MCEN90018 Advanced Fluid Dynamics

Credit Points:	12.50
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	This subject is not offered in 2014.
Time Commitment:	Contact Hours: 36 hours lectures, 12 hours tutorials and workshops, 4 hours laboratory Total Time Commitment: 200 hours
Prerequisites:	Prerequisite for this subject is - **MCEN90008 Fluid Dynamics (../../view/2012/MCEN90008)**
Corequisites:	None
Recommended Background Knowledge:	N/A
Non Allowed Subjects:	None
Core Participation Requirements:	For the purposes of considering request for Reasonable Adjustments under the Disability Standards for Education (Cwth 2005), and Students Experiencing Academic Disadvantage Policy, academic requirements for this subject are articulated in the Subject Description, Subject Objectives, Generic Skills and Assessment Requirements of this entry. The University is dedicated to provide support to those with special requirements. Further details on the disability support scheme can be found at the Disability Liaison Unit website: http://www.services.unimelb.edu.au/disability/
Contact:	daniel.chung@unimelb.edu.au
Subject Overview:	The study of fluid dynamics is one of the fundamental disciplines in Mechanical Engineering. In the first part of the course, students will learn about boundary-layer theory, which is a key element of aerodynamic design. Students will also learn about the atmospheric boundary layer and learn how this affects the design of cities, meteorological forecasts and pollutant dispersion. A guest-lecture series on wind engineering will build on this knowledge to give students a perspective on one of the most important forms of renewable energy in our society today. In the second part of the course, students will learn about data acquisition and analysis. These skills are required of engineers working with the technology of today and into the future. The course will help students understand the costs, difficulties and possibilities afforded by sensor systems and instrumentation, with applications for, but not limited to, fluid dynamics. **INDICATIVE CONTENT** This subject will cover selected advanced topics in fluid mechanics. Building on previous fluids courses, the subject is broadly split into two units, although content of these will overlap. Unit 1: Turbulence and boundary layers. Topics covered include Navier-stokes equations applied to wall-bounded flows, similarity solutions of the boundary layer equations, Blasius solution, Falkner and Skan solution, separated flows, turbulent boundary layers, Reynolds averaged Navier-Stokes equations, scaling parameters, pipe friction, Von Karman momentum integral equation, atmospheric turbulence. Unit 2: Experimental techniques. Through a series of lectures, labs and assignments, students will be introduced to key concepts of experimental (and numerical) techniques related to experiments in fluid mechanics. Topics will include: data analysis (to include correlations, fast Fourier transform, energy spectra); Particle Image Velocimetry (PIV); hot-wire anemometry; advanced potential flow numerical techniques.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES / SUBJECT OBJECTIVES** At the conclusion of this subject the student is expected to - 1 - Understand the limitations and advantages of various experimental techniques for fluid mechanics, and also have a sound understanding of the physics underpinning these techniques

	2 - Apply contemporary data analysis techniques for experiments in the area of fluid mechanics, especially for experiments relating to boundary layers and turbulence 3 - Apply the techniques of particle image velocimetry and hot-wire anemometry to investigate complex fluid flows 4 - Understand how the equations of fluid motion are applied to flows near walls 5 - Understand the importance of the boundary layer in engineering applications 6 - Understand the role of turbulence in the atmosphere including weather prediction
Assessment:	One 2 hour examination (40%) at the end of semester. Associated with Intended Learning Outcomes (ILOs) 4-6. Five assignments (including laboratory reports) during semester worth a total of 60%. These assignments will be a combination of laboratory work, computational work and advanced data analysis. Assignments will all involve basic programming skills (for data treatment and analysis). Associated with ILOs 1-3. INDICATIVE ASSESSMENT INFORMATION Two 2 hour laboratory classes will be followed with reports for assessment. Each report should not exceed 1500 words. The reports are submitted in groups. Three written assignments assessed as a combination of individual and group assignments. Each will consist of no more than 1000 words.
Prescribed Texts:	None
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 this unit a student is expected to have the skills to - • Apply knowledge of science and engineering fundamentals • Undertake problem identification, formulation, and solution • Be proficient in engineering design • Communicate effectively with the engineering team and with the community at large • Be creative and innovative
Notes:	**LEARNING AND TEACHING METHODS** The subject will be delivered through a combination of lectures, guest lectures, tutorials and laboratory demonstrations. The laboratory classes and tutorials are highly interactive and computer software will be used during lectures and laboratory classes. **CAREERS / INDUSTRY LINKS** Clean Energy Council: Ms Alicia Webb presents three lectures on wind engineering
Related Course(s):	Master of Philosophy - Engineering Ph.D.- Engineering
Related Majors/Minors/ Specialisations:	Master of Engineering (Mechanical)