COURSE OUTLINE

MEC200 Thermodynamics

School: School of Science, Technology and Engineering

2026 | Trimester 2

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 unisc.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

Thermodynamics studies the fundamental concepts of energy through an engineering lens. Proficient engineers require a strong fundamental understanding of thermodynamics and its applications. In this course, you will learn and apply fundamental concepts of thermodynamics 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 – Online learning materials (asynchronous)	1hr	Week 1	12 times
Tutorial/Workshop 1 – Problem-based learning related to weekly thermodynamics topics	2hrs	Week 1	12 times
Laboratory 1 – A total of two labs (2 hr each)	2hrs	Week 9	2 times
Seminar – Face-to-face seminars for the whole cohort	1hr	Week 2	2 times

1.3. Course Topics

Topics may include:

- Introduction to thermodynamics
- Basic concepts of thermodynamics
- Energy and the first law of thermodynamics
- Properties of pure substances
- The first law of thermodynamics for closed systems
- The first law of thermodynamics for open systems
- The second law of thermodynamics
- Entropy
- Gas power cycles
- Vapour power cycles
- Refrigerators and heat pump cycles

2. What level is this course?

200 Level (Developing)

Building on and expanding the scope of introductory knowledge and skills, developing breadth or depth and applying knowledge and skills in a new context. May require pre-requisites where discipline specific introductory knowledge or skills is necessary. Normally, undertaken in the second or third full-time year of an undergraduate programs.

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...	Competencies from multiple Professional Bodies (see below) *
1 Explain and investigate the first law of thermodynamics for both closed and open systems and apply to solve problems.	Knowledgeable Creative and critical thinker	1, 1, 1.1.a, 1.1.a, 1.2.a, 1.2.a, 1.1, 1.1, 1.2, 1.2, 2, 2, 2.2.b, 2.2.b, 2.2, 2.2
2 Estimate the thermal efficiencies and coefficients of performance for heat engines, heat pumps and refrigerators	Knowledgeable Creative and critical thinker	1, 1, 1.1.a, 1.1.a, 1.2.a, 1.2.a, 1.3.a, 1.3.a, 1.1, 1.1, 1.2, 1.2, 1.3, 1.3
3 Analyse systems and thermodynamic cycles through the second law of thermodynamics and entropy	Creative and critical thinker Sustainability-focussed	1, 1, 1.2.a, 1.2.a, 1.2, 1.2, 2, 2, 2.1.a, 2.1.a, 2.2.b, 2.2.b, 2.1, 2.1, 2.2, 2.2
4 Solve foundational-level energy-balance problems for closed and open systems that involve heat and work interactions	Knowledgeable Creative and critical thinker Empowered	1, 1, 1.3.a, 1.3.a, 1.3, 1.3, 2, 2, 2.2.b, 2.2.b, 2.2, 2.2
5 Demonstrate the procedures for determining thermodynamics properties of pure substances from tables of property data.	Creative and critical thinker Empowered	2, 2, 2.2.a, 2.2.a, 2.2, 2.2, 3, 3, 3.1.b, 3.1.b, 3.2.b, 3.2.b, 3.1, 3.1, 3.2, 3.2

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...	Competencies from multiple Professional Bodies (see below) *
6 Communicate and modelling results through sketching and reports	Engaged	1, 1, 1.2.a, 1.2.a, 1.2, 1.2, 2, 2, 2.2.c, 2.2.c, 2.2, 2.2, 3, 3, 3.2.a, 3.2.a, 3.2.b, 3.2.b, 3.2, 3.2

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 ENGINEERING TECHNOLOGIST COMPETENCY STANDARDS	
1	Elements of competency: Knowledge and Skill Base
1.1.a	Knowledge and Skill Base - Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain: Engages with the technology domain at a phenomenological level, applying sciences and engineering fundamentals to systematic investigation, interpretation, analysis and innovative solution of broadly-defined problems and engineering technology practice.
1.2.a	Knowledge and Skill Base - Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the technology domain: Fluently applies relevant investigation, analysis, interpretation, assessment, characterisation, prediction, evaluation, modelling, decision making, measurement, evaluation, knowledge management and communication tools and techniques pertinent to the technology domain.
1.3.a	Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the technology domain: Proficiently applies advanced technical knowledge and skills to deliver engineering outcomes in specialist area(s) of the technology domain and associated industry, commercial and community sectors.
1.1	Knowledge and Skill Base: Systematic, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the technology domain.
1.2	Knowledge and Skill Base: Conceptual understanding of the, mathematics, numerical analysis, statistics, and computer and information sciences which underpin the technology domain.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the technology domain.
2	Elements of competency: Engineering Application Ability
2.2.b	Engineering Application Ability - Application of engineering techniques, tools and resources within the technology domain: Understands the principles, limitations and accuracy of mathematical, physical or computational modelling.
2.1.a	Engineering Application Ability - Application of established engineering methods to broadly-defined problem solving within the technology domain: 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.
2.2.a	Engineering Application Ability - Application of engineering techniques, tools and resources within the technology domain: Proficiently identifies, selects and applies the materials, components, devices, systems, processes, resources, plant and equipment relevant to the technology domain.
2.2.c	Engineering Application Ability - Application of engineering techniques, tools and resources within the technology domain: Selects and applies such models in the representation of phenomenon, processes, systems, components or devices.
2.1	Engineering Application Ability: Application of established engineering methods to broadly-defined problem solving within the technology domain.
2.2	Engineering Application Ability: Application of engineering techniques, tools and resources within the technology domain.
3	Elements of competency: Professional and Personal Attributes
3.1.b	Professional and Personal Attributes - Ethical conduct and professional accountability: Understands the need for ‘due-diligence’ in certification, compliance and risk management processes.
3.2.b	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the technology domain.

CODE	COMPETENCY
3.2.a	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Is proficient in listening, speaking, reading and writing English.
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
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.
1.2.a	Knowledge and Skill Base - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline: Develops and fluently applies relevant investigation analysis, interpretation, assessment, characterisation, prediction, evaluation, modelling, decision making, measurement, evaluation, knowledge management and communication tools and techniques pertinent to the engineering discipline.
1.3.a	Knowledge and Skill Base - In-depth understanding of specialist bodies of knowledge within the engineering discipline: Proficiently applies advanced technical knowledge and skills in at least one specialist practice domain of the engineering discipline.
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.
1.2	Knowledge and Skill Base: Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.
1.3	Knowledge and Skill Base: In-depth understanding of specialist bodies of knowledge within the engineering discipline.
2	Elements of competency: Engineering Application Ability
2.2.b	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Constructs or selects and applies from a qualitative description of a phenomenon, process, system, component or device a mathematical, physical or computational model based on fundamental scientific principles and justifiable simplifying assumptions.
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.
2.2.a	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Proficiently identifies, selects and applies the materials, components, devices, systems, processes, resources, plant and equipment relevant to the engineering discipline.
2.2.c	Engineering Application Ability - Fluent application of engineering techniques, tools and resources: Determines properties, performance, safe working limits, failure modes, and other inherent parameters of materials, components and systems relevant to the engineering discipline.
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.
2.2	Engineering Application Ability: Fluent application of engineering techniques, tools and resources.
3	Elements of competency: Professional and Personal Attributes
3.1.b	Professional and Personal Attributes - Ethical conduct and professional accountability: Understands the need for ‘due-diligence’ in certification, compliance and risk management processes.
3.2.b	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Prepares high quality engineering documents such as progress and project reports, reports of investigations and feasibility studies, proposals, specifications, design records, drawings, technical descriptions and presentations pertinent to the engineering discipline.
3.2.a	Professional and Personal Attributes - Effective oral and written communication in professional and lay domains: Is proficient in listening, speaking, reading and writing English.

CODE	COMPETENCY
3.1	Professional and Personal Attributes: Ethical conduct and professional accountability.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.

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

Prerequisite: (MTH103; AND MTH104; AND SCI107) or Enrolled in MC004

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

ENG204

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

Not applicable

5.5. Microcredential Information

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 assessments.

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	40%	1500-word written report (group) and 10-minute oral presentation	Week 7	Online Assignment Submission with plagiarism check
All	2	Report	Individual	40%	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	20%	3 Hours	Exam Period	Online Assignment Submission with plagiarism check

All - Assessment Task 1: Report and Presentation

GOAL:	The goal of this task is to investigate and apply principles of thermodynamics through a given engineering context. You will be required analyse, discuss and present a thermodynamics-related topic.
PRODUCT:	Oral and Written Piece
AUTHORSHIP STATEMENT:	
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	Explanation and investigation of the first law of thermodynamics for both closed and open systems and apply to solve problems.	1
2	Estimation of the forces on moving or stationary bodies in either a static fluid situation or caused by flowing fluids.	2
3	Analysis of the transportation of different types of fluids using the principles of conservation of mass, momentum, and energy.	3

GENERIC SKILLS:	Communication, Organisation

All - Assessment Task 2: Laboratory Reports

GOAL:	The goal of this task is to investigate fundamental principles of thermodynamics through experimental applications and subsequent analyses.
PRODUCT:	Report
AUTHORSHIP STATEMENT:	
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	Explanation and investigation of the first law of thermodynamics for both closed and open systems and apply to solve problems.	1
2	Estimation of the forces on moving or stationary bodies in either a static fluid situation or caused by flowing fluids.	2
3	Application of the principles of heat transfer (conduction, convection, radiation) to solve foundational-level problems.	4
4	Communication and modelling of results through sketching and reports	6

GENERIC SKILLS:	Problem solving, Organisation, Applying technologies

All - Assessment Task 3: Examination

GOAL:	The goal of this task is to evaluate your knowledge of concepts in thermodynamics and to demonstrate the use of standard methods to analyse problems within the subject area.
PRODUCT:	Examination - Centrally Scheduled
AUTHORSHIP STATEMENT:	
FORMAT:	Centrally scheduled 3-hour examination.
CRITERIA:	

No.		Learning Outcome assessed
1	Explanation and investigation of the first law of thermodynamics for both closed and open systems and apply to solve problems.	1
2	Estimation of the forces on moving or stationary bodies in either a static fluid situation or caused by flowing fluids.	2
3	Analysis of the transportation of different types of fluids using the principles of conservation of mass, momentum, and energy.	3
4	Application of the principles of heat transfer (conduction, convection, radiation) to solve foundational-level problems.	4
5	Demonstration of the procedures for determining thermodynamics properties of pure substances from tables of property data.	5

GENERIC SKILLS:	Communication, Problem solving, Organisation, Applying technologies

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

You need regular access to the resource(s) below. Many texts are available as ebooks through the Library at no additional cost.

REQUIRED?	AUTHOR	YEAR	TITLE	EDITION	PUBLISHER
Required	Yunus A. Çengel, Michael A. Boles, Mehmet Kanoglu	0	THERMODYNAMICS: AN ENGINEERING APPROACH, SI	9th edition in SI units (or a later edition)	McGraw-Hill
Recommended	Cengel,John M. Cimbala,Robert H. Turner	2016	Fundamentals of Thermal-Fluid Sciences (SI Units)	5th Edition in SI Units (or a later edition)	Asia Higher Education Engineering/Computer Science Mechanical Engineering

8.2. Specific requirements

All students will be required to wear closed footwear for laboratory sessions. Students who do not have the appropriate footwear will not be permitted to enter the laboratory space. Also, no food and beverages can be consumed within laboratories.

9. How are risks managed in this course?

Risk assessments have been conducted for the field activities being undertaken and a high level of risk has been identified. High level risk may include, boating, diving, and hot works such as welding, cutting and grinding. Where high risks exist you will be given training and advice about how to control the high level risk, however it is also 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:
(a) The final mark is in the percentage range 47% to 49.4%; and
(b) The course is graded using the Standard Grading scale

10.3. Assessment: Submission penalties

Late submissions may be penalised up to and including the following maximum percentage of the assessment task's identified value, with weekdays and weekends included in the calculation of days late:
(a) One day: deduct 5%;
(b) Two days: deduct 10%;
(c) Three days: deduct 20%;
(d) Four days: deduct 40%;
(e) Five days: deduct 60%;
(f) Six days: deduct 80%;
(g) Seven days: A result of zero is awarded for the assessment task.

The following penalties will apply for a late submission for an online examination:
Less than 15 minutes: No penalty
From 15 minutes to 30 minutes: 20% penalty
More than 30 minutes: 100% penalty

10.4. 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

10.5. 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.

10.6. General Enquiries

For course-specific questions, contact your teaching staff or Course Coordinator.

For other enquiries or to access support, please contact Student Central:

- UniSC Student Central
- UniSC Adelaide Student Central