



## COURSE OUTLINE

# MEC200 Thermofluids 1

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2021 | Semester 2

USC Sunshine Coast  
USC Moreton Bay

**ON CAMPUS**

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

*Please go to the USC website 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 deals with the relations between heat and other forms of energy and how it relates to the mechanics of fluids. Engineers require an understanding of thermofluids and their applications to using machines to do work. In this course, you will learn and apply basic concepts including an introduction to systems, first law of thermodynamics, relationship between pressure and flow, momentum analysis, piping system analysis, open channel flows, mechanisms of heat transfer, and fundamental pump performance.

### 1.2. How will this course be delivered?

ACTIVITY	HOURS	BEGINNING WEEK	FREQUENCY
<b>ON CAMPUS</b>			
<b>Tutorial/Workshop 1</b>	2hrs	Week 1	13 times
<b>Laboratory 1</b> – Two labs in 2 hr X 2wk over weeks 5-9	2hrs	Week 5	2 times
<b>Lecture</b> – Online synchronous delivery	2hrs	Week 1	13 times

### 1.3. Course Topics

- Introduction to Thermofluids
- Basic Concepts of Thermodynamics
- Work and Energy
- Thermodynamic Properties
- The First Law of Thermodynamics for Closed Systems
- The First Law of Thermodynamics for Open Systems
- Fluid Statics
- Fundamental Fluid Laws
- Fluid in Motion
- Internal Flow and Piping Systems
- External Flow
- Open Channel Flow
- Basic Concepts of Heat Transfer
- Pump Performance Curves

## 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
<p>1 Explain and investigate the first law of thermodynamics for both closed and open systems and apply to solve problems.</p>	<p>Knowledgeable Creative and critical thinker Ethical Sustainability-focussed</p>	<p>1.1 - Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 2.1 - Application of established engineering methods to complex engineering problem solving.</p>
<p>2 Demonstrate the procedures for determining thermodynamics properties of pure substances from tables of property data.</p>	<p>Knowledgeable Creative and critical thinker Empowered</p>	<p>1.2 - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. 1.4 - Discernment of knowledge development and research directions within the engineering discipline. 2.2 - Fluent application of engineering techniques, tools and resources.</p>
<p>3 Estimate the forces on moving or stationary bodies in either a static fluid situation or caused by flowing fluids.</p>	<p>Knowledgeable Creative and critical thinker</p>	<p>1.3 - In-depth understanding of specialist bodies of knowledge within the engineering discipline. 1.5 - Knowledge of engineering design practice and contextual factors impacting the engineering discipline. 2.3 - Application of systematic engineering synthesis and design processes.</p>
<p>4 Analyse the transportation of different types of fluids using the principles of conservation of mass, momentum, and energy.</p>	<p>Creative and critical thinker Empowered</p>	<p>1.1 - Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 2.1 - Application of established engineering methods to complex engineering problem solving. 2.2 - Fluent application of engineering techniques, tools and resources.</p>

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
<p>5 Solve foundational-level problems by applying the principles of heat transfer (conduction, convection, radiation).</p>	<p>Knowledgeable Empowered Engaged Sustainability-focussed</p>	<p>1.3 - In-depth understanding of specialist bodies of knowledge within the engineering discipline. 2.1 - Application of established engineering methods to complex engineering problem solving. 2.2 - Fluent application of engineering techniques, tools and resources.</p>
<p>6 Communicate results through reports, sketching, and modelling</p>	<p>Creative and critical thinker Empowered Ethical Engaged</p>	<p>1.6 - Understanding of the scope, principles, norms, accountabilities and bounds of sustainable engineering practice in the specific discipline. 2.3 - Application of systematic engineering synthesis and design processes. 2.4 - Application of systematic approaches to the conduct and management of engineering projects.</p>

## 5. Am I eligible to enrol in this course?

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

### 5.1. Pre-requisites

MTH102 or MTH103 and enrolled in Program 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 Blackboard. 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	40%	Short answer / multi-choice / mathematical working	Throughout teaching period (refer to Format)	Online Test (Quiz)
All	2	Practical / Laboratory Skills	Individual	20%	Pre-work quiz questions and individual laboratory reports	Throughout teaching period (refer to Format)	In Class
All	3	Examination - Centrally Scheduled	Individual	40%	2 hours	Exam Period	Exam Venue

All - Assessment Task 1: Online activities

<b>GOAL:</b>	This assessment will develop your problem-solving skills in thermodynamics, fluid mechanics, and heat transfer. It will allow you to demonstrate your understanding of the fundamental laws and principles of the discipline.	
<b>PRODUCT:</b>	Quiz/zes	
<b>FORMAT:</b>	Weekly (1-13) quizzes will be distributed via Blackboard which will require students to respond with a mixture of short answer, multiple-choice, and mathematical working. This is an individual task.	
<b>CRITERIA:</b>	<b>No.</b>	<b>Learning Outcome assessed</b>
	1 Accuracy of the explanation and/or numerical result	1 2 3 4 5 6
	2 Application of the fundamental laws and principles to solve problems	1 2 3 4 5
	3 Identification and verification of the system being analysed using sketches and modelling	2 6
	4 Communication of results	6
	5 1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	1 2 3 4 5
	6 2.1. Application of established engineering methods to complex engineering problem solving.	2 3 4 5
	7 3.2 Effective oral and written communication in professional and lay domains	6

All - Assessment Task 2: Laboratory reports

<b>GOAL:</b>	The goal of this task is to investigate fundamental principles of thermodynamics, fluid mechanics and heat transfer through experimental applications and by reporting on the results.
<b>PRODUCT:</b>	Practical / Laboratory Skills
<b>FORMAT:</b>	You will attend 2 laboratory sessions over the semester. You will attend one session between weeks 3 - 7 and one session between weeks 8 - 12. Prior to each session, you will complete a series of pre-lab questions on Blackboard. During the session, you will conduct an experiment and complete 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 report submission. This report will be submitted at the end of the session.

CRITERIA:	No.	Learning Outcome assessed	
	1	Accuracy of the explanation and/or numerical result	1 2 3 4 5
	2	Application of the fundamental laws and principles to the experimental conditions	1 2 3 4 5
	3	Identification and verification of the system being analysed using sketches and modelling	2 6
	4	Communication of results	6
	5	1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	1 3 5
	6	2.2 Fluent application of engineering techniques, tools and resources.	1 2 3 4 5
	7	3.5 Orderly management of self, and professional conduct.	6

### All - Assessment Task 3: Examination

<b>GOAL:</b>	The goal of this task is to evaluate your knowledge of the foundational concepts in thermodynamics, fluid mechanics and heat transfer, and to demonstrate the use of standard methods to analyse problems within the discipline.		
<b>PRODUCT:</b>	Examination - Centrally Scheduled		
<b>FORMAT:</b>	This examination will occur during the central examination period. You will respond to questions using short answer and mathematical working. All teaching modules covered during the semester may be assessed in this examination.		
CRITERIA:	No.	Learning Outcome assessed	
	1	Accuracy of the explanation and/or numerical result	1 2 3 4 5 6
	2	Application of the fundamental laws and principles to solve problems	1 2 3 4 5
	3	Identification and verification of the system being analysed using sketches and modelling	2 6
	4	1.1 Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline.	1 2 3 4 5
	5	1.3 In-depth understanding of specialist bodies of knowledge within the engineering discipline.	1 2 3 4 5
	6	2.2 Fluent application of engineering techniques, tools and resources.	1 2 3 4 5

## 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. Directed study hours may vary by location. 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 Blackboard 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	PUBLISHER
Required	Y.A. Cengel, J. Cimbala, and R.H. Turner	2017	Fundamentals of Thermal-Fluid Sciences	McGraw-Hill Education
Recommended	Yunus A. Çengel,Boles,Michael A. Boles	2015	Thermodynamics	McGraw-Hill Education Limited
Recommended	Yunus A. Cengel,Afshin Jahanshahi Ghajar	2015	Heat and Mass Transfer	McGraw-Hill Education
Recommended	Yunus Cengel, John Cimbala	2017	Fluid Mechanics	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 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 Blackboard, are electronically checked through SafeAssign. This software allows for text comparisons to be made between your submitted assessment item and all other work that SafeAssign has access to.

### 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. 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](mailto:studentcentral@usc.edu.au).

#### 10.5. 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](mailto:studentwellbeing@usc.edu.au) or call 07 5430 1226.

#### 10.6. 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](mailto:AccessAbility@usc.edu.au) or call 07 5430 2890.

#### 10.7. 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
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

Visit the USC website: <http://www.usc.edu.au/explore/policies-and-procedures#academic-learning-and-teaching>

#### 10.8. General Enquiries

##### In person:

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

**Tel:** +61 7 5430 2890

**Email:** [studentcentral@usc.edu.au](mailto:studentcentral@usc.edu.au)