



The University of Southern Queensland

## Course specification

### Description: Fluid Mechanics

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
MEC	3102	40472	1, 2005	EXT	1.00	Toowoomba

<b>Academic group:</b>	FOENS
<b>Academic org:</b>	FOES02
<b>Student contribution band:</b>	2
<b>ASCED code:</b>	030799

### STAFFING

Examiner: Ruth Mossad

Moderator: David Buttsworth

### REQUISITES

Pre-requisite: MAT2100 and MEC2101

### RATIONALE

Mechanical engineers are expected to have the knowledge and the understanding of the basic principles and concepts of fluid mechanics both in static and dynamic conditions. This is to enable them to analyse and design systems in which fluid is the working medium.

### SYNOPSIS

This course presents the fundamental concepts of fluid behaviour both under static and dynamic conditions. This course is designed to enable the student to analyse and design any practical problem in which fluid is the working medium. The contents of this course includes statics and dynamics of fluid flow, dimensional analysis, internal viscous flow, eg laminar and turbulent flows in pipes and ducts. Also, viscous flow around bodies, boundary layer and compressible flow. The theoretical knowledge is reinforced by practical work, videos and a project.

### OBJECTIVES

On completion of this course, students should be able to analyse and design many of the real life flow type problems and be able to choose a suitable simple model for the analysis to make the solution possible with the tools they have learned. Some examples of these problems are:

1. estimation of forces on submerged bodies in static fluid situation and their stability;
2. transportation of different types of fluids in a variety of applications and be able to avoid unwanted phenomena such as cavitation and water hammer;
3. estimation of 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, different types of constructions, aircraft's and ships;
4. behaviour of high speed flows ie compressible flow in ducts, nozzles and diffusers.

## TOPICS

	Description	Weighting (%)
1.	Introduction and Fundamental Concepts	5.00
	1.1. Definition of a fluid, dimensions, units and methods of analysis, fluid as a continuum, some basic definitions, description and classification of fluid motions.	
2.	Fluid Statics	15.00
	2.1. Pressure variations in static fluid, hydrostatic forces on submerged bodies.	
3.	Control Volume Formulation	15.00
	3.1. Basic equations for fluid flow, such as continuity, momentum and energy equations for control volume approach, and the angular momentum principle.	
4.	Differential Form Formulation	15.00
	4.1. Differential form of the basic equations, Euler's and Bernoulli's equations.	
5.	Similitude and Dimensional Analysis	8.00
	5.1. Buckingham's p theorem, important dimensionless groups, dynamic similarity practical use of the dimensionless groups.	
6.	Internal Incompressible Viscous Flow	18.00
	6.1. 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.	
7.	External Incompressible Viscous Flow	12.00
	7.1. Boundary layer, laminar and turbulent flow on flat plate Fluid flow about immersed bodies, drag and lift forces.	
8.	Compressible Flow	12.00
	8.1. Study compressible flow in changing area channels with or without friction.	

## TEXT and MATERIALS required to be PURCHASED or ACCESSED

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at <http://bookshop.usq.edu.au> click 'Semester', then enter your 'Course Code' (no spaces).

Fox, RW & McDonald, AT 2003, *Introduction to Fluid Mechanics*, 6th edn, Wiley, New York.

## REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Crowe, CT 200 *Engineering Fluid Mechanics*, 7th edn, Wiley, New York.

Esposito, A 1998, *Fluid Mechanics with Applications*, Prentice Hall, New Jersey.

Giles, RV et al 1994, *Fluid Mechanics and Hydraulics*, 3rd edn, McGraw-Hill, New York.  
(Schaum's Outline Series)

Munson, et al 1998, *Fundamentals of Fluid Mechanics*, 3rd edn, Wiley and Sons, New York.

Shames, IH 1992, *Mechanics of Fluids*, 3rd edn, McGraw Hill, New York.

Street, RL 1995, *Elementary Fluid Mechanics*, 7th edn, John Wiley and Sons, New York.  
(SI Edition)

White, F 1994, *Fluid Mechanics*, 3rd edn, McGraw-Hill, New York.

## STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessment	15.00
Directed Study	74.00
Examinations	3.00
Private Study	63.00

## ASSESSMENT DETAILS

Description	Marks out of	Wtg(%)	Due date
ASSIGNMENT 1	150.00	15.00	22 Apr 2005
ASSIGNMENT 2	150.00	15.00	03 Jun 2005
3 HOUR RESTRICTED EXAMINATION	700.00	70.00	END S1 (see note 1)

### NOTES

1. Student Administration will advise students of the dates of their examinations during the semester.

## IMPORTANT ASSESSMENT INFORMATION

- 1 Attendance requirements:  
There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.
- 2 Requirements for students to complete each assessment item satisfactorily:  
(i) To complete each of the assignments satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for each assignment. (ii) To

complete the examination satisfactorily, students must obtain at least 50% of the marks available (or at least a grade of C-) for the examination.

- 3 Penalties for late submission of required work:  
If students submit assignments after the due date without prior approval then a penalty of 10% of the total marks gained by the student for the assignment will apply for each working day late.
- 4 Requirements for student to be awarded a passing grade in the course:  
To be assured of a passing grade, students must demonstrate, via the summative assessment items, that they have achieved the required minimum standards in relation to the objectives of the course by satisfactorily completing all summative assessment items (the examination and assignments), as stated in 2 above.
- 5 Method used to combine assessment results to attain final grade:  
The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.
- 6 Examination information:  
In a Restricted Examination, candidates are allowed access to specific materials during the examination. The only materials that candidates may use in the restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); any type of calculator may be brought in to the examination; Formula sheets. A handwritten A4 sheet (two sides) containing any information that they believe will be relevant for the examination. Tables, charts and graphs needed for the solution of the examination will be provided.
- 7 Examination period when Deferred/Supplementary examinations will be held:  
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.
- 8 University Regulations:  
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL <http://www.usq.edu.au/corporateservices/calendar/part5.htm> or in the current USQ Handbook.

## **ASSESSMENT NOTES**

- 1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.
- 2 Students must retain a copy of each item submitted for assessment. This must be produced within five days if required by the Examiner.
- 3 In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.
- 4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media.
- 5 The Faculty will NOT accept submission of assignments by facsimile.
- 6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.

- 7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.
- 8 Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded one of the temporary grades: IM (Incomplete - Make up), IS (Incomplete - Supplementary Examination) or ISM (Incomplete -Supplementary Examination and Make up). A temporary grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non directed personal study.
- 9 Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination; IDM (Incomplete Deferred Make-up); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).

#### **OTHER REQUIREMENTS**

- 1 Students will require access to e-mail and internet access to USQConnect for this course.
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