



# MECH4002

## Energy Sustainable Design

Session 2, In person-scheduled-weekday, North Ryde 2024

*School of Engineering*

### Contents

<u>General Information</u>	2
<u>Learning Outcomes</u>	2
<u>General Assessment Information</u>	3
<u>Assessment Tasks</u>	4
<u>Delivery and Resources</u>	7
<u>Unit Schedule</u>	7
<u>Policies and Procedures</u>	7
<u>Changes from Previous Offering</u>	9
<u>Engineers Australia Competency Mapping</u>	9

#### Disclaimer

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## General Information

Unit convenor and teaching staff

Convenor

Dr Ann Lee

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Contact via Email

Room 132 Level 1, 44 Waterloo Rd, Macquarie Park

By appointment

Credit points

10

Prerequisites

((MECH3001 or MECH301) and (MECH3002 or MECH302)) or admission to MEngMechEng

Corequisites

Co-badged status

Unit description

This unit examines energy sustainable design processes, energy efficiency, heating, ventilation and air-conditioning systems design. The unit also covers knowledge in psychrometric analysis, heating and cooling load calculations, air-conditioning equipment selection, duct design methods, concepts of refrigeration and its applications, refrigeration cycles, refrigeration compressors, condensers, evaporators, expansion devices, vapour compression system design and analysis. At the end of the unit, students are expected to demonstrate a thorough and detailed understanding of the design of highly efficient heating ventilation and airconditioning (HVAC) systems.

## Important Academic Dates

Information about important academic dates including deadlines for withdrawing from units are available at <https://www.mq.edu.au/study/calendar-of-dates>

## Learning Outcomes

On successful completion of this unit, you will be able to:

**ULO1:** Demonstrate comprehensive knowledge of energy sustainable design processes

**ULO2:** Demonstrate clear analytical and critical thinking ability in the design of real-world HVAC systems by applying integrative knowledge in the field of fluid mechanics, thermodynamics and heat transfer.

**ULO3:** Analyse refrigeration and air-conditioning cycles and apply critical knowledge to improve the design and optimization of HVAC systems performances.

**ULO4:** Demonstrate specific skills in project management, teamwork and transformative capabilities relevant to enhance employability including the demonstration of professional dispositions such as ethical stance.

## General Assessment Information

Student must achieve at least a 50% aggregate grade in order to obtain a passing grade (P/CR/D/HD).

### Notifications

Formal notification of assessment tasks, grading rubrics and due dates will be posted on iLearn. Although all reasonable measures to ensure the information is accurate, the University reserves the right to make changes without notice. Each student is responsible for checking iLearn for changes and updates.

### Assignment Tasks and Group Project

Assignment Problems will be posted on iLearn at least two weeks before their submission date. Assignment solutions will be demonstrated by teaching staff within a week after the submission date in the practical class. Submissions will not be accepted once the solution is given.

All assignments must be submitted electronically through iLearn (in pdf format). Submissions are expected to be typed set in a logical layout and sequence. Markers WILL NOT grade poorly organised or illegible scans or drafts. The expected workload includes preparation of final copies and clear diagrams.

Group project must be submitted in a group report format with the percentage indication of individual contribution.

### Late Assessment Submission Penalty

From 1 July 2022, Students enrolled in Session based units with written assessments will have the following university standard late penalty applied. Please see <https://students.mq.edu.au/study/assessment-exams/assessments> for more information.

Unless a Special Consideration request has been submitted and approved, a 5% penalty (of the total possible mark) will be applied each day a written assessment is not submitted, up until the 7th day (including weekends). After the 7th day, a grade of '0' will be awarded even if the assessment is submitted. Submission time for all written assessments is set at 11:55 pm. A 1-hour grace period is provided to students who experience a technical concern.

For any late submission of time-sensitive tasks, such as scheduled tests/exams, performance assessments/presentations, and/or scheduled practical assessments/labs, students need to submit an application for Special Consideration.

### Assessments where Late Submissions will be accepted

In this unit, late submissions will accepted as follows: ·

Assessments I, II and group project– YES, Standard Late Penalty applies

The unit will be graded according to the Macquarie University Grading policy. The following grades will be used according to the listed numerical range:

HD	High Distinction	85-100
D	Distinction	75-84
Cr	Credit	65-74
P	Pass	50-64
F	Fail	0-49

## Assessment Tasks

Name	Weighting	Hurdle	Due
<u>Midterm Examination</u>	20%	No	Week 7
<u>Assignments</u>	20%	No	Week 7, Week 11
<u>Final examination</u>	40%	No	Exam Period
<u>Group Project</u>	20%	No	Week 13

### Midterm Examination

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 1 hours

Due: **Week 7**

Weighting: **20%**

A 1-hour test assessing material delivered between weeks 1 and 6.

On successful completion you will be able to:

- Demonstrate comprehensive knowledge of energy sustainable design processes
- Demonstrate clear analytical and critical thinking ability in the design of real-world HVAC systems by applying integrative knowledge in the field of fluid mechanics, thermodynamics and heat transfer.
- Analyse refrigeration and air-conditioning cycles and apply critical knowledge to improve

the design and optimization of HVAC systems performances.

- Demonstrate specific skills in project management, teamwork and transformative capabilities relevant to enhance employability including the demonstration of professional dispositions such as ethical stance.

## Assignments

Assessment Type <sup>1</sup>: Problem set

Indicative Time on Task <sup>2</sup>: 30 hours

Due: **Week 7, Week 11**

Weighting: **20%**

Two individual assignments will test the student's understanding of the course material taught up to the point each assignment is distributed. The student is expected to solve problems which test both the concepts taught as well as the technical capabilities of the students in doing energy sustainable design. These assignments must be completed individually.

On successful completion you will be able to:

- Demonstrate comprehensive knowledge of energy sustainable design processes
- Demonstrate clear analytical and critical thinking ability in the design of real-world HVAC systems by applying integrative knowledge in the field of fluid mechanics, thermodynamics and heat transfer.
- Analyse refrigeration and air-conditioning cycles and apply critical knowledge to improve the design and optimization of HVAC systems performances.
- Demonstrate specific skills in project management, teamwork and transformative capabilities relevant to enhance employability including the demonstration of professional dispositions such as ethical stance.

## Final examination

Assessment Type <sup>1</sup>: Examination

Indicative Time on Task <sup>2</sup>: 3 hours

Due: **Exam Period**

Weighting: **40%**

Final examination assessing all material delivered throughout the course

On successful completion you will be able to:

- Demonstrate comprehensive knowledge of energy sustainable design processes
- Demonstrate clear analytical and critical thinking ability in the design of real-world HVAC systems by applying integrative knowledge in the field of fluid mechanics, thermodynamics and heat transfer.
- Analyse refrigeration and air-conditioning cycles and apply critical knowledge to improve the design and optimization of HVAC systems performances.
- Demonstrate specific skills in project management, teamwork and transformative capabilities relevant to enhance employability including the demonstration of professional dispositions such as ethical stance.

## Group Project

Assessment Type <sup>1</sup>: Project

Indicative Time on Task <sup>2</sup>: 30 hours

Due: **Week 13**

Weighting: **20%**

Students will be divided to a group of 5. Each group will be given a topic and required to perform heating/cooling load calculation and design in group report format.

On successful completion you will be able to:

- Demonstrate comprehensive knowledge of energy sustainable design processes
- Demonstrate clear analytical and critical thinking ability in the design of real-world HVAC systems by applying integrative knowledge in the field of fluid mechanics, thermodynamics and heat transfer.
- Analyse refrigeration and air-conditioning cycles and apply critical knowledge to improve the design and optimization of HVAC systems performances.
- Demonstrate specific skills in project management, teamwork and transformative capabilities relevant to enhance employability including the demonstration of professional dispositions such as ethical stance.

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<sup>1</sup> If you need help with your assignment, please contact:

- the academic teaching staff in your unit for guidance in understanding or completing this type of assessment
- the [Writing Centre](#) for academic skills support.

<sup>2</sup> Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation

## Delivery and Resources

The following texts are recommended:

“Heating, Ventilating and Air Conditioning: Analysis and Design, 6th Edition” by F.C. McQuiston, D. Parker and J.D. Spitler

## Unit Schedule

Refer to ilearn page for unit schedule

Lectures: Weeks 1-13

Practicals: Weeks 2-13

## Policies and Procedures

Macquarie University policies and procedures are accessible from [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>). Students should be aware of the following policies in particular with regard to Learning and Teaching:

- [Academic Appeals Policy](#)
- [Academic Integrity Policy](#)
- [Academic Progression Policy](#)
- [Assessment Policy](#)
- [Fitness to Practice Procedure](#)
- [Assessment Procedure](#)
- [Complaints Resolution Procedure for Students and Members of the Public](#)
- [Special Consideration Policy](#)

Students seeking more policy resources can visit [Student Policies](https://students.mq.edu.au/support/study/policies) (<https://students.mq.edu.au/support/study/policies>). It is your one-stop-shop for the key policies you need to know about throughout your undergraduate student journey.

To find other policies relating to Teaching and Learning, visit [Policy Central](https://policies.mq.edu.au) (<https://policies.mq.edu.au>) and use the [search tool](#).

## Student Code of Conduct

Macquarie University students have a responsibility to be familiar with the Student Code of Conduct: <https://students.mq.edu.au/admin/other-resources/student-conduct>

## Results

Results published on platform other than [eStudent](#), (eg. iLearn, Coursera etc.) or released directly by your Unit Convenor, are not confirmed as they are subject to final approval by the

University. Once approved, final results will be sent to your student email address and will be made available in [eStudent](#). For more information visit [connect.mq.edu.au](http://connect.mq.edu.au) or if you are a Global MBA student contact [globalmba.support@mq.edu.au](mailto:globalmba.support@mq.edu.au)

## Academic Integrity

At Macquarie, we believe [academic integrity](#) – honesty, respect, trust, responsibility, fairness and courage – is at the core of learning, teaching and research. We recognise that meeting the expectations required to complete your assessments can be challenging. So, we offer you a range of resources and services to help you reach your potential, including free [online writing and maths support](#), [academic skills development](#) and [wellbeing consultations](#).

## Student Support

Macquarie University provides a range of support services for students. For details, visit <http://students.mq.edu.au/support/>

### The Writing Centre

[The Writing Centre](#) provides resources to develop your English language proficiency, academic writing, and communication skills.

- [Workshops](#)
- [Chat with a WriteWISE peer writing leader](#)
- [Access StudyWISE](#)
- [Upload an assignment to Studiosity](#)
- [Complete the Academic Integrity Module](#)

The Library provides online and face to face support to help you find and use relevant information resources.

- [Subject and Research Guides](#)
- [Ask a Librarian](#)

## Student Services and Support

Macquarie University offers a range of [Student Support Services](#) including:

- [IT Support](#)
- [Accessibility and disability support](#) with study
- Mental health [support](#)
- [Safety support](#) to respond to bullying, harassment, sexual harassment and sexual assault
- [Social support](#) including information about finances, tenancy and legal issues
- [Student Advocacy](#) provides independent advice on MQ policies, procedures, and processes

## Student Enquiries

Got a question? Ask us via the [Service Connect Portal](#), or contact [Service Connect](#).

## IT Help

For help with University computer systems and technology, visit [http://www.mq.edu.au/about\\_us/offices\\_and\\_units/information\\_technology/help/](http://www.mq.edu.au/about_us/offices_and_units/information_technology/help/).

When using the University's IT, you must adhere to the [Acceptable Use of IT Resources Policy](#). The policy applies to all who connect to the MQ network including students.

## Changes from Previous Offering

NA

## Engineers Australia Competency Mapping

EA Competency Standard		Unit Learning Outcomes
Knowledge and Skill Base	1.1 Comprehensive, theory-based understanding of the underpinning fundamentals applicable to the engineering discipline.	ULO1:100%
	1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing.	ULO2:50%
	1.3 In-depth understanding of specialist bodies of knowledge	ULO2:50% ULO3:33%
	1.4 Discernment of knowledge development and research directions	
	1.5 Knowledge of engineering design practice	
	1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice.	
Engineering Application Ability	2.1 Application of established engineering methods to complex problem solving	ULO3:33%
	2.2 Fluent application of engineering techniques, tools and resources.	
	2.3 Application of systematic engineering synthesis and design processes.	
	2.4 Application of systematic approaches to the conduct and management of engineering projects.	ULO3:34%
Professional and Personal Attributes	3.1 Ethical conduct and professional accountability.	
	3.2 Effective oral and written communication in professional and lay domains.	ULO4:50%

	3.3 Creative, innovative and pro-active demeanour.	
	3.4 Professional use and management of information.	
	3.5 Orderly management of self, and professional conduct.	
	3.6 Effective team membership and team leadership	ULO4:50%

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Unit information based on version 2024.01R of the [Handbook](#)