MCEN30018 Thermodynamics and Fluid Mechanics

Credit Points:	12.5
Level:	3 (Undergraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 1, Parkville - Taught on campus. Semester 2, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 36 hours of lectures and 20 hours of tutorials and laboratories Total Time Commitment: 170 hours
Prerequisites:	

Subject	Study Period Commencement:	Credit Points:
ENGR20004 Engineering Mechanics	Summer Term, Semester 1, Semester 2	12.50

AND either

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

OR both of the following subjects -

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

MAST20030 may be taken concurrently.

Corequisites:	
Recommended Background Knowledge:	PHYC10003 Physics 1 and PHYC10004 Physics 2
Non Allowed Subjects:	Students cannot enrol and gain credit for this subject and - # ENGR30001 Fluid Mechanics and Thermodynamics # MCEN30015 Thermofluids
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:	Dr Jimmy Philip, Prof Joseph Klewicki

Contact:	Semester 1 Prof Joe Klewicki Email: **klewicki@unimelb.edu.au (mailto:klewicki@unimelb.edu.au)** Semester 2 Dr Jimmy Philip Email: **jimmyp@unimelb.edu.au (mailto:jimmyp@unimelb.edu.au)**
Subject Overview:	**AIMS** This course is an introduction to basic principles of fluid mechanics and thermodynamics. These two subjects are introduced together in a single course, reflecting the large degree of cross-over in applications and basic first principles between the two subjects. Fluid mechanics is a very important core subject, influencing a diverse range of engineering systems (aircraft, ships, road vehicle design, air conditioning, energy conversion, wind turbines, hydroelectric schemes to name but a few) and also impacts on many biological (blood flow, bird flight etc) and even meteorological studies. As engineers, we are typically concerned with predicting the force required to move a body through a fluid, or the power required to pump fluid through a system. However, before we can achieve this goal, we must start from fundamental principles governing fluid flow. Thermodynamics could be defined as the science of energy. This subject can be broadly interpreted to include all aspects of energy and energy transformations. Like fluid mechanics, this is a hugely important subject in engineering, underpinning many key engineering systems including power generation, engines, gas turbines, refrigeration, heating etc. This unit again starts from first principles to introduce the basic concepts of thermodynamics, paving the way for later more advanced units This course aims to develop a fundamental understanding of thermodynamics and fluid mechanics, based on first principles and physical arguments. Real world engineering examples will be used to illustrate and develop an intuitive understanding of these subjects. **INDICATIVE CONTENT** Topics include: Fluid Mechanics - fluid statics, static forces on submerged structures, stability of floating bodies; solid body motion; fluid dynamics; streamlines; pathlines and streaklines; conservation of mass, momentum and energy; Euler's equation and Bernoulli's equation; control volume analysis; dimensional analysis; incompressible flow in pipes and ducts; boundary layers; flow around immersed bodies; and drag and lift. Thermodynamics - heat and work, ideal non-flow and flow processes; laws of thermodynamics; Carnot's principle; Clausius inequality; direct and reversed heat engines; thermal efficiencies; properties of pure substances; change of phase; representation of properties; steam and air tables; and vapour equation of state, ideal gases.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILOs)** Having completed this unit the student is expected to - 1 Have developed an intuitive fundamental understanding of thermo-fluid systems 2 Be able to determine the thermodynamic and physical properties of numerous substances 3 Apply the first and second laws of thermodynamics to several engineering devices 4 Apply control volume analysis to numerous fluid mechanical systems 5 Appreciate the elegance of dimensional analysis 6 Be able to analyse simple, incompressible and inviscid fluid flows, such as pipe and pump flow systems 7 Appreciate basic tenets of external flows, including lift, drag & separated flows.
Assessment:	Two Laboratory reports not exceeding 1500 words (equal weight) (20%), approximately 10 hours work each. Associated with Intended Learning Outcomes (ILOs) 1, 3 and 7 Two assignments during semester, each not exceeding 1500 words and requiring approximately 10 hours of work (10% each). Associated with ILOs 4-6 One 50 minute written test in week 6 or 7 (10%). Associated with ILOs 1-7 One 3 hour examination at the end of semester (50%). Associated with ILOs 1-7 Hurdle Requirement - students must pass the exam component to pass the subject Note: Some laboratory reports and assignments will be completed in teams of two.

Prescribed Texts:	None
Breadth Options:	This subject potentially can be taken as a breadth subject component for the following courses: # **Bachelor of Arts (https://handbook.unimelb.edu.au/view/2016/B-ARTS)** # **Bachelor of Biomedicine (https://handbook.unimelb.edu.au/view/2016/B-BMED)** # **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2016/B-COM)** # **Bachelor of Music (https://handbook.unimelb.edu.au/view/2016/B-MUS)** You should visit **learn more about breadth subjects (http://breadth.unimelb.edu.au/breadth/info/index.html)** and read the breadth requirements for your degree, and should discuss your choice with your student adviser, before deciding on your subjects.
Fees Information:	Subject EFTSL, Level, Discipline & Census Date, http://enrolment.unimelb.edu.au/fees
Generic Skills:	On completion of this subject, students should have developed the following generic 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 function effectively as an individual and in multidisciplinary and multicultural teams, as a team leader or manager as well as an effective team member.
Related Majors/Minors/ Specialisations:	B-ENG Mechanical Engineering stream Master of Engineering (Mechanical with Business) Master of Engineering (Mechanical) Master of Engineering (Mechatronics) Mechanical Systems Science-credited subjects - new generation B-SCI and B-ENG. Selective subjects for B-BMED