



The University of Southern Queensland

Course specification

The current and official versions of the course specifications are available on the web at <http://www.usq.edu.au/coursespecification/current>.
Please consult the web for updates that may occur during the year.

Description: Fluid Mechanics

| Subject | Cat-nbr | Class | Term | Mode | Units | Campus |
|---------|---------|-------|---------|------|-------|-----------|
| MEC | 3102 | 86305 | 1, 2009 | EXT | 1.00 | Toowoomba |

| | |
|-----------------------------------|--------|
| Academic group: | FOENS |
| Academic org: | FOES02 |
| Student contribution band: | 2 |
| ASCED code: | 030799 |

STAFFING

Examiner: Ahmad Sharifian
Moderator: Talal Yusaf

REQUISITES

Pre-requisite: (MAT2500 and MEC2101) or Students must be enrolled in one of the following Programs: GCEN or GDET or METC or MEPR

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 systems 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), viscous flow around bodies, boundary layer and compressible flow.

OBJECTIVES

The course objectives define the student learning outcomes for a course. The assessment item(s) that may be used to assess student achievement of an objective are shown in parenthesis. On completion of this course, students should be able to:

1. estimation of forces on submerged bodies in static fluid situation (Assignment 1, Exam);
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 (Assignment 1, Assignment 2, Exam);
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 and ships (Assignment 1, Assignment 2, Exam);
4. behaviour of high speed flows ie compressible flow in ducts, nozzles and diffusers (Assignment 2, Exam).

TOPICS

| Description | Weighting (%) |
|---|---------------|
| 1. Introduction and Fundamental Concepts | 7.00 |
| 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 | 10.00 |
| 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, Pritchard, PJ & McDonald, AT 2008, *Introduction to fluid mechanics*, 7th 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 2000, *Engineering fluid mechanics*, 7th edn, Wiley, New York.

Esposito, A 1998, *Fluid mechanics with applications*, Prentice Hall, New Jersey.

Giles, RV et al 1994, *Schaum's outline of theory and problems of fluid mechanics and hydraulics*, 3rd edn, McGraw-Hill, New York.

(Schaum's Outline Series)

Munson, et al 2005, *Fundamentals of fluid mechanics*, 5th 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 & Sons, New York.

(SI Edition)

White, F 2003, *Fluid mechanics*, 5th edn, McGraw-Hill, New York.

STUDENT WORKLOAD REQUIREMENTS

| ACTIVITY | HOURS |
|----------------|-------|
| Assessments | 15.00 |
| Directed Study | 74.00 |
| Examinations | 2.00 |
| Private Study | 64.00 |

ASSESSMENT DETAILS

| Description | Marks out of | Wtg (%) | Due date |
|-------------------------------|--------------|---------|------------------------|
| ASSIGNMENT 1 | 150.00 | 15.00 | 23 Apr 2009 |
| ASSIGNMENT 2 | 150.00 | 15.00 | 05 Jun 2009 |
| 2 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:
To satisfactorily complete an assessment item a student must achieve at least 50% of the marks or a grade of at least C-. Students do not have to satisfactorily complete each assessment item to be awarded a passing grade in this course. Refer to Statement 4 below for the requirements to receive a passing grade in this course.
- 3 Penalties for late submission of required work:
If students submit assignments after the due date without extenuating circumstances then a penalty of 5% of the assigned mark may apply for each working day late up to a maximum of ten working days at which time a mark of zero can be recorded for that assignment.
- 4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade in a course a student must obtain at least 50% of the total weighted marks for the course.
- 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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