COURSE OUTLINE

MEC302 Thermofluids 2

Course Coordinator: Charith Rathnayaka Mudiyanselage (crathnayaka@usc.edu.au) **School:** School of Science, Technology and Engineering

2022 | Semester 1

USC Sunshine Coast
USC 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 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 is an area of study that combines thermodynamics, fluid mechanics, and heat transfer. This course will extend on the foundational concepts covered in the Thermofluids 1 course and will introduce you to more advanced 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 – Two laboratory sessions per semester	3hrs	Not applicable	2 times

1.3. Course Topics

- Revision of Fundamental Concepts
- The Second Law of Thermodynamics
- Entropy
- Internal Fluid Flow and Piping Systems
- Navier-Stokes Equations and Differential Analysis of Fluid Flow
- External Fluid Flow
- Dimensional Analysis and Similarity
- Steady Heat Conduction
- Forced Convection
- Heat Exchangers

2. What level is this course?

300 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
1 Examine and appraise the application of concepts in thermodynamics, fluid mechanics, and heat transfer through theoretical and experimental techniques	Knowledgeable Creative and critical thinker Engaged	1.1 - Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 1.2 - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. 2.2 - Fluent application of engineering techniques, tools and resources.
2 Manipulate and apply the laws and principles used in thermodynamics, fluid mechanics, and heat transfer	Knowledgeable Creative and critical thinker Empowered	1.1 - Comprehensive, theory based understanding of the underpinning natural and physical sciences and the engineering fundamentals applicable to the engineering discipline. 1.2 - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. 1.3 - In-depth understanding of specialist bodies of knowledge within the engineering discipline.
3 Identify hypotheses for modelling engineering thermal and fluid systems and verify their suitability	Creative and critical thinker Empowered Engaged	1.2 - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin 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.
4 Solve intermediate-level problems in thermodynamics, fluid mechanics and heat transfer, and model the systems through sketches	Creative and critical thinker Empowered	1.3 - In-depth understanding of specialist bodies of knowledge within the engineering discipline. 2.2 - Fluent application of engineering techniques, tools and resources. 3.2 - Effective oral and written communication in professional and lay domains.

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
5 Demonstrate the ability to work collaboratively in teams	Empowered Ethical Engaged Sustainability-focussed	3.1 - Ethical conduct and professional accountability. 3.2 - Effective oral and written communication in professional and lay domains. 3.6 - Effective team membership and team leadership.
6 Develop models to address particular engineering problems and communicate that models clearly and coherently in written and oral forms using correct terminology and appropriate formats	Knowledgeable Empowered Ethical Engaged Sustainability-focussed	1.2 - Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline. 2.2 - Fluent application of engineering techniques, tools and resources. 3.2 - Effective oral and written communication in professional and lay domains.

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

MEC200 and MTH203 and enrolled in Program SC404, SC405, SC410, SC411, SC425, AB101, UU301, UU302 or XU301

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

ENG300

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

Students are assumed to have foundational skills in mathematics and physical sciences. A solid knowledge of calculus is also required.

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 formative assessment for this course includes online quizzes. The results of these quizzes will provide you with feedback on your performance. 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?

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All	1	Practical / Laboratory Skills	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	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 and in class
All	3	Examination - Centrally Scheduled	Individual	40%	3 hours	Exam Period	Exam Venue
All	4	Quiz/zes	Individual	0%	Short answer / multiple-choice / analytical working	Week 3	Online Test (Quiz)

All - Assessment Task 1: Laboratory Reports

GOAL:	The goal of this task is to investigate fundamental principles of thermodynamics, fluid mechanics and heat transfer through experimental applications and subsequent analyses.
PRODUCT:	Practical / Laboratory Skills
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. A template will be provided for the calculations and report. Students attend a total of two lab sessions.
CRITERIA:	

No.		Learning Outcome assessed
1	Examination and appraisal of fundamental laws and principles and their applications through experimental techniques	1 2 5
2	Identification and verification of suitable hypotheses for modelling the system	2 3 4
3	Solution of intermediate-level problems in thermodynamics, fluid mechanics and heat transfer	3 4
4	Modelling of the system through sketches	1 4
5	Accuracy of the numerical result	1 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 through a given engineering context. You will be required analyse, discuss and present a thermofluids 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	Manipulation and application of the appropriate fundamental laws and principles for the given problem	3 4
2	Identification and verification of suitable hypotheses for modelling the system	1 2
3	Peer assessment of the group collaborative work	5 6
4	Development of a model that addresses the given problem	1 3
5	Communication of models clearly and coherently in written form using correct terminology and appropriate formats	5 6

All - Assessment Task 3: 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 examination.

CRITERIA:

No.		Learning Outcome assessed
1	Manipulation and application of appropriate fundamental laws and principles for the given problem	1 2
2	Identification and verification of suitable hypotheses for modelling the systems	3 4
3	Solution of intermediate-level problems in thermodynamics, fluid mechanics and heat transfer	2 4
4	Accuracy of the explanation and/or numerical result	2 4

All - Assessment Task 4: Zero-Weight Formative Quiz for Early Feedback

GOAL:	This zero-weight formative assessment for this course 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 working. This will be an individual task.

CRITERIA:	No.		Learning Outcome assessed
	1	Accuracy of the explanation and/or numerical result	1 2 4
	2	Application of the fundamental thermofluids laws and principles to solve problems	3 4
	3	Identification and verification of the system being analysed using sketches and modelling	1 4
	4	Communication of results	6

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.

7.1. Schedule

PERIOD AND TOPIC	ACTIVITIES
1	Revision of Fundamental Concepts
2	Second Law of Thermodynamics
3	Entropy
4	Entropy
5	Internal Fluid Flow and Piping Systems
6	Navier-Stokes Equations and Differential Analysis of Fluid Flow
7	External Fluid Flow
9	Dimensional Analyis and Similarity
10	Steady Heat Conduction
11	Forced Convection
12	Heat Exchangers

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
Required	Yunus A. Cengel, John M. Cimbala	2017	Fluid Mechanics: Fundamentals and Applications	4th Edition in SI Units (or a later edition)	McGraw-Hill Education
Recommended	Yunus A. Çengel,Boles,Michael A. Boles	2014	Thermodynamics	8th edition in SI units (or a later edition)	McGraw-Hill Education
Recommended	Yunus A. Cengel, Afshin J. Ghajar	2014	Heat and Mass Transfer	Fifth 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 spaces (for lab classes and tutorials that are held in a laboratory space). Students who do not have appropriate footwear will not be permitted to enter laboratory spaces due to health and safety requirements.

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 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 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. SafeUSC

USC 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 SafeUSC by phone: 07 5430 1168 or using the SafeZone app. For general enquires contact the SafeUSC team by phone 07 5456 3864 or email safe@usc.edu.au.

The SafeUSC 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 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
- Administration of Central Examinations
- Deferred Examinations
- Student Academic Misconduct
- Students with a Disability

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

10.9. Student Charter

USC 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:

- **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