

MEC402 Heat Transfer

School: School of Science, Technology and Engineering

2024 | Semester 1

UniSC Sunshine Coast
UniSC Moreton Bay

**BLENDED
LEARNING**

Most of your course is on campus but you may be able to do some components of this course online.

Please go to usc.edu.au for up to date information on the teaching sessions and campuses where this course is usually offered.

1. What is this course about?

1.1. Description

Heat transfer studies the mechanisms of conduction, convection, radiation and their applications through an engineering perspective. Proficient engineers require a good fundamental understanding of heat transfer. In this course, you will learn and apply fundamental concepts of heat transfer for a variety of engineering systems and processes.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Asynchronous weekly learning material	1hr	Week 1	13 times
Seminar – On campus	1hr	Week 2	2 times
Tutorial/Workshop 1 – On campus	2hrs	Week 1	13 times
Laboratory 1 – On campus	2hrs	Week 9	3 times

1.3. Course Topics

Topics may include:

- Basic concepts of heat transfer
- Steady heat conduction
- Forced convection
- Heat exchangers
- Transient heat conduction
- Natural convection
- Thermal radiation
- Radiation heat transfer

2. What level is this course?

400 Level (Graduate)

Demonstrating coherence and breadth or depth of knowledge and skills. Independent application of knowledge and skills in unfamiliar contexts. Meeting professional requirements and AQF descriptors for the degree. May require pre-requisites where discipline specific introductory or developing knowledge or skills is necessary. Normally undertaken in the third or fourth full-time study year of an undergraduate program.

3. What is the unit value of this course?

12 units

4. How does this course contribute to my learning?

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES MAPPING	PROFESSIONAL STANDARD MAPPING *
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...	Engineers Australia Stage 1 Professional Engineer Competency Standards
1 Explain heat transfer theories and the principles and concepts which govern the methods of utilisation of energy and heat.	Knowledgeable	1, 1.1.a, 1.1
2 Critically evaluate and transform established theories and concepts to generate and transmit solutions to complex problems in the area of heat transfer.	Creative and critical thinker	2, 2.1.a, 2.1.f, 2.1
3 Exercise critical thinking and judgement in developing new understanding in the area of heat transfer.	Creative and critical thinker	2, 2.1.d, 2.1
4 Apply initiative and judgement in professional practice scholarship in relation to the area of heat transfer.	Ethical Engaged	3, 3.5.b, 3.5
5 Demonstrate responsibility for own learning and professional development and collaborate with others on technical and analytical engineering projects.	Engaged	3, 3.5.a, 3.5.b, 3.6.a, 3.5, 3.6

COURSE LEARNING OUTCOMES	GRADUATE QUALITIES MAPPING	PROFESSIONAL STANDARD MAPPING *
On successful completion of this course, you should be able to...	Completing these tasks successfully will contribute to you becoming...	Engineers Australia Stage 1 Professional Engineer Competency Standards
6 Explain the importance of efficiency and its impact on economy and sustainability.	Sustainability-focussed	1, 1.6.c, 1.6

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.1.a	Knowledge and Skill Base - Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline: Engages with the engineering discipline at a phenomenological level, applying sciences and engineering fundamentals to systematic investigation, interpretation, analysis and innovative solution of complex problems and broader aspects of engineering practice.
1.6.c	Knowledge and Skill Base - Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline: Appreciates the social, environmental and economic principles of sustainable engineering practice.
1.1	Knowledge and Skill Base: Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.
1.6	Knowledge and Skill Base: Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline.
2	Elements of competency: Engineering Application Ability
2.1.a	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Identifies, discerns and characterises salient issues, determines and analyses causes and effects, justifies and applies appropriate simplifying assumptions, predicts performance and behaviour, synthesises solution strategies and develops substantiated conclusions.
2.1.f	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Conceptualises alternative engineering approaches and evaluates potential outcomes against appropriate criteria to justify an optimal solution choice.
2.1.d	Engineering Application Ability - Application of established engineering methods to complex engineering problem solving: Investigates complex problems using research-based knowledge and research methods.
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.
3	Elements of competency: Professional and Personal Attributes
3.5.b	Professional and Personal Attributes - Orderly management of self, and professional conduct: Understands the importance of being a member of a professional and intellectual community, learning from its knowledge and standards, and contributing to their maintenance and advancement.
3.5.a	Professional and Personal Attributes - Orderly management of self, and professional conduct: Demonstrates commitment to critical self-review and performance evaluation against appropriate criteria as a primary means of tracking personal development needs and achievements
3.6.a	Professional and Personal Attributes - Effective team membership and team leadership: Understands the fundamentals of team dynamics and leadership.
3.5	Professional and Personal Attributes: Orderly management of self, and professional conduct.
3.6	Professional and Personal Attributes: Effective team membership and team leadership.

5. Am I eligible to enrol in this course?

Refer to the [UniSC Glossary of terms](#) for definitions of “pre-requisites, co-requisites and anti-requisites”.

5.1. Pre-requisites

MEC200 and (MEC305 or MEC302)

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

Not applicable

5.4. Specific assumed prior knowledge and skills (where applicable)

Not applicable

6. How am I going to be assessed?

6.1. Grading Scale

Standard Grading (GRD)

High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL).

6.2. Details of early feedback on progress

Early feedback will be provided through completion of weekly activities in workshops. Furthermore, feedback on each assessment will be provided which will be used to help with the following assessment.

6.3. Assessment tasks

DELIVERY MODE	TASK NO.	ASSESSMENT PRODUCT	INDIVIDUAL OR GROUP	WEIGHTING %	WHAT IS THE DURATION / LENGTH?	WHEN SHOULD I SUBMIT?	WHERE SHOULD I SUBMIT IT?
All	1	Oral and Written Piece	Group	30%	1500-word written report (group) and 10-minute oral presentation	Week 7	Online Assignment Submission with plagiarism check
All	2	Practical / Laboratory Skills, and Written Piece	Individual	30%	Two lab sessions. Pre-lab quiz questions and individual laboratory reports (1200 word equivalent)	Week 12	Online Assignment Submission with plagiarism check
All	3	Examination - Centrally Scheduled	Individual	40%	3 hours	Exam Period	Online Assignment Submission with plagiarism check

All - Assessment Task 1: Group Report and Presentation

GOAL:	The goal of this task is to investigate and apply principles of heat transfer through a given engineering context. You will be required analyse, discuss and present a heat-transfer-related topic.
PRODUCT:	Oral and Written Piece
FORMAT:	The written group report will be approximately 1500 words while the corresponding group oral presentation will be approximately 10 minutes followed by a Q&A time.

CRITERIA:	No.	Learning Outcome assessed
	1	Critical evaluation and transformation of established theories and concepts to generate and transmit solutions to complex problems in the area of heat transfer. 1 2 3
	2	Execution of critical thinking and judgement in developing new understanding in the area of heat transfer. 1 2 3
	3	Application of initiative and judgement in professional practice scholarship in relation to the area of heat transfer. 3 4 5
	4	Demonstration of responsibility for own learning and professional development and collaboration with others on technical and analytical engineering projects. 4 5
	5	Explanation of heat transfer theories and the principles and concepts which govern the methods of utilisation of energy and heat. 1 3
	6	Explanation of the importance of efficiency and its impact on economy and sustainability. 6

All - Assessment Task 2: Laboratory Reports

GOAL:	The goal of this task is to investigate fundamental principles of heat transfer through experimental applications and subsequent analyses.	
PRODUCT:	Practical / Laboratory Skills, and Written Piece	
FORMAT:	Prior to each session, you will complete a series of pre-lab questions online. During the lab session, you will conduct an experiment and start working on a report. The experimental work will be conducted in a group format, however the pre-lab questions and the lab reports are to be submitted individually by all students.	
CRITERIA:	No.	Learning Outcome assessed
	1	Critical evaluation and transformation of established theories and concepts to generate and transmit solutions to complex problems in the area of heat transfer. 1 2
	2	Application of initiative and judgement in professional practice scholarship in relation to the area of heat transfer. 2 3 4
	3	Demonstration of responsibility for own learning and professional development and collaboration with others on technical and analytical engineering projects. 3 4 5

All - Assessment Task 3: Examination

GOAL:	The goal of this task is to evaluate your knowledge of concepts of heat transfer and to demonstrate the use of standard methods to analyse problems within the subject area.	
PRODUCT:	Examination - Centrally Scheduled	
FORMAT:	Centrally scheduled 3-hour examination.	
CRITERIA:	No.	Learning Outcome assessed
	1	Critical evaluation and transformation of established theories and concepts to generate and transmit solutions to complex problems in the area of heat transfer. 1 2
	2	Explanation of heat transfer theories and the principles and concepts which govern the methods of utilisation of energy and heat. 1 2

7. Directed study hours

A 12-unit course will have total of 150 learning hours which will include directed study hours (including online if required), self-directed learning and completion of assessable tasks. Student workload is calculated at 12.5 learning hours per one unit.

8. What resources do I need to undertake this course?

Please note: Course information, including specific information of recommended readings, learning activities, resources, weekly readings, etc. are available on the course Canvas site– Please log in as soon as possible.

8.1. Prescribed text(s) or course reader

Please note that you need to have regular access to the resource(s) listed below. Resources may be required or recommended.

REQUIRED?	AUTHOR	YEAR	TITLE	EDITION	PUBLISHER
Required	Yunus A. Çengel, Afshin J. Ghajar	0	Heat And Mass Transfer, 6th Edition, SI Units	5th Edition or later	McGraw-Hill
Recommended	Cengel, John M. Cimbala, Robert H. Turner	0	Fundamentals of Thermal-Fluid Sciences (SI Units)	5th Edition or later	McGraw-Hill

8.2. Specific requirements

Not applicable

9. How are risks managed in this course?

Health and safety risks for this course have been assessed as low. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the health and safety risks associated with your specific course of study and to familiarise yourself with the University's general health and safety principles by reviewing the [online induction training for students](#), and following the instructions of the University staff.

10. What administrative information is relevant to this course?

10.1. Assessment: Academic Integrity

Academic integrity is the ethical standard of university participation. It ensures that students graduate as a result of proving they are competent in their discipline. This is integral in maintaining the value of academic qualifications. Each industry has expectations and standards of the skills and knowledge within that discipline and these are reflected in assessment.

Academic integrity means that you do not engage in any activity that is considered to be academic fraud; including plagiarism, collusion or outsourcing any part of any assessment item to any other person. You are expected to be honest and ethical by completing all work yourself and indicating in your work which ideas and information were developed by you and which were taken from others. You cannot provide your assessment work to others. You are also expected to provide evidence of wide and critical reading, usually by using appropriate academic references.

In order to minimise incidents of academic fraud, this course may require that some of its assessment tasks, when submitted to Canvas, are electronically checked through Turnitin. This software allows for text comparisons to be made between your submitted assessment item and all other work to which Turnitin has access.

10.2. Assessment: Additional Requirements

Eligibility for Supplementary Assessment

Your eligibility for supplementary assessment in a course is dependent of the following conditions applying:

- The final mark is in the percentage range 47% to 49.4%
- The course is graded using the Standard Grading scale
- You have not failed an assessment task in the course due to academic misconduct

10.3. Assessment: Submission penalties

Late submission of assessment tasks will be penalised at the following maximum rate (the rates are cumulative):

- 5% (of the assessment task's identified value) per day for the first two days from the date identified as the due date for the assessment task
- 10% (of the assessment task's identified value) for the third day
- 20% (of the assessment task's identified value) for the fourth day and subsequent days up to and including seven days from the date identified as the due date for the assessment task
- A result of zero is awarded for an assessment task submitted seven days from the date identified as the due date for the assessment task.

Weekdays and weekends are included in the calculation of days late.

To request an extension, you must contact your Course Coordinator and supply the required documentation to negotiate an outcome.

Refer to the Assessment: Courses and Coursework Programs – Procedures

10.4. SafeUniSC

UniSC is committed to a culture of respect and providing a safe and supportive environment for all members of our community. For immediate assistance on campus contact SafeUniSC by phone: [07 5430 1168](tel:0754301168) or using the [SafeZone](#) app. For general enquires contact the SafeUniSC team by phone [07 5456 3864](tel:0754563864) or email safe@usc.edu.au.

The SafeUniSC Specialist Service is a Student Wellbeing service that provides free and confidential support to students who may have experienced or observed behaviour that could cause fear, offence or trauma. To contact the service call [07 5430 1226](tel:0754301226) or email studentwellbeing@usc.edu.au.

10.5. Study help

For help with course-specific advice, for example what information to include in your assessment, you should first contact your tutor, then your course coordinator, if needed.

If you require additional assistance, the Learning Advisers are trained professionals who are ready to help you develop a wide range of academic skills. Visit the [Learning Advisers](#) web page for more information, or contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au.

10.6. Wellbeing Services

Student Wellbeing provide free and confidential counselling on a wide range of personal, academic, social and psychological matters, to foster positive mental health and wellbeing for your academic success.

To book a confidential appointment go to [Student Hub](#), email studentwellbeing@usc.edu.au or call 07 5430 1226.

10.7. AccessAbility Services

Ability Advisers ensure equal access to all aspects of university life. If your studies are affected by a disability, learning disorder mental health issue, injury or illness, or you are a primary carer for someone with a disability or who is considered frail and aged, [AccessAbility Services](#) can provide access to appropriate reasonable adjustments and practical advice about the support and facilities available to you throughout the University.

To book a confidential appointment go to [Student Hub](#), email AccessAbility@usc.edu.au or call 07 5430 2890.

10.8. Links to relevant University policy and procedures

For more information on Academic Learning & Teaching categories including:

- Assessment: Courses and Coursework Programs
- Review of Assessment and Final Grades
- Supplementary Assessment
- Central Examinations
- Deferred Examinations
- Student Conduct
- Students with a Disability

For more information, visit <https://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching>

10.9. Student Charter

UniSC is committed to excellence in teaching, research and engagement in an environment that is inclusive, inspiring, safe and respectful. The [Student Charter](#) sets out what students can expect from the University, and what in turn is expected of students, to achieve these outcomes.

10.10.General Enquiries

In person:

- **UniSC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **UniSC Moreton Bay** - Service Centre, Ground Floor, Foundation Building, Gympie Road, Petrie
- **UniSC SouthBank** - Student Central, Building A4 (SW1), 52 Merivale Street, South Brisbane
- **UniSC Gympie** - Student Central, 71 Cartwright Road, Gympie
- **UniSC Fraser Coast** - Student Central, Student Central, Building A, 161 Old Maryborough Rd, Hervey Bay
- **UniSC Caboolture** - Student Central, Level 1 Building J, Cnr Manley and Tallon Street, Caboolture

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au