USC

Course Outline

Code: ENG300
Title: Fluid Mechanics

School: Science & Engineering
Teaching Session: Semester 1
Year: 2019
Course Coordinator: Dr Carolyn Jacobs Email: cjacobs1@usc.edu.au
Course Moderator: Dr Helen Fairweather Email: hfairwea@usc.edu.au

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

All engineers must have an understanding of fluid behaviour under both static and dynamic conditions. In this course, you will learn how to estimate the forces on moving or stationary bodies caused by flowing fluids, either internally or externally such as forces on nozzles, elbows, blades and drag forces on chimneys, high rise buildings, and different types of constructions, aircraft and ships. You will also become proficient in analysing enclosed and pressurised fluids. The course will allow students to analyse and design systems in which fluids form the working medium.

1.2 Course topics

The teaching themes in this course include:

- analysis and design of the statics and dynamics of fluid flow
- similitude and dimensional analysis: Buckingham's Pi theorem, important dimensionless groups, dynamic similarity practical use of the dimensionless groups
- internal viscous flow (eg laminar and turbulent flows in pipes and ducts),
- viscous flow around bodies
- boundary layer and compressible flow
- control volume analysis using basic equations for fluid flow
- differential form formulation of the basic equations such as Euler's and Bernoulli's equations.
- viscous flow: laminar and turbulent flows, pipe flow, head loss in pipes, minor head loss in pipe systems, hydraulic and energy grade lines, multiple path pipe systems.
- viscous flow: boundary layer, laminar and turbulent flow on flat plate fluid flow about immersed bodies, drag and lift forces
- compressible flow in changing area channels with or without friction

2. What level is this course?

300 level Graduate - Independent application of graduate knowledge and skills. Meets AQF and professional requirements. May require pre-requisites and developing level knowledge/skills. Normally taken in the 3rd or 4th 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?

Specific Learning Outcomes On successful completion of this course you should be able to:	**Assessment Tasks** You will be assessed on the learning outcome in task/s:	**Graduate Qualities or Professional Standards mapping** Completing these tasks successfully will contribute to you becoming:
Estimate the forces on submerged bodies in static fluid situation	Task 1	Knowledgeable. Empowered.
Analyse the transportation of different types of fluids in a variety of applications and be able to avoid unwanted phenomena such as cavitation and water hammer	Task 1, Task 3	Creative and critical thinkers. Empowered.
Estimate the forces on moving, or stationary bodies caused by flowing fluids, either internally or externally such as forces on nozzles, elbows, blades and drag forces on chimneys, high rise buildings, aircraft and ships	Task 1, Task 2, Task 3	Empowered. Knowledgeable.
Analyse the behaviour of high speed flows i.e. compressible flow in ducts, nozzles and diffusers	Task 1, Task 3	Creative and critical thinkers. Empowered.

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 Enrolment restrictions

This course is only available to students enrolled in SC411 program

5.2 Pre-requisites

MTH312 or MTH203

5.3 Co-requisites

Nil

5.4 Anti-requisites

MEC3102

5.5 Specific assumed prior knowledge and skills (where applicable)

N/A

6. How am I going to be assessed?

6.1 Grading scale

Standard – High Distinction (HD), Distinction (DN), Credit (CR), Pass (PS), Fail (FL)

6.2 Assessment tasks

Task No.	Assessment Tasks	Individual or Group	Weighting %	What is the duration / length?	When should I submit?	Where should I submit it?
1	Tutorial assignments	Individual	30% (6 x 5%)	Short answer response	Weeks 2, 4, 6, 8, 10, 12	Safe Assign on Blackboard
2	Laboratory report	Group	25%	5 pages	Week 13	Safe Assign on Blackboard
3	Final Examination	Individual	45%	2 hours	Exam period	At exam centre
			100%			

Assessment Task 1: Tutorial assignments

Goal:	The goal of this task is for you to demonstrate mastery of the basic concepts of fluid flow and the use of Control Volume analyses..
Product:	Full written solutions to assigned tutorial problems.
Format:	The assignments are to be submitted as a PDF file on Blackboard through Safe Assign. Tasks will be submitted in weeks 2, 4, 6, 8, 10, and 12 of semester. Tasks will be assigned via Blackboard. The assessment will be graded on the correctness and clarity of the submitted working, diagrams and solutions, and the correct selection of methods
Criteria:	You will be assessed on: • Accuracy of the explanation and/or numerical result • Investigation and application of fluid mechanics concepts • Identification and verification of the system being analysed using sketches and modelling • Communication of results

Generic skill assessed	**Skill assessment level**
Applying technologies	Graduate
Problem Solving	Graduate

Engineers Australia competencies assessed in this task

1.1 Comprehensive theory based understanding of the underpinning natural and physical fundamentals applicable to an engineering discipline

1.2 Conceptual understanding of the mathematics, numerical analysis, statistic and computer and information sciences which underpin the engineering discipline.

2.2 Fluent application of engineering techniques, tools and resources.

Assessment Task 2: Mid-semester examination

Goal:	The goal of this task is to explain fluid mechanics principles through experimental applications and reporting on the results.
Product:	Written laboratory report
Format:	You will attend 3 laboratory sessions over the semester. These sessions will be held in weeks 2, 10, and 12. During the sessions, you will conduct an experiment and complete a report. One laboratory report will be selected for submission as a detailed written report due in week 13. The experimental work and reports will be written as a group. Detailed instructions on the report format will be provided.
Criteria:	You will be assessed on: • Accuracy of the explanation and/or numerical result Investigation and application of fluid mechanics concepts Identification and verification of the system being analysed using sketches and modelling Communication of results

Generic skll assessed	**Skill assessment level**
Communication	Graduate
Applying Technologies	Graduate
Engineers Australia competencies assessed in this task	
1.1 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.	

Assessment Task 3: Final Examination

Goal:	This assessment is to ensure that you have achieved a sound knowledge of the fluid statics and flow, and can use the standard methods of analysis and design
Product:	Written exam paper
Format:	Exam booklet to be submitted at the end of the examination
Criteria:	You will be assessed on: • Accuracy of the explanation and/or numerical result Investigation and application of fluid mechanics concepts Identification and verification of the system being analysed using sketches and modelling

Generic skill assessed	**Skill assessment level**
Applying technologies	Graduate
Problem solving	Graduate
Engineers Australia competencies assessed in this task	
2.1 Application of established engineering methods to complex engineering problem solving 2.2. Fluent application of engineering techniques, tools and resources.	

7. What are the course activities?

7.1 Directed study hours

Lectures – 2 hours/week
Tutorials – 2 hours/week
Laboratory – 2 hours on weeks 2, 10, 12

7.2 Teaching semester/session(s) offered

Sippy Downs: Semester 1

7.3 Course content

Teaching Week / Module	What key concepts/content will I learn?	What activities will I engage in to learn the concepts/content?	
		Directed Study Activities	Independent Study Activities
1	Introduction and Fundamental Concepts	Lectures Tutorial Classes	Directed reading from textbook required
2	Fluid Statics	Lectures Tutorial Classes	Directed reading from textbook required 1st Laboratory Class
3	Fluids in Motion	Lectures Tutorial Classes	Directed reading from textbook required
4	Integral Form of Fundamental Laws	Lectures Tutorial Classes	Directed reading from textbook required
5	Dimensional Analysis and Similitude	Lectures Tutorial Classes	Directed reading from textbook required
6	Internal Flows	Lectures Tutorial Classes	Directed reading from textbook required
7	External Flows	Lectures Tutorial Classes	Directed reading from textbook required
8	Compressible Flow	Lectures Tutorial Classes	Directed reading from textbook required
9	Flow in Open Channels	Lectures Tutorial Classes	Directed reading from textbook required
10	Flow in Piping Systems	Lectures Tutorial Classes	Directed reading from textbook required 2nd Laboratory Class
11	Turbomachinery	Lectures Tutorial Classes	Directed reading from textbook required
12	Introduction to Computational Fluid Dynamics	Lectures Tutorial Classes	Directed reading from textbook required 3rd Laboratory Class
13	Revision	Lectures	

Please note that the course activities may be subject to variation.

8. What resources do I need to undertake this course?

Please note that 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)

Please note that you need to have regular access to the resource(s) listed below as they are required:

Author	Year	Title	Publisher
Potter, M.C, Wiggert, D.C. & Ramadan, B.H.	2012	Mechanics of Fluids (SI edition)	Cengage Learning

8.2 Specific requirements

Covered shoes required for laboratory work.

9. Risk management

Health and safety risks have been assessed as low.

It is your responsibility as a student 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. It is also your responsibility to familiarise yourself with the University's general health and safety principles by reviewing the online Health Safety and Wellbeing training module 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

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%
b) The course is graded using the Standard Grading scale
c) You have not failed an assessment task in the course due to academic misconduct

10.3 Assessment: Submission penalties

Late submission of assessment tasks will 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 and supply the required documentation to negotiate an outcome.

10.4 Study help

In the first instance, you should contact your tutor, then the Course Coordinator. Additional assistance is provided to all students through Academic Skills Advisers. To book an appointment or find a drop-in session go to Student Hub.

Contact Student Central for further assistance: +61 7 5430 2890 or studentcentral@usc.edu.au

10.5 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

10.6 General Enquiries

In person:

- **USC Sunshine Coast** - Student Central, Ground Floor, Building C, 90 Sippy Downs Drive, Sippy Downs
- **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

Tel: +61 7 5430 2890

Email: studentcentral@usc.edu.au