MECH6002

Advanced Heat and Mass Transfer Applications

Session 2, In person-scheduled-weekday, North Ryde 2026

School of Engineering

Contents

General Information

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Credit points
10

Prerequisites

Corequisites

Co-badged status
MECH3002

Unit description
This unit builds on the fundamental principles of heat and mass transfer in engineering systems, with an emphasis on advanced analysis and application. You will study the three primary modes of heat transfer (conduction, convection, and radiation) and examine how these processes interact in complex thermofluidic systems. Throughout the unit, you will develop the ability to analyse and predict heat and mass transfer behaviour in both local and large-scale systems. You will evaluate heat and mass transfer coefficients, interpret system performance, and design experiments to optimise engineering systems involving thermal and mass-transport processes. Learning activities focus on problem-solving, critical thinking, and applying theory to contemporary engineering challenges. By the end of the unit, you will be able to apply heat and mass transfer principles to analyse, design, and improve engineering systems across a range of applications and industries.

This unit also highlights connections to global sustainability challenges, including the United Nations Sustainable Development Goals (UNSDGs) of Affordable and Clean Energy, and Industry, Innovation and Infrastructure.

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: Design heat transfer systems experiencing conduction, convection, and/or radiation processes, both with and without the involvement of mass transfer.

ULO2: Apply advanced theoretical knowledge of analytical equations, dimensional analysis, and empirical correlations to develop solutions for heat and mass transfer systems.

ULO3: Design and assess the performance and limitations of heat and mass transfer systems within real-world applications.

ULO4: Demonstrate deep understanding in developing practical and efficient heat transfer system by employing problem-solving skills and critical thinking.

ULO5: Demonstrate adeptness in problem-solving skills suitable for industry demands.

General Assessment Information

To pass this unit, students must obtain a mark of 50 or more for the unit (i.e. obtain a passing grade P/ CR/ D/ HD). There are no hurdle assessment tasks.

The University's standard late penalty applies to all eligible written assessments in the unit. For further information, please refer to the University's Assessment Policy: https://students.mq.edu.au/study/assessment-exams/assessments

Unless an approved Special Consideration request has been granted, a 5% penalty of the total available marks per calendar day (including weekends) will be applied to late written assessments for up to 7 days after the due date. Assessments submitted more than 7 days late will receive a mark of 0. This policy supports the timely return of assessment results to all students.

The submission deadline for all written assessments is 11:55 pm. A 1-hour grace period is provided to accommodate unforeseen technical issues.

For time-sensitive assessments, such as examinations, late submissions are not permitted. Students who are unable to attend must submit an approved Special Consideration request.

In this unit, late submissions are considered as follows:

• Assignment – YES, Standard Late Penalty applies

• Practical lab report – YES, Standard Late Penalty applies (attendance requirements still apply)

• Final examination – NO, unless an approved Special Consideration has been granted

All assessments will be marked according to the published marking rubrics. Students will receive a numerical grade for each assessment which will be representative of a Fail (0-49%), Pass (50-64%), Credit (65-74%), Distinction (75-84%) or High Distinction (85-100%) as defined by the university grading scheme.

Assessment rubrics and grading criteria will be made available on iLearn long before the relevant assessment due date.

Assignment

This individual assignment assesses students' ability to apply heat and mass transfer principles covered in lectures to the design of a functional thermal product. Students will use concepts such as conduction, convection, and insulation to develop a design that effectively manages heat transfer. The assessment emphasises the integration of theoretical knowledge with practical engineering design through analytical calculations, design justification, and, where appropriate, prototype development or performance evaluation.

The submission will include analytical calculations, system design, and a technical report. A detailed marking rubric will be provided with the assessment instructions.

Practical Lab Report

Students are required to submit one individual laboratory report based on a practical laboratory session.

Attendance at the practical class is compulsory. Students who do not attend the laboratory session will receive a mark of 0 for the lab report, regardless of whether the report is submitted by the deadline. Students unable to attend a practical class must obtain approved Special Consideration to arrange an alternative session.

Details of laboratory times and locations will be provided on iLearn. The report will be assessed using a marking rubric available on iLearn.

Final Examination

A 2-hour final examination will assess students' understanding of all unit content covered during Weeks 1–13.

Assessment Tasks

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Assignment based on design implementation	35%	No	18/10/2026	Individual	Yes	Open
Practical Lab Report	25%	No	08/11/2026	Individual and Group	Yes	Open

Name	Weighting	Hurdle	Due	Groupwork/Individual	Short Extension	AI Approach
Final Exam	40%	No	Exam Period	Individual	No	Open

Assignment based on design implementation

Assessment Type [1]: Creative task
Indicative Time on Task [2]: 24 hours
Due: **18/10/2026**
Weighting: **35%**
Groupwork/Individual: Individual
Short extension [3]: Yes
AI Approach: Open

Apply deep understanding into designing and creating a heat transfer system.

On successful completion you will be able to:

- Design heat transfer systems experiencing conduction, convection, and/or radiation processes, both with and without the involvement of mass transfer.
- Apply advanced theoretical knowledge of analytical equations, dimensional analysis, and empirical correlations to develop solutions for heat and mass transfer systems.
- Design and assess the performance and limitations of heat and mass transfer systems within real-world applications.
- Demonstrate deep understanding in developing practical and efficient heat transfer system by employing problem-solving skills and critical thinking.
- Demonstrate adeptness in problem-solving skills suitable for industry demands.

Practical Lab Report

Assessment Type [1]: Practice-based task
Indicative Time on Task [2]: 12 hours
Due: **08/11/2026**
Weighting: **25%**
Groupwork/Individual: Individual and Group
Short extension [3]: Yes
AI Approach: Open

Experiments to explore and investigate heat transfer systems. One single report will be submitted.

On successful completion you will be able to:

- Design heat transfer systems experiencing conduction, convection, and/or radiation

processes, both with and without the involvement of mass transfer.
- Apply advanced theoretical knowledge of analytical equations, dimensional analysis, and empirical correlations to develop solutions for heat and mass transfer systems.
- Design and assess the performance and limitations of heat and mass transfer systems within real-world applications.
- Demonstrate adeptness in problem-solving skills suitable for industry demands.

Final Exam

Assessment Type [1]: Examination
Indicative Time on Task [2]: 2 hours
Due: **Exam Period**
Weighting: **40%**
Groupwork/Individual: Individual
Short extension [3]: No
AI Approach: Open

You will undertake a final examination during the formal examination period.

On successful completion you will be able to:

- Design heat transfer systems experiencing conduction, convection, and/or radiation processes, both with and without the involvement of mass transfer.
- Apply advanced theoretical knowledge of analytical equations, dimensional analysis, and empirical correlations to develop solutions for heat and mass transfer systems.
- Design and assess the performance and limitations of heat and mass transfer systems within real-world applications.
- Demonstrate adeptness in problem-solving skills suitable for industry demands.

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[1] 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
- Academic Success for academic skills support.

[2] Indicative time-on-task is an estimate of the time required for completion of the assessment task and is subject to individual variation.

[3] An automatic short extension is available for some assessments. Apply through the Service Connect Portal.

Delivery and Resources

Week 1 classes

In Week 1, only the lecture will be held. There are no tutorials, SGTA sessions, practical classes, or other non-lecture activities during this week. All non-lecture activities will commence from Week 2, as outlined in the unit timetable.

Method of Communications

We will communicate with you via your university email and through announcements on iLearn. Queries to convenors can either be placed on the iLearn discussion board or sent to the unit convenor via the contact email on iLearn.

Please stay up to date with announcements on the iLearn platform. If you have any questions or would like to discuss the course content, feel free to post them in the General Discussion Forum on iLearn. I will respond to your questions as soon as possible after they are posted.

Useful References

There is no prescribed textbook for this unit. However, the following texts are recommended as useful references:

- J. P. Holman, *Heat Transfer*
- Y. A. Çengel, *Heat and Mass Transfer: Fundamentals and Applications*
- J. H. Lienhard IV and J. H. Lienhard V, *A Heat Transfer Textbook*

These texts provide good coverage of the fundamental principles and applications of heat and mass transfer and will serve as valuable resources throughout the unit.

Unit Schedule

Week	Topic	Lecturer	Laboratory/ Tutorial	Assessments
1	Introduction to heat transfer, basic modes of heat transfer, steady-state conduction	Dr. Joe Lin	No tutorial	
2	Conduction equations, thermal resistance network	Dr. Joe Lin	Tutorial	
3	Overall heat transfer coefficient, thermal contact resistance	Dr. Joe Lin	Tutorial	Assignment task released
4	Introduction to heat convection, Buckingham-pi Theorem, thermal boundary layers	Dr. Joe Lin	Tutorial	
5	Convection analysis, external forced convection	Dr. Joe Lin	Tutorial	
6	External forced convection (continued)	Dr. Joe Lin	Tutorial	
7	Internal forced convection	Dr. Joe Lin	Tutorial	

8	Natural convection	Dr. Joe Lin	Tutorial	
9	Radiative heat transfer, black bodies, solar energy	Dr. Joe Lin	Tutorial	
10	Heat exchangers, log-mean temperature difference method and NTU approach	Dr. Joe Lin	Tutorial	Assignment due
11	Overall heat transfer equations, fouling, heat transfer effectiveness, Practical design of heat exchangers	Dr. Joe Lin	Tutorial	Practical session
12	Mass transfer, boiling, condensation, evaporation	Dr. Joe Lin	Tutorial	
13	Unit review and examination preparation	Dr. Joe Lin	Tutorial	Practical lab report due

Policies and Procedures

Macquarie University policies and procedures are accessible from Policy Central (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). 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) 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 or if you are a Global MBA student contact 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/

Academic Success

Academic Success provides resources to develop your English language proficiency, academic writing, and communication skills.

- Ask a Study Coach
- 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 https://students.mq.edu.au/support/technology/service-desk.

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.

Unit information based on version 2026.04 of the Handbook