MECH4880

Refrigeration and Air Conditioning 1

Term 3, 2022

Course Overview

Staff Contact Details

Convenors

Name	Email	Availability	Location	Phone
Chris Menictas	c.menictas@unsw.edu.au		Room 402F, Mechanical and Manufacturing Engineering	(02) 9385 6269

Demonstrators

Name	Email	Availability	Location	Phone
Hengrui Liu	h.liu@unsw.edu.au			
Fernand Werdi	f.werdi@unsw.edu.au			
Zen Athawale	z.athawale@student.unsw.edu.au			

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

Course Details

Units of Credit 6

Summary of the Course

This course introduces the student to the terminology, principles and methods used in refrigeration and air conditioning.

The aim of this course is to take your knowledge of thermodynamics further, and in a much more general fashion, than you obtained in your first course in thermodynamics. In particular, to extend your theoretical background of the thermodynamics of refrigeration and air conditioning.

The term air conditioning implies the creation and maintenance of an atmosphere having such conditions of: (i) temperature, (ii) humidity, (iii) air circulation and (iv) air purity, as to produce the desired effects upon the occupants or materials (or both) in a given space. It is the simultaneous control of all these four factors within required limits which defines an air conditioning system.
Refrigeration is the control of the environment, e.g. air conditioning, cold room, refrigerators, display cabinets etc., and involves the use of refrigeration in one form or another.

Course Learning Outcomes

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

Learning Outcome	EA Stage 1 Competencies
1. Be familiar with the terminology associated with refrigeration & air conditioning	PE1.3
2. Apply the basic principles of psychrometry and applied psychrometrics	PE1.1
3. Undertake system analysis and mathematical modelling	PE1.1, PE1.2
4. Perform load calculations and elementary duct design	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE3.2, PE3.5
5. Understand the function of refrigerants and the components in vapour compression refrigeration systems	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2
6. Analyse the performance of vapour compression systems and other types of cooling systems	PE1.1, PE1.2, PE1.3, PE1.5, PE2.1, PE2.2, PE2.4

Teaching Strategies

There are two online forums for participation in this class. The first is Moodle and the second and main platform is the MECH4880 Teams site hosted in Microsoft Teams. All official online content will be linked clearly and appropriately from these sites.
Presentation of the material will be through lectures, workshops and laboratory sessions so that students know how to approach complex engineering calculations in addition, real-world engineering examples will be presented to provide an understanding for how refrigeration and air conditioning is applied in

industry.

Additional Course Information

The normal workload expectations of a student are approximately 25 hours per term for each UOC, including class contact hours, other learning activities, preparation and time spent on all assessable work. You should aim to spend about 12 h/w on this course. The additional time should be spent in making sure that you understand the lecture material, completing the set assignments, further reading, and revising for any examinations.

The following assumed knowledge is expected for postgraduate students undertaking this course: MMAN2700 Thermodynamics (Understanding of thermodynamic principles and evaluation of thermodynamic properties of real fluids)

Assessment

Assessment task	Weight	Due Date	Course Learning Outcomes Assessed
1. Quiz	20%	Week 4	1, 2, 3
2. Building Heat Load Estimation	40%	Part A Monday Week 7, Part B Friday Week 10	1, 2, 3, 4
3. Assignment 2	10%	Tuesday Week 9	1, 2, 3, 4, 5, 6
4. Final Examination	30%	Not Applicable	1, 2, 4, 5, 6

Assessment 1: Quiz

Due date: Week 4
Marks returned: Two weeks after submission.

The quiz assesses the understanding of the lecture material covered in Weeks 1-3.

Assessment 2: Building Heat Load Estimation

Due date: Part A Monday Week 7, Part B Friday Week 10
Deadline for absolute fail: Part A Saturday Week 7, Part B Wednesday Week 11
Marks returned: Two weeks after submission.

This assignment involves calculation of heat loads and designing of a HVAC system for a commercial building. Technical content, design capability and report writing skills will be assessed.

Assessment 3: Assignment 2

Due date: Tuesday Week 9
Deadline for absolute fail: Sunday Week 9
Marks returned: Two weeks after submission.

This assignment involves analysis of an air conditioning system and laboratory demonstration.

Assessment 4: Final Examination

Assessment length: 2 hours

The exam assesses all course content from weeks 1-10.

Attendance Requirements

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

Course Schedule

View class timetable

Timetable

Date	Type	Content
Week 1: 12 September - 16 September	Lecture	Introduction, Psychrometry, Applied Psychrometrics
Week 2: 19 September - 23 September	Lecture	Air Conditioning
Week 3: 26 September - 30 September	Lecture	Cooling and Heating Loads
Week 4: 3 October - 7 October	Assessment	Quiz
Week 5: 10 October - 14 October	Workshop	Demonstration of Heat Load Estimation Software
Week 6: 17 October - 21 October	-- Select --	No Lecture
Week 7: 24 October - 28 October	Lecture	Components of Vapour Compression Systems and System Modelling and Refrigerants
	Laboratory	Air conditioning and refrigeration systems demonstration
Week 8: 31 October - 4 November	Lecture	Vapour Compression Refrigeration
Week 9: 7 November - 11 November	Lecture	Multi-Stage Vapour Compression Systems
Week 10: 14 November - 18 November	Lecture	Other Types of Cooling Systems and Revision

Resources

Prescribed Resources

- *Load Estimation and Psychrometrics: Application Manual DA9*. Australian Institute of Refrigeration, Air-conditioning and Heating. *(available for purchase in the bookshop)*
- F.C. McQuiston, D. Parker and J.D. Spitler, *Heating, Ventilation, and Air Conditioning: Analysis and Design*, 6th Edition, John Wiley & Sons Inc., 2005 *(available for purchase in the bookshop and available in the UNSW library).*

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 additional guest lectures to provide an industry perspective and case studies during various lectures. Recent changes also include a reduction in the scope and workload associated with assignment 1.

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 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 example:

- Your course has an assessment task worth a total of 100 marks (Max Possible Mark)
- You submit the assessment on time and you get 60/100 (Awarded Mark)
- You submit the assessment 1 day late and the late penalty of 5% per day is applied (5% deducted/day from maximum possible mark for that assessment item)
- Your adjusted final score is 55/100.

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.

Special Consideration Outcomes

Assessments have default Special Consideration outcomes. The default outcome for the assessment will be advised when you apply for Special Consideration. Below is the list of possible outcomes:

Outcome	Explanation	Example
Time extension	Student provided more time to submit the assessment	e.g. 1 more week of time granted to submit a report
Supplementary assessment	Student provided an alternate assessment at a later date/time	e.g. a supplementary exam is scheduled during the supplementary exam period of the term
Substitute item	The mark for the missed assessment is substituted with the mark of another assessment	e.g. mark for Quiz 1 applied also applied as mark for Quiz 2, meaning if a student achieved a mark of 20/30 for Quiz 1 and was granted Special Consideration for Quiz 2, a mark of 20/30 would be applied for Quiz 2, etc
Exemption	All course marks are recalculated excluding this assessment and its weighting	e.g. The course has an assessment structure of: - Assignments 30%, - Lab report 30%, - Final Exam 40%. If the Lab report is missed and student is granted Special Consideration, then the assessment structure may be reweighted as follows: - Assignments 50% - Final Exam 50% as though the Lab report did not exist
Non-standard	Course Coordinator is contacted for the outcome when special consideration is granted as the outcome differs on a case-by-case basis	e.g. typical for group assessments where time extension supplementary assessment could be granted to the group member, time extension could be granted to the whole group, etc. Clarify with your Course Convenor for

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

****T3-2022 UPDATE****

Any offshore students who cannot attend activities which are timetabled to be delivered face to face are advised to contact the course convenor to discuss their options. In most courses coordinated by the School of Mechanical and Manufacturing Engineering, especially core courses, there is usually an online alternative.

- -

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 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 polices. In particular, students should be familiar with the following:

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

Note: This course outline sets out 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 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 (as updated in Moodle), the description in the Course Outline/Moodle applies.

Image Credit

Photo of the inside of a Dubai Metro station

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	