COURSE OUTLINE

MEC400 Thermofluids 3

School: School of Science, Technology and Engineering

2023 | 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

Thermofluids is an area of study that combines thermodynamics, fluid mechanics, and heat transfer. This course will extend foundational concepts covered in Thermofluids 1 and Thermofluids 2. In this course, you will work with advanced concepts of thermodynamics, fluid mechanics and heat transfer. For example, gas power cycles, vapour power cycles, refrigeration and air-conditioning under thermodyanmics. Fluid mechanics applications of turbomachinery and compressible flow will also be discussed. Furthermore, advanced heat transfer concepts and applications of transient heat conduction, natural convection and thermal radiation will be introduced.

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 four labs (3 hr each) per semester (Two Engineering Labs and Two CFD Computer Labs)	3hrs	Week 5	4 times
Seminar – Face-to-face seminars for the whole cohort	1hr	Week 2	2 times

1.3. Course Topics

- Revision of Fundamental Concepts
- Gas Power Cycles
- Vapour Power Cycles and Refrigeration
- Air-conditioning
- Turbomachinery
- Compressible Flow
- 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 Manipulate and apply advanced laws and principles used in thermodynamics, fluid mechanics, and heat transfer	Knowledgeable Empowered Sustainability-focussed	2.1, 2.2, 2.4
2 Identify and justify hypotheses for modelling advanced engineering thermal and fluid systems	Knowledgeable Creative and critical thinker Empowered Ethical Engaged	1.2, 1.5, 3.3
3 Solve complex problems in thermodynamics, fluid mechanics and heat transfer, and model the system through diagrams	Knowledgeable Creative and critical thinker Empowered Sustainability-focussed	1.5, 2.2, 3.2
4 Examine and appraise the diverse application of concepts in thermodynamics, fluid mechanics, and heat transfer through experimental techniques in a range of scales	Ethical Engaged Sustainability-focussed	1.6, 2.2, 3.4
5 Develop a model that presents a solution to a complex engineering problem in thermodynamics, fluid mechanics, and heat transfer	Knowledgeable Creative and critical thinker Empowered Ethical	1.2, 2.3, 3.2
6 Communicate complex concepts effectively and fluently in written and oral form susing correct terminology and appropriate formats	Knowledgeable Empowered Engaged Sustainability-focussed	3.1, 3.2, 3.4, 3.6

* Competencies by Professional Body

CODE	COMPETENCY
ENGINEERS AUSTRALIA STAGE 1 PROFESSIONAL ENGINEER COMPETENCY STANDARDS	
1.2	Knowledge and Skill Base: Conceptual understanding of the mathematics, numerical analysis, statistics, and computer and information sciences which underpin the engineering discipline.
1.5	Knowledge and Skill Base: Knowledge of engineering design practice and contextual factors impacting 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.
2.1	Engineering Application Ability: Application of established engineering methods to complex engineering problem solving.

CODE	COMPETENCY
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.
2.4	Engineering Application Ability: Application of systematic approaches to the conduct and management of engineering projects.
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.
3.3	Professional and Personal Attributes: Creative, innovative and pro-active demeanour.
3.4	Professional and Personal Attributes: Professional use and management of information.
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

MEC302 or ENG300

5.2. Co-requisites

Not applicable

5.3. Anti-requisites

ENG400

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?
All	1	Quiz/zes	Individual	0%	Short answer / multiple-choice / analytical working	Week 3	Online Test (Quiz)
All	2	Practical / Laboratory Skills	Individual	40%	Two Engineering lab sessions (3 hr each). Pre-lab quiz questions and individual laboratory reports (1500 word equivalent)	Week 8	Online Assignment Submission with plagiarism check
All	3	Oral and Written Piece	Individual and Group	30%	2000-word written group report and 15-minute group oral presentation	Week 12	Online Assignment Submission with plagiarism check and in class
All	4	Examination - Centrally Scheduled	Individual	30%	2 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 3
2	Application of the fundamental thermofluids laws and principles to solve problems	1 3
3	Identification and verification of the system being analysed using sketches and modelling	3 5
4	Communication of results	6

All - Assessment Task 2: Laboratory Skills

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 report. Students attend a total of two Engineering lab sessions.

CRITERIA:

No.		Learning Outcome assessed
1	Examination and appraisal of laws and principles and their applications through experimental techniques	1 2 4 6
2	Identification and justification of hypotheses for modelling the system	3 5
3	Solution of complex problems in thermodynamics, fluid mechanics and heat transfer	3 4
4	Modelling of the system through sketches	1 2
5	Accuracy of the numerical result	1 3

All - Assessment Task 3: 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 situation. 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 2000 words while the corresponding group oral presentation will be approximately 15 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 2
2	Identification and verification of suitable hypotheses for modelling the system	2 3
3	Development of a model that addresses the given complex engineering problem	1 3 5
4	Communication of models effectively and fluently in written form using correct terminology and appropriate formats	5 6

All - Assessment Task 4: Examination

GOAL:	The goal of this task is to evaluate your knowledge of the advanced concepts of thermodynamics, fluid mechanics and heat transfer, and to demonstrate the use of standard and advanced methods to analyse problems within the discipline.
PRODUCT:	Examination - Centrally Scheduled
FORMAT:	Centrally scheduled 2-hour examination.

CRITERIA:	No.		Learning Outcome assessed
	1	Manipulation and application of appropriate fundamental laws and principles for the given problem	1 3
	2	Identification and verification of suitable hypotheses for modelling the systems	2 5
	3	Solution of advanced-level problems in thermodynamics, fluid mechanics and heat transfer	1 2 3
	4	Accuracy of the explanation and/or numerical result	3 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. 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	Gas power cycles
3	Vapour power cycles
4	Refrigeration
5	Air-conditioning
6	Turbomachinery
7	Compressible flow
8	Transient heat conduction
9	Numerical heat conduction
10	Natural convection
11	Thermal radiation
12	Radiation heat exchange

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. Çengel,John M. Cimbala	2017	FLUID MECHANICS: FUNDAMENTALS AND APPLICATIONS, SI	4th Edition in SI units (or a later edition)	MCGRAW-HILL EDUCATION
Recommended	Yunus A. Cengel,Afshin Jahanshahi Ghajar	0	Heat and Mass Transfer	Fifth edition in SI units (or a later edition)	n/a
Recommended	Yunus A. Çengel,Boles,Michael A. Boles	2014	Thermodynamics	8th edition in SI units (or a later edition)	McGraw-Hill Education Limited

8.2. Specific requirements

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

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

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. 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 or using the SafeZone app. For general enquires contact the SafeUniSC team by phone 07 5456 3864 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 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