

MEC200 Thermofluids 1

School: School of Science, Technology and Engineering

2023 | Semester 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 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

Thermofluids studies the fundamental concepts of energy as well as how they are related to fluid mechanics and heat transfer. Proficient engineers require a strong fundamental understanding of thermofluids and its applications. In this course, you will learn and apply basic concepts of thermodynamics, fluid mechanics and heat transfer through a variety of learning methods and assessment types.

1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
BLENDED LEARNING			
Learning materials – Online learning materials (asynchronous)	1hr	Week 1	13 times
Tutorial/Workshop 1 – Solving problems related to weekly thermodynamics, fluid mechanics and heat transfer concepts	2hrs	Week 1	13 times
Laboratory 1 – A total of two labs (3 hr each)	3hrs	Week 9	2 times
Seminar – Face-to-face seminars for the whole cohort	1hr	Week 2	2 times

1.3. Course Topics

- Introduction to Thermofluids
- Basic Concepts of Thermodynamics
- Energy and the First Law of Thermodynamics
- Thermodynamic Properties
- The First Law of Thermodynamics for Closed Systems
- The First Law of Thermodynamics for Open Systems
- Introduction and Properties of Fluids
- Fluid Statics
- Bernoulli and Energy Equations for Fluids
- Momentum Analysis for Fluid Flows
- Basic Concepts of Heat Transfer

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...	Engineers Australia Stage 1 Professional Engineer Competency Standards
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 Ethical Sustainability-focussed	1.1, 2.1
2 Demonstrate the procedures for determining thermodynamics properties of pure substances from tables of property data.	Knowledgeable Creative and critical thinker Empowered	1.2, 1.4, 2.2
3 Estimate the forces on moving or stationary bodies in either a static fluid situation or caused by flowing fluids.	Knowledgeable Creative and critical thinker	1.3, 1.5, 2.3
4 Analyse the transportation of different types of fluids using the principles of conservation of mass, momentum, and energy.	Creative and critical thinker Empowered	1.1, 2.1, 2.2
5 Solve foundational-level problems by applying the principles of heat transfer (conduction, convection, radiation).	Knowledgeable Empowered Engaged Sustainability-focussed	1.3, 2.1, 2.2
6 Communicate results through reports, sketching, and modelling	Creative and critical thinker Empowered Ethical Engaged	1.6, 3.2, 3.6

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
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.
1.4	Knowledge and Skill Base: Discernment of knowledge development and research directions within the engineering discipline.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting the engineering discipline.

CODE	COMPETENCY
1.6	Knowledge and Skill Base: Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific 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.
2.3	Engineering Application Ability: Application of systematic engineering synthesis and design processes.
3.2	Professional and Personal Attributes: Effective oral and written communication in professional and lay domains.
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

(MTH102 or MTH103), MTH104 and SCI107. Must be enrolled in SC404, SC405, SC410, SC411 or SC425

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

ENG204 or MEC2101 (USQ course)

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

Students are assumed to have foundational skills in mathematics and physical sciences.

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

The summative assessment for this course includes weekly quizzes submitted via Canvas. The results of these quizzes will provide you with an ongoing feedback on your performance in each module. Additional feedback will be provided during regular contact sessions via worked examples and formative peer-assisted problem-solving activities.

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	Quiz/zes	Individual	0%	Short answer / multiple-choice / analytical working	Week 3	Online Test (Quiz)
All	2	Oral and Written Piece	Individual and Group	30%	1500-word written report (group) and 10-minute oral presentation.	Week 7	Online Assignment Submission with plagiarism check
All	3	Practical / Laboratory Skills, and Written Piece	Individual	30%	Two lab sessions (3 hr each). Pre-lab quiz questions and individual laboratory reports (1200 word equivalent)	Week 12	Online Assignment Submission with plagiarism check
All	4	Examination - Centrally Scheduled	Individual	40%	3 hours	Exam Period	Exam Venue

All - Assessment Task 1: Zero-Weight Formative Quiz for Early Feedback

GOAL:	This zero-weight formative assessment includes online quiz/zes. The results of these quiz/zes will provide students with feedback on their performance early in the semester.					
PRODUCT:	Quiz/zes					
FORMAT:	Online quizz/es will be distributed via the online learning management system (Canvas) which will require students to respond with a mixture of short answer, multiple-choice, and analytical workings. This is an individual task.					
CRITERIA:	No.					Learning Outcome assessed
	1	Accuracy of the explanation and/or numerical result				1 2 6
	2	Application of the fundamental thermofluids laws and principles to solve problems				1 2 6
	3	Identification and verification of the system being analysed using sketches and modelling				1 2 6
	4	Communication of results				6

All - Assessment Task 2: Group Report and Presentations

GOAL:	The goal of this task is to investigate and apply principles of thermodynamics, fluid mechanics and heat transfer to a given problem. You will be required to develop models and analyse a complex engineering problem within the provided context, by researching into the provided problem and identifying other necessary information.					
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 Manipulation and application of the appropriate fundamental laws and principles for the given problem	1 3 4 5
	2 Identification and verification of suitable hypotheses for modelling the system	2 5 6
	3 Development of a model that addresses the given problem	1 2 3 4 5
	4 Communication of models clearly and coherently in written form using correct terminology and appropriate formats	6

All - Assessment Task 3: Laboratory Reports

GOAL:	The goal of this task is to investigate fundamental principles of thermodynamics, fluid mechanics and heat transfer through experimental applications.										
PRODUCT:	Practical / Laboratory Skills, and Written Piece										
FORMAT:	You will attend 2 laboratory sessions over the semester. 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 reports are to be submitted individually by all students. A template will be provided for the calculation and the report.										
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4 Communication of results	6										

All - Assessment Task 4: Examination

GOAL:	The goal of this task is to evaluate your knowledge of concepts in thermodynamics, fluid mechanics and heat transfer, and to demonstrate the use of standard methods to analyse problems within the discipline.										
PRODUCT:	Examination - Centrally Scheduled										
FORMAT:	Centrally scheduled 3-hour open-book examination.										
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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. Cengel, John M. Cimbala, Robert H. Turner	2016	Fundamentals of Thermal-Fluid Sciences (SI Units)	5th Edition in SI Units (or a later edition)	McGraw-Hill Education
Recommended	Yunus A. Çengel, Boles, Michael A. Boles	2015	Thermodynamics	Fifth edition in SI units (or a later edition)	McGraw-Hill Education Limited
Recommended	Yunus A. Cengel, Afshin Jahanshahi Ghajar	2015	Heat and Mass Transfer	Fifth edition in SI units (or a later edition)	McGraw-Hill Education
Recommended	Yunus A. Çengel, John M. Cimbala	0	FLUID MECHANICS: FUNDAMENTALS AND APPLICATIONS, SI	4th Edition in SI units (or a later edition)	McGraw-Hill Education

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 performed for all studio and laboratory classes and a low level of health and safety risk exists. Some risk concerns may include equipment, instruments, and tools; as well as manual handling items within the laboratory. It is your responsibility to review course material, search online, discuss with lecturers and peers and understand the 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

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 may be penalised at the following maximum rate:

- 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 after 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 to negotiate an outcome.

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