hours) after which an assessment can no longer be submitted and a grade of 0 will be applied.

Grading Basis

Standard

Requirements to pass course

To obtain a passing grade in this course, you must achieve a minimum overall mark of 50% and a minimum mark of 40% on the final exam.

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 15 July - 19 July	Lecture	Propellers and Thrust
	Tutorial	Propellers and Thrust
Week 2 : 22 July - 26 July	Lecture	Ideal Gas Turbine Cycle
	Tutorial	Ideal Gas Turbine Cycle
Week 3 : 29 July - 2 August	Lecture	Ideal Gas Turbine Cycle
	Tutorial	Ideal Gas Turbine Cycle
	Assessment	Quiz 1 - 15% (30/07/2024)
Week 4 : 5 August - 9 August	Lecture	Feedback on Quiz 1 and Introduction to Gas Turb software.
	Tut-Lab	Assembly of Gas Turbine components - Activity 1
Week 5 : 12 August - 16 August	Lecture	Real Gas Turbines
	Tutorial	Real Gas Turbines
Week 6 : 19 August - 23 August	Lecture	Real Gas Turbines
	Tutorial	Real Gas Turbine cycle
	Assessment	Release of Assignment.
Week 7 : 9 September - 13 September	Lecture	Jet Engine and Development
	Tutorial	Real Gas Turbine cycle
Week 8 : 16 September - 20 September	Lecture	Intakes and Nozzles.
	Tutorial	Intakes and Nozzles
Week 9 : 23 September - 27 September	Lecture	Intakes and Nozzles
	Assessment	Quiz 2 - 15% (24/09/2024)
	Tutorial	Intakes and Nozzles.
Week 10 : 30 September - 4 October	Lecture	Turbofans, Turboshafts and Turboprops.
	Tutorial	Turbofans, Turboshafts and Turboprops.
	Assessment	Assignment due end of Week 10.
Week 11 : 7 October - 11 October	Lecture	Turbofans, Turboshafts and Turboprops.
	Tutorial	Turbofans, Turboshafts and Turboprops.
Week 12 : 14 October - 18 October	Lecture	Overall performance and High speed Propulsion.
	Tutorial	Overall performance.
	Assessment	Assignment due (18/10/2024)
Week 13 : 21 October - 25 October	Lecture	High speed propulsion and Wrap up.
	Tutorial	High speed propulsion.

Attendance Requirements

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

General Schedule Information

Lectures

Monday *14:00 – 16:00* *Z-32-LT09*

Tuesday *12:00 – 13:00* *Z-32-LT07*

Tutorial/Lectures

Wednesday *10:00 – 12:00* Z-30-LT04

Friday *10:00 – 12:00* Z-30-LT04

Compensation/Military training days - S2 2024

Military Training Day Fri 18 Aug Compensation Day: Friday 16 August classes to be delivered on Tuesday 13 August. Tuesday 13 August lost.

Military Training Day Wed 18 Sep Wednesday lost

Labour Day Mon 7 Oct Monday lost

Military Training Day Thu 10 Oct Thursday lost

Military Training Day Fri 11 Oct Friday lost

Course Resources

Prescribed Resources

A course website is available on Moodle. Copies of the lecture notes, assessable materials, tutorials, and other resources will be distributed on this site. Please check Moodle regularly for updates.

Prescribed textbook: Saravanamuttoo. HIH et al., Gas Turbine Theory, Prentice Hall (any edition).

Other texts, papers, and websites will be mentioned during the course. The lecturer will be free to

use the most appropriate material for the subject at hand. The students will ultimately be responsible for the material presented in class, through Moodle, and required reading.

Recommended Resources

Oates, Gordon: Aerothermodynamics of gas turbine and rocket propulsion. AIAA Education Series (any edition).

Cumpsty, Nicholas, Jet Propulsion, Cambridge University Press (any edition).

Sutton, George, Rocket Propulsion Elements, Wiley (any edition).

Most of the above books are available as e-books through SearchFirst (Knovel).

Additional Costs

Not applicable.

Course Evaluation and Development

Your feedback matters!

We've used your feedback to make some improvements.

Previous students told us:

1. Review of thermodynamics.

2. More worked solutions would be useful.

3. Make the quizes worth more (like 15%).

We have responded to this feedback by:

1. We will provide notes and summary slides on these topics.

2. We included lots of numerical problems to be solved in the class.

3. Quizzes are now 15% each.

One of the key priorities in the 2025 Strategy for UNSW is a drive for academic excellence in education. One of the ways of determining how well UNSW is progressing towards this goal is by

listening to our own students. Students will be asked to complete the myExperience survey towards the end of this course.

Students can also provide feedback during the semester via: direct contact with the lecturer, the "On-going Student Feedback" link in Moodle, Student-Staff Liaison Committee meetings in schools, informal feedback conducted by staff, and focus groups. Student opinions really do make a difference. Refer to the Moodle site for this course to see how the feedback from previous students has contributed to the course development.

Important note: Students are reminded that any feedback provided should be constructive and professional and that they are bound by the Student Code of Conduct Policy

https://www.gs.unsw.edu.au/policy/documents/studentcodepolicy.pdf

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Krishna Tall uru Murali		Room 202, BLDG 16	02 5114 5331	I am usually available for consultation during normal working hours. Please email me to make an appointment.	No	Yes
Lecturer	Andrew Nee ly		Room 361, BLDG 21	02 5114 5637	I am usually available for consultation during normal working hours. Please email me to make an appointment.	No	No
Tutor	Jisheng Zh ao		Room 365, Building 21	02 5114 5307	I am usually available for consultation during normal working hours. Please email me to make an appointment.	No	No