



MECH3610

Advanced Thermofluids

Term Two // 2021

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Charitha de Silva	c.desilva@unsw.edu.au	Contact via Microsoft Teams Chat	J17 Ainsworth Building Room 311/H	Teams

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

Course Details

Credit Points 6

Summary of the Course

This course further develops foundational Thermofluids concepts first introduced in Thermodynamics and Fluid Mechanics courses. This course is split into 1 large component and 2 small components:

- Heat transfer
- Advanced fluids
- Gas mixtures & combustion.

Course Aims

The heat transfer component of the course aims to teach students the basic concepts of heat transfer, units, dimensions and exchange mechanisms. This includes steady-state conduction, multi-dimensional conduction and radiative heat transfer. Knowledge of these areas will be applied to heat exchanger and cooling fin design, which will include experiments on heat transfer mechanisms to validate theoretical calculations. Advanced fluids will also be covered, including the structure of boundary layers, internal and external laminar flow and turbulent forced convection. Also covered are compressible flows and shocks. Finally, non-reacting gas mixtures/combustion and their energy release will be covered.

The aim of covering these smaller topics is to prepare students for later electives within the course of mechanical engineering and to raise a fundamental awareness of these fields for those who do not take the elective extension subjects later in their program.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Apply steady state and transient conduction, convection and radiation modes of heat transfer to idealized analysis cases. Extend this analysis to the particular cases of heat exchangers and cooling fins.	PE1.3, PE2.1
2. Undertake compressible flow analysis and assess whether compressibility needs to be considered for a stated case.	PE1.2, PE1.3
3. Undertake thermodynamic analysis of gas mixtures /combustion and their energy release	PE1.2, PE1.3, PE1.6

Teaching Strategies

Lectures are designed to cover the theoretical aspects of the course listed in the course schedule. Students are encouraged to attend and actively participate to gain the greatest understanding from these lectures.

The textbooks are recommended reading throughout the course to supplement the theory covered in

class.

Problem solving sessions provide the opportunity for students to test their conceptual framework on problems.

The laboratories focus on the Heat Transfer component of the course and provide students with the opportunity to compare specific parts of the theory to practical results in a controlled environment. This is to encourage students to consider the practical implications of their theoretical learning.

The assignment will cover theory from the second half of the course and give students the opportunity to research a specific area of engineering knowledge in depth.

Discussions via Teams provide an opportunity to further explore and discuss content. Students are encouraged to seek other learning resources and share them on the forums for the benefit of all via Microsoft Teams.

Assessment

Assessment Tasks

Assessment task	Weight	Due Date	Student Learning Outcomes Assessed
Formative Quiz	N/A	25/06/2021	1
Mid Term Exam	30%	01/07/2021	1
Laboratory Report	20%	16/07/2021	1
Assignment	15%	30/07/2021	2
Final Exam	35%	Exam Period, date TBC	2, 3

Assessment Details

Assessment 1: Formative Quiz

Start date: 21/06/2021

Length: 2 hours

Details:

There will be a Moodle quiz held in Week 4 to give students the opportunity to verify that they have understood the material so far. This quiz has a zero percent (0%) weighting and does not contribute to your overall course mark; however, students are encouraged to participate. It is intended that the style and difficulty of the Moodle quiz will be representative of that in the Mid Term exam – although marking and feedback comments will be automatically applied by computer marking.

- Individual submission and marks returned after completion
- Deadline for absolute fail: N/A

Submission notes: Via Moodle

Turnitin setting: This is not a Turnitin assignment

Assessment 2: Mid Term Exam

Start date: 01/07/2021

Length: 2 Hours

Details:

- Test covering heat transfer component of the course.

- Assessment criteria: Understanding of Heat Transfer content delivered.
- Individual submission and marks returned two weeks after submission
- Deadline for absolute fail: N/A

Submission notes: Via Moodle

Turnitin setting: This is not a Turnitin assignment

Assessment 3: Laboratory Report

Start date: 14/06/2021

Length: 10 pages

Details:

- Validation of theory with practical laboratory exercises including a laboratory report.
- Assessment criteria: Demonstrating heat transfer theory knowledge and data analysis through writing a laboratory report
- Individual submission and marks returned two weeks after submission
- Deadline for absolute fail: 5 days after the due date.

Submission notes: Via Moodle

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

Assessment 4: Assignment

Start date: 05/07/2021

Length: 10 pages

Details:

- Assignment focusing on fluids the component of course
- Assessment criteria: Advanced Fluids, material from weeks 5-7.
- Individual submission and marks returned two weeks after submission
- Deadline for absolute fail: 5 days after the due date.

Submission notes: Via Moodle

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

Assessment 5: Final Exam

Start date: Not Applicable

Details:

- Test covering fluids, mixtures and combustion component of the course.
- Assessment criteria: Final exam testing material from weeks 5 to 10
- Individual submission and Marks returned upon release of final results
- Deadline for absolute fail: N/A

Submission notes: Via Moodle

Turnitin setting: This is not a Turnitin assignment

Attendance Requirements

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

Course Schedule

[View class timetable](#)

Timetable

Date	Type	Content
O Week: 25 May - 28 May		
Week 1: 31 May - 4 June	Lecture	Introduction / Conduction Topics: Heat Transfer Overview; Units and Dimensions; Conduction
Week 2: 7 June - 11 June	Lecture	Conduction and Transience Topics: 1D Steady-State Conduction; Extended Fins; Lumped Capacitance Method.
Week 3: 14 June - 18 June	Lecture	Convection Topics: Forced / Free (Natural) Convection
	Tut-Lab	Labs: See Moodle for further details Topic: Convection
Week 4: 21 June - 25 June	Lecture	Heat Exchangers / Radiation Topic: Heat Exchanger Types; LMTD method; Blackbody Radiation
	Tut-Lab	Labs: See Moodle for further details Topic: Heat Exchangers
Week 5: 28 June - 2 July	Lecture	Radiation / Fluids Topic: Radiative Heat Transfer / Compressible Flow
	Assessment	Mid-Term Exam Covers material from Heat Transfer component of the course
Week 7: 12 July - 16 July	Lecture	Fluids Topic: Mach Number / Stagnation Flow conditions; Nozzles;
Week 8: 19 July - 23 July	Lecture	Fluids

		Topics: Normal shocks; Oblique shocks
Week 9: 26 July - 30 July	Lecture	Mixtures / Combustion Topic: Ideal Gas Mixtures; Partial Pressures
Week 10: 2 August - 6 August	Lecture	Mixtures / Combustion Topic: Chemical Equation Balancing; Heat of Combustion; Adiabatic Flame Temperature

Resources

Recommended Resources

ÇG: *Heat and Mass Transfer, Fundamentals and Applications*, 5th/6th Edition in SI Units by Yunus Çengel and Afshin Ghajar

A: *Fundamentals of Aerodynamics*, 6th Edition by John Anderson

ÇB: *Thermodynamics, An Engineering Approach*, 8th Edition in SI Units by Yunus Çengel and Michael Boles

UNSW Library website: <https://www.library.unsw.edu.au/>

Moodle: <https://moodle.telt.unsw.edu.au/login/index.php/>

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 restructuring the course to group the heat transfer material and related content which may be useful to a graduate engineer in industry. Also, online classes and communication is via Microsoft Teams.

Laboratory Workshop Information

Details will be provided on Moodle

Submission of Assessment Tasks

Assessment submission and marking criteria

Should the course have any non-electronic assessment submission, these should have a standard School cover sheet.

All submissions are expected to be neat and clearly set out. Your results are the pinnacle of all your hard work and should be treated with due respect. Presenting results clearly gives the marker the best chance of understanding your method; even if the numerical results are incorrect.

Marking guidelines for assignment submissions will be provided at the same time as assignment details to assist with meeting assessable requirements. Submissions will be marked according to the marking guidelines provided.

Late policy

Work submitted late without an approved extension by the course coordinator or delegated authority is subject to a late penalty of 20 percent (20%) 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.

Work submitted after the 'deadline for absolute fail' is not 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 are clearly indicated in the course outline, and such assessments receive a mark of zero if not completed by the specified date. Examples include:

1. Weekly online tests or laboratory work worth a small proportion of the subject mark, or
2. Online quizzes where answers are released to students on completion, or
3. Professional assessment tasks, where the intention is to create an authentic assessment that has an absolute submission date, or
4. Pass/Fail assessment tasks.

Examinations

You must be available for all quizzes, tests and examinations. For courses that have final examinations, these are held during the University examination periods: February for Summer Term, May for T1, August for T2, and November/December for T3.

Please visit myUNSW for Provisional Examination timetable publish dates. For further information on exams, please see the [Exams](#) webpage.

Special Consideration

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 submitting an assessment or sitting an exam.

UNSW now has a [Fit to Sit / Submit rule](#), which means that if you attempt an exam or submit a piece of assessment, 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](#).

Please note that students will **not** be required to provide **any** documentary evidence to support absences from any classes missed **because of COVID-19 public health measures such as isolation**. UNSW will **not** be insisting on medical certificates from anyone deemed to be a positive case, or when they have recovered. Such certificates are difficult to obtain and put an unnecessary strain on students and medical staff.

Applications for special consideration **will** be required for assessment and participation absences – but no documentary evidence **for COVID 19 illness or isolation** will be required.

Academic Honesty and Plagiarism

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.

If plagiarism is found in your work when you are in first year, your lecturer will offer you assistance to improve your academic skills. They may ask you to look at some online resources, attend the Learning Centre, or sometimes resubmit your work with the problem fixed. However more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.

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) even suspension from the university. The Student Misconduct Procedures are available here:

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

Academic Information

Credit points

Course credit is calculated in Units-Of-Credit (UOC). The normal workload expectation for one UOC is approximately 25 hours per term. This includes class contact hours, private study, other learning activities, preparation and time spent on all assessable work.

Most coursework courses at UNSW are 6 UOC and involve an estimated 150 hours to complete, for both regular and intensive terms. Each course includes a prescribed number of hours per week (h/w) of scheduled face-to-face and/or online contact. Any additional time beyond the prescribed contact hours should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

On-campus class attendance

Public distancing conditions must be followed for all face-to-face classes. To ensure this, only students enrolled in those classes will be allowed in the room. No over-enrolment is allowed in face-to-face classes. Students enrolled in online classes can swap their enrolment from online to a **limited** number of on-campus classes by Sunday, Week 1. Please refer to your course's Microsoft Teams and Moodle sites for more information about class attendance for in-person and online class sections/activities.

Your health and the health of those in your class is critically important. You must stay at home if you are sick or have been advised to self-isolate by [NSW health](#) or government authorities. Current alerts and a list of hotspots can be found [here](#). **You will not be penalised for missing a face-to-face activity due to illness or a requirement to self-isolate.** We will work with you to ensure continuity of learning during your isolation and have plans in place for you to catch up on any content or learning activities you may miss. Where this might not be possible, an application for fee remission may be discussed. Further information is available on any course Moodle or Teams site.

In certain classroom and laboratory situations where physical distancing cannot be maintained or there is a high risk that it cannot be maintained, face masks will be considered **mandatory PPE** for students and staff.

For more information, please refer to the FAQs: <https://www.covid-19.unsw.edu.au/safe-return-campus-faqs>

Guidelines

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

- [Attendance](#)
- [UNSW Email Address](#)
- [Special Consideration](#)
- [Exams](#)
- [Approved Calculators](#)
- [Academic Honesty and Plagiarism](#)

Important Links

- [Moodle](#)
- [Lab Access](#)
- [Computing Facilities](#)
- [Student Resources](#)
- [Course Outlines](#)
- [Faculty Transitional Arrangements for COVID-19](#)
- [Makerspace](#)
- [UNSW Timetable](#)
- [UNSW Handbook](#)
- [Equitable Learning Services](#)

Image Credit

Synergies in Sound 2016

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	