UNSW Course Outline

MECH4880 Refrigeration and Air Conditioning 1 - 2024

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General Course Information

Course Code : MECH4880
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, Undergraduate
Units of Credit : 6

Useful Links

Handbook Class Timetable

Course Details & Outcomes

Course Description

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

Course Learning Outcomes
CLO1 : Be familiar with the terminology associated with refrigeration & air conditioning
CLO2 : Apply the basic principles of psychrometry and applied psychrometrics
CLO3 : Undertake system analysis and mathematical modelling
CLO4 : Perform load calculations and elementary duct design
CLO5 : Understand the function of refrigerants and the components in vapour compression refrigeration systems
CLO6 : Analyse the performance of vapour compression systems and other types of cooling systems

Course Learning Outcomes	Assessment Item
CLO1 : Be familiar with the terminology associated with refrigeration & air conditioning	• Quiz • Building Heat Load Estimation • Assignment 2 • Final Examination
CLO2 : Apply the basic principles of psychrometry and applied psychrometrics	• Quiz • Building Heat Load Estimation • Assignment 2 • Final Examination
CLO3 : Undertake system analysis and mathematical modelling	• Quiz • Building Heat Load Estimation • Assignment 2 • Final Examination
CLO4 : Perform load calculations and elementary duct design	• Building Heat Load Estimation • Assignment 2 • Final Examination
CLO5 : Understand the function of refrigerants and the components in vapour compression refrigeration systems	• Assignment 2 • Final Examination
CLO6 : Analyse the performance of vapour compression systems and other types of cooling systems	• Assignment 2 • Final Examination

Learning and Teaching Technologies

Moodle - Learning Management System | Microsoft Teams

Learning and Teaching in this course

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.

Other Professional Outcomes

https://www.unsw.edu.au/engineering/student-life/student-resources/program-design

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).

Assessments

Assessment Structure

Assessment Item	Weight	Relevant Dates
Quiz Assessment Format: Individual	20%	
Building Heat Load Estimation Assessment Format: Individual	40%	
Assignment 2 Assessment Format: Individual	10%	
Final Examination Assessment Format: Individual	30%	

Assessment Details

Quiz

Assessment Overview

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

Course Learning Outcomes

- CLO1 : Be familiar with the terminology associated with refrigeration & air conditioning
- CLO2 : Apply the basic principles of psychrometry and applied psychrometrics
- CLO3 : Undertake system analysis and mathematical modelling

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.

Building Heat Load Estimation

Assessment Overview

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.

Course Learning Outcomes

- CLO1 : Be familiar with the terminology associated with refrigeration & air conditioning
- CLO2 : Apply the basic principles of psychrometry and applied psychrometrics
- CLO3 : Undertake system analysis and mathematical modelling
- CLO4 : Perform load calculations and elementary duct design

Assignment submission Turnitin type

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

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.

Assignment 2

Assessment Overview

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

Course Learning Outcomes

- CLO1 : Be familiar with the terminology associated with refrigeration & air conditioning
- CLO2 : Apply the basic principles of psychrometry and applied psychrometrics
- CLO3 : Undertake system analysis and mathematical modelling
- CLO4 : Perform load calculations and elementary duct design
- CLO5 : Understand the function of refrigerants and the components in vapour compression refrigeration systems
- CLO6 : Analyse the performance of vapour compression systems and other types of cooling systems

Assignment submission Turnitin type

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

Generative AI Permission Level

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Final Examination

Assessment Overview

Assessment length: 2 hours

The exam assesses all course content.

Course Learning Outcomes

- CLO1 : Be familiar with the terminology associated with refrigeration & air conditioning
- CLO2 : Apply the basic principles of psychrometry and applied psychrometrics
- CLO3 : Undertake system analysis and mathematical modelling

- CLO4 : Perform load calculations and elementary duct design
- CLO5 : Understand the function of refrigerants and the components in vapour compression refrigeration systems
- CLO6 : Analyse the performance of vapour compression systems and other types of cooling systems

Assessment Length

2 hours

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

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 Friday 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: Friday 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.

Grading Basis

Standard

Course Schedule

Teaching Week/Module	Activity Type	Content
Week 1 : 9 September - 15 September	Lecture	Introduction, Psychrometry, Applied Psychrometrics
Week 2 : 16 September - 22 September	Lecture	Air Conditioning
Week 3 : 23 September - 29 September	Lecture	Cooling and Heating Loads
Week 4 : 30 September - 6 October	Assessment	Quiz
Week 5 : 7 October - 13 October	Workshop	Demonstration of Heat Load Estimation Software
Week 6 : 14 October - 20 October	Other	No Lecture
Week 7 : 21 October - 27 October	Lecture	Components of Vapour Compression Systems and System Modelling and Refrigerants Laboratory Air conditioning and refrigeration systems demonstration
Week 8 : 28 October - 3 November	Lecture	Vapour Compression Refrigeration
Week 9 : 4 November - 10 November	Lecture	Multi-Stage Vapour Compression Systems
Week 10 : 11 November - 17 November	Lecture	Other Types of Cooling Systems and Revision

Attendance Requirements

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

Course Resources

Prescribed Resources

- Load Estimation and Psychrometrics: Application Manual DA9. Australian Institute of Refrigeration, Air-conditioning and Heating. (available via AIRAH student membership or 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 from AIRAH or purchase in the bookshop)

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 air conditioning modelling, extra industry talks 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 and tours of new HVAC facilities on campus.

Staff Details

Position	Name	Email	Location	Phone	Availability	Equitable Learning Services Contact	Primary Contact
Convenor	Chris Menictas		Room 402F, Mechanical and Manufacturing Engineering	(02) 9385 6269		No	Yes
Head demonstrator	Harvey Ling					No	No
Demonstrator	Svetlana Tkachenko					No	No
	Xinjie Guan					No	No
	Hengrui Liu					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