



## UNSW Course Outline

# ZEIT2500 Thermofluids - 2024

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## General Course Information

**Course Code :** ZEIT2500

**Year :** 2024

**Term :** Semester 1

**Teaching Period :** Z1

**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

Have you ever wondered, “how many hair dryers it takes to launch into space? Or pondered if it is possible to reverse the effects of climate change with air conditioning?” These captivating questions serve as the entry point into the world of ThermoFluids - an intricate intersection of thermodynamics and fluid mechanics that has captivated engineers for centuries. In the pursuit

of economical and efficient solutions, engineers have grappled with challenges like generating power, transferring heat and energy, and constructing fluid-immersed structures such as airplanes, dams, wind turbines, and bridges. As we propel into the future, the next generation of engineers will harness their expertise to design innovative devices and unravel solutions to unforeseen problems, making this course an essential exploration of the foundational knowledge required for analysing and designing cutting-edge equipment and technologies.

Within the context of engineering, this course delves deep into the profound impact of ThermoFluids. From unravelling the fundamental properties of fluids to exploring their dynamic motion, students gain invaluable insights into the intricate interplay between thermodynamics and fluid mechanics. The application of the first and second laws of thermodynamics to scenarios like closed and open systems, along with the examination of simple thermodynamic cycles, equips students with the skills needed to navigate real-world challenges. These compelling questions not only spark curiosity but also encourage students to explore the limitless possibilities within the captivating realm of ThermoFluids.

## Course Aims

The overarching objectives of this course are designed to empower students with the essential skills and knowledge necessary to address core challenges in energy transfer and basic fluid flow problem-solving. Specifically, the aims of this course are:

- 1. Establish a Foundation in Thermodynamics Fundamentals:** Instil a solid understanding of the fundamentals of thermodynamics, encompassing the governing laws that underpin this crucial discipline.
- 2. Lay the Groundwork for Fluid Mechanics Principles:** Provide a foundational grasp of the fundamental principles of fluid mechanics, including the key laws governing fluid flow, fostering a comprehensive comprehension of fluid behaviour.
- 3. Enhance Problem-Solving Proficiency in ThermoFluids:** Develop comprehension and proficiency of students in applying fundamental ThermoFluids principles to solve simple to complex problems.
- 4. Cultivate Engineering Problem-Solving and Critical Thinking Skills:** Foster the development of students' engineering approach to problem-solving and critical thinking, enabling them to apply both new and existing knowledge to address challenges within the realm of ThermoFluids.

## Relationship to Other Courses

ZEIT1503 is a prerequisite for this course.

This course is a prerequisite for several other courses, namely, ZEIT2503, ZEIT3503, ZEIT3507, ZEIT3701, ZEIT4500, ZEIT4508, and ZEI4502.

# Course Learning Outcomes

Course Learning Outcomes	Engineers Australia - Professional Engineer (Stage 1)
CLO1 : Define the thermodynamic state of a fluid system.	<ul style="list-style-type: none"> <li>• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</li> </ul>
CLO2 : Calculate the operating conditions of engineering processes using thermodynamics principles.	<ul style="list-style-type: none"> <li>• PEE2.1 : Application of established engineering methods to complex engineering problem solving</li> </ul>
CLO3 : Analyse the performance of power generating engines.	<ul style="list-style-type: none"> <li>• PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline</li> <li>• PEE2.3 : Application of systematic engineering synthesis and design processes</li> </ul>
CLO4 : Define foundational concepts of fluid mechanics (Hydrostatic pressure, Bernoulli equation and conservation of mass and momentum).	<ul style="list-style-type: none"> <li>• PEE1.1 : Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline</li> </ul>
CLO5 : Apply control volume analysis to fluid-mechanical systems.	<ul style="list-style-type: none"> <li>• PEE2.2 : Fluent application of engineering techniques, tools and resources</li> </ul>
CLO6 : Integrate fluid mechanics principles to study forces on offshore structures.	<ul style="list-style-type: none"> <li>• PEE1.3 : In-depth understanding of specialist bodies of knowledge within the engineering discipline</li> <li>• PEE2.3 : Application of systematic engineering synthesis and design processes</li> <li>• PEE3.2 : Effective oral and written communication in professional and lay domains</li> </ul>

Course Learning Outcomes	Assessment Item
CLO1 : Define the thermodynamic state of a fluid system.	
CLO2 : Calculate the operating conditions of engineering processes using thermodynamics principles.	
CLO3 : Analyse the performance of power generating engines.	
CLO4 : Define foundational concepts of fluid mechanics (Hydrostatic pressure, Bernoulli equation and conservation of mass and momentum).	
CLO5 : Apply control volume analysis to fluid-mechanical systems.	
CLO6 : Integrate fluid mechanics principles to study forces on offshore structures.	

# Learning and Teaching Technologies

Moodle - Learning Management System

## Learning and Teaching in this course

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](mailto: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](mailto: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

## **Additional Course Information**

### **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
Lab Reports Assessment Format: Group	10%	
Group Assignments Assessment Format: Group	20%	Due Date: Group Assignment 1: 03/05/2024 11:59 PM; Group Assignment 2: 31/05/2024 11:59 PM
Tutorial Competencies Assessment Format: Individual	10%	
Final Exam Assessment Format: Individual	50%	Due Date: Exam week
Class Quizzes Assessment Format: Individual	10%	Due Date: Class quiz 1: 15/3; class quiz 2: 17/5

## Assessment Details

### Lab Reports

#### Assessment Overview

Two Lab Reports, worth 5% each

#### Detailed Assessment Description

- Lab report 1 will assess learning outcome, LO1.
- Lab report 2 will assess learning outcome, LO4.

Lab reports will be submitted as a group submission within a week after your lab session. The grades will be awarded based on the individual contributions (as agreed and signed by the group members).

*Thermo lab: Weeks 5 – 8*

*Fluids lab: Weeks 9 - 12*

#### Assignment submission Turnitin type

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

### Group Assignments

#### Assessment Overview

n/a

### Detailed Assessment Description

Group Assignment 1 will assess LO2 and LO3.

Group Assignment 2 will assess LO4 and LO6.

Two group assignments are of equal weights, worth 10% each.

The group assignment will be submitted in groups, and the grades will be awarded based on the individual contributions (as agreed and signed by the group members).

### Assignment submission Turnitin type

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

## **Tutorial Competencies**

### Assessment Overview

Due in the weekly tutorial. A minimum of 10 tutorial sessions to be attended.

### Detailed Assessment Description

Tutorial competencies will assess all the learning outcomes but in a relaxed environment of tutorial sessions.

### Assignment submission Turnitin type

This is not a Turnitin assignment

## **Final Exam**

### Assessment Overview

n/a

### Detailed Assessment Description

Final Exam will assess LO2, LO3, LO5 and LO6.

### Assignment submission Turnitin type

Not Applicable

## **Class Quizzes**

### Assessment Overview

Two class quizzes, worth 5% each

### Detailed Assessment Description

Class Quiz 1 will assess LO1 and LO2.

Class Quiz 2 will assess LO4 and LO5.

### Assignment submission Turnitin type

Not Applicable

## 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**. Assessments have been designed to encourage and support your learning and consists of mix of group and individual assessment items that reflect professional engineering practice and skills. Detailed descriptions of assessment items, including individual and group components, tasks, submission requirements and grading criteria will be released on Moodle.

Feedback in this course will be provided in a timely and appropriate manner through a range of formative exercises and class discussions, comments on summative assessment work and generic comments to the cohort. Mechanisms for providing feedback can include both verbal and written, formal and informal. All feedback provided is aimed at benefiting and enhancing student learning and engagement.

### Late Submission of Assessment

Unless a prior arrangement is made with the course convenor of a formal application for special consideration is submitted, a penalty of 5% of the mark for the assessment item 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.

### Feedback on Assessment tasks

All the assessment tasks will be graded and individual feedback will be provided to students within 10 business days. The first class quiz will be held in week 3 and feedback will be provided to students during week 4. This is to facilitate an early constructive feedback to students about their performances and support will be offered to needy students.

### Use of Generative AI in Assessments

## SIMPLE EDITING ASSISTANCE

For the assessment tasks of lab reports and assignments, 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 complete the tasks (e.g., you may wish to specify software such as Microsoft Office suite, Grammarly, etc.). If the use of generative AI such as ChatGPT or Google Bard is detected, it will be regarded as serious academic misconduct and subject to the standard penalties, which may include 00FL, suspension and exclusion.

### Grading Basis

Standard

### Requirements to pass course

To obtain a passing grade in this course, you must attain a minimum cumulative mark of 40% in both the fluids and thermodynamics components and an overall mark of 50% or higher.

## Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 26 February - 1 March	Lecture	<ul style="list-style-type: none"><li>• Overview of the course contents, course schedule and the assessments - Krishna Talluru.</li><li>• A review of differential and integral calculus - Krishna Talluru.</li><li>• Introduction to Visual Studio code - David Petty.</li></ul>
Week 2 : 4 March - 8 March	Lecture	The theory of Pure substances - David Petty.
Week 3 : 11 March - 15 March	Lecture	First Law of Thermodynamics for a closed system - David Petty.
	Assessment	Class Quiz 1 during the Friday Lecture. Venue details will be provided on Moodle.
Week 4 : 18 March - 22 March	Lecture	First law of Thermodynamics for an open system - David Petty.
Week 5 : 25 March - 29 March	Lecture	Second Law of Thermodynamics - David Petty.
Week 6 : 1 April - 5 April	Lecture	Entropy & Isentropic Processes - David Petty.
Week 7 : 22 April - 26 April	Lecture	Cycles: Otto & Diesel - David Petty.
Week 8 : 29 April - 3 May	Lecture	Cycles: Brayton & Rankine - David Petty.
	Assessment	Thermodynamics Group Assignment is due at the end of Week 8 (Friday 23:59).
Week 9 : 6 May - 10 May	Lecture	Introduction to Fluid properties and Hydrostatics - Krishna Talluru.
Week 10 : 13 May - 17 May	Lecture	Hydrostatics & Bernoulli Equation - Krishna Talluru.
	Assessment	Class Quiz 2 during the Friday lecture in Week 10.
Week 11 : 20 May - 24 May	Lecture	Conservation of mass and momentum - Krishna Talluru.
Week 12 : 27 May - 31 May	Lecture	Reynolds transport theorem - Krishna Talluru.
	Assessment	Fluids Group Assignment is due at the end of Week 12 (Friday 23:59).
Week 13 : 3 June - 7 June	Lecture	Applications of mass and momentum conservation equations - Krishna Talluru.

## Attendance Requirements

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

# General Schedule Information

Scheduled contact times are:

## **Lectures**

*Tuesday, 10:00 – 11:50, LT01*

*Thursday, 10:00 – 11:50, LT07*

*Friday, 11:00 – 11:50, LT07*

## **Tutorials**

*Tuesday, 14:10 – 16:00, Z-32-SR04*

*Thursday, 14:10 – 16:00, Z-15-152*

*Friday, 13:10 – 15:00, Z-15-152*

## **Labs** (Check your individual timetable)

*Thermo lab: Weeks 5 – 8*

*Fluids lab: Weeks 9 - 12*

*Students must attend the assigned tutorial and lab sessions. Lab reports will be due within a week after the lab.*

# Course Resources

## Prescribed Resources

### Compulsory textbook

Cengel, Y. A., Cimbala, J. M and Turner, R. H. (2017) Fundamentals of Thermal-Fluid Sciences (5<sup>th</sup> Edition in SI units)

## Recommended Resources

## Course Evaluation and Development

**Your feedback matters!**

We've used the past feedback to make some improvements.

**Previous students told us:**

1. Students wanted more activities in class and tutorials.
2. More support in the tutorials.
3. Difficulties with calculus problems in the course.
4. More time on the conservation of mass and momentum equations.

**We have responded to this feedback by:**

1. We will have lots of activities (poll questions, slido quizzes, think-pair-share, one minute paper, etc.) and group work (interactive visual studio code) and informal quizzes in the tutorials.
2. Lecturers will conduct the tutorial sessions to help students with solving tutorial problems.
3. We will have review classes on differential and integral calculus in the first week of the semester.
4. We have reserved three weeks on the topics of mass and momentum conservation equations, and included lots of numerical problems to be solved in the class.
5. Friday's lecture will be devoted to solving numerical problems throughout the course.

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

## Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Talluru Murali Krishna		Room 202, BLDG 16	+61 2 5114 5331	Available for consultation during Friday's lecture.	No	Yes
Lecturer	David Petty		Room 127, BLDG 17	+61 2 5114 5393	Available for consultation during Friday's lecture	No	No
Demonstrator	Lily Attwood				Available for consultation only during the lab.	No	No
	Nick Heath				Available for consultation only during the lab.	No	No

## Other Useful Information

### Academic Information

#### Course Evaluation and Development

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 each 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 (where applicable). Student opinions really do make a difference. Refer to the Moodle site for your 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.

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

#### Equitable Learning Services (ELS)

Students living with neurodivergent, physical and/or mental health conditions or caring for someone with these conditions may be eligible for support through the Equitable Learning

Services team. Equitable Learning Services is a free and confidential service that provides practical support to ensure your mental or physical health conditions do not adversely affect your studies.

Our team of dedicated **Equitable Learning Facilitators** (ELFs) are here to assist you through this process. We offer a number of services to make your education at UNSW easier and more equitable.

Further information about ELS for currently enrolled students can be found at: <https://www.student.unsw.edu.au/equitable-learning>

## Academic Honesty 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. Find relevant information at: [Student Code of Conduct \(unsw.edu.au\)](https://www.student.unsw.edu.au/student-code-of-conduct)

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>

## Submission of Assessment Tasks

### Special Consideration

Special Consideration is the process for assessing and addressing the impact on students of short-term events, that are beyond the control of the student, and that affect performance in a specific assessment task or tasks.

Applications for Special Consideration will be accepted in the following circumstances only:

- Where academic work has been hampered to a substantial degree by illness or other cause;
- The circumstances are unexpected and beyond the student's control;
- The circumstances could not have reasonably been anticipated, avoided or guarded against by the student; and either:

(i) they occurred during a critical study period and was 3 consecutive days or more duration, or a total of 5 days within the critical study period; or

(ii) they prevented the ability to complete, attend or submit an assessment task for a specific date (e.g. final exam, in class test/quiz, in class presentation)

Applications for Special Consideration must be made as soon as practicable after the problem occurs and at the latest within three working days of the assessment or the period covered by the supporting documentation.

By sitting or submitting the assessment task the student is declaring that they are fit to do so and cannot later apply for Special Consideration (UNSW 'fit to sit or submit' requirement).

Sitting, accessing or submitting an assessment task on the scheduled assessment date, after applying for special consideration, renders the special consideration application void.

Find more information about special consideration at: <https://www.student.unsw.edu.au/special/consideration/guide>

Or apply for special consideration through your [MyUNSW portal](#).

### **Late Submission of assessment tasks (other than examinations)**

UNSW has a standard late submission penalty of:

- 5% per day,
- capped at five days (120 hours) from the assessment deadline, after which a student cannot submit an assessment, and
- no permitted variation.

Students are expected to manage their time to meet deadlines and to request extensions as early as possible before the deadline.

### **Electronic submission of assessment**

Except where the nature of an assessment task precludes its electronic submission, all assessments must be submitted to an electronic repository, approved by UNSW or the Faculty, for archiving and subsequent marking and analysis.

### **Release of final mark**

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.