MCEN90008 Fluid Dynamics

Credit Points:	12.5
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2015, Parkville This subject commences in the following study period/s: Semester 2, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 36 hours of lectures, 12 hours of tutorials and up to 10 hours of practical work. Total Time Commitment: 200 hours
Prerequisites:	see below

Prerequisites:

Subject	Study Period Commencement:	Credit Points:
COMP20005 Engineering Computation	Semester 1, Semester 2	12.50

and

Subject	Study Period Commencement:	Credit Points:
MCEN30018 Thermodynamics and Fluid Mechanics	Semester 1, Semester 2	12.50

PLUS either

Subject	Study Period Commencement:	Credit Points:
MAST20029 Engineering Mathematics	Summer Term, Semester 1, Semester 2	12.50

OR both of:

Subject	Study Period Commencement:	Credit Points:
MAST20009 Vector Calculus	Semester 1, Semester 2	12.50
MAST20030 Differential Equations	Semester 2	12.50

Corequisites:	None
Recommended Background Knowledge:	None
Non Allowed Subjects:	Students cannot enrol in and gain credit for this subject and - # MCEN30004 Thermofluids 2 or # MCEN30005 Thermofluids 3
Core Participation Requirements:	For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Student Support and Engagement Policy, academic requirements for this subject are articulated in the Subject Overview, Learning Outcomes, Assessment and Generic Skills sections of this entry. It is University policy to take all reasonable steps to minimise the impact of disability upon academic study, and reasonable adjustments will be made to enhance a student's participation in the University's programs. Students who feel their disability may impact on meeting the requirements of this subject are encouraged to discuss this matter with a Faculty Student Adviser and Student Equity and Disability Support: http://services.unimelb.edu.au/disability

Coordinator:	Assoc Prof Nicholas Hutchins
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Subject Overview:	**AIMS** This subject builds upon previous fluids subjects, providing students with the basic skills necessary to calculate fluid flows around bodies. Broadly speaking the subject is divided into two units; Unit 1: potential flow and Unit 2: compressible flow. These could equally be described as subsonic and supersonic aerodynamics respectively. Fluid flows have broad reaching applications in many engineering systems and examples as broad as building ventilation, mixing, as well as meteorological applications are considered in unit 1. The supersonic course is more firmly concentrated on aeronautical / astronautical applications. Both units will start from the basic equations of motion governing fluid flow, and build a useable set of tools that enable the students to calculate flow fields in potential and supersonic flows. This approach will give students a clear sense of the origins of the tools that they use, and also a clear sense of the limitations. Such knowledge is necessary since these theories provided much of the backbone to early computational fluid dynamics packages used in industry. The two units are strongly linked by the same goal. Throughout the potential flow unit, we build slowly from first principles, proving the utility of potential flow solutions, adding building block flows until eventually the course culminates with a demonstration of how these techniques can be used to calculate the flow (and lift coefficient) of subsonic airfoils. The supersonic unit follows a similar approach, building from first principles, until we eventually develop a set of tools that enables the calculation of the flow (and lift coefficient) of supersonic airfoils. In doing so, students will be introduced to many aspects of supersonic aircraft design. **INDICATIVE CONTENT** This subject introduces students to analysis techniques used in subsonic and supersonic flows. Topics covered include (Unit 1) basic introduction to inviscid flow with and without vorticity; concepts and analysis using stream function and velocity potential; incompressible viscous flow past bodies with vortex shedding; magnus effect; complex velocity potential; (Unit 2) speed of sound; aerodynamic heating; normal and oblique shock waves; expansion fans; theories of thin airfoils; shock expansion theory; boundary layer and shock wave interactions; the `sound barrier'; experimental techniques.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO)** Having completed this unit the student is expected to be able to: 1 Use complex velocity potential analysis to solve a variety of inviscid flow problems including incompressible flow past airfoils 2 Use Matlab to find numerical solutions of certain more complicated flow situations 3 Understand the basic features of subsonic airfoils, including lift, drag and stall 4 Apply shock expansion theory to the solution of flow in a variety of situations including prediction of lift and drag of two-dimensional bodies in supersonic flow 5 Apply Ackeret or linear theory to thin airfoils 6 Understand the basic features of supersonic airfoil designs and appreciate the differences between subsonic and supersonic airframe design.
Assessment:	Two assignments of up to 2000 words each, requiring 35-40 hours of work in total, due before week 10 of semester (15% each - 30% total) One practical laboratory report of up to 2000 words, requiring approximately 13-15 hours work, scheduled throughout the semester (10%) One 3 hour examination at the end of semester (60%) HURDLE - students must pass the exam component to pass this subject. Intended Learning Outcomes (ILOs) 1 and 3 to 6 are assessed in the examination and the assignments. ILO 2 is assessed throughout the laboratories and assignments. ILO 3 is assessed in the laboratory.
Prescribed Texts:	TBA
Breadth Options:	This subject is not available as a breadth subject.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees

Generic Skills:	On completion of the subject students should have the following skills: # Ability to apply knowledge of science and engineering fundamentals # Ability to undertake problem identification, formulation, and solution # Ability to utilise a systems approach to complex problems and to design and operational performance # Ability to communicate effectively, with the engineering team and with the community at large # Ability to function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member.
Notes:	**LEARNING AND TEACHING METHODS** The subject will be delivered through a combination of lectures and tutorials. Students will also complete two experiments which will reinforce the material covered in lectures.
Related Majors/Minors/ Specialisations:	B-ENG Mechanical Engineering stream Master of Engineering (Mechanical with Business) Master of Engineering (Mechanical)