# MCEN90019 Advanced Thermodynamics

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| **Credit Points:** | 12.5 |
| **Level:** | 9 (Graduate/Postgraduate) |
| **Dates & Locations:** | 2016, Parkville<br>This subject commences in the following study period/s:<br>Semester 2, Parkville - Taught on campus. |
| **Time Commitment:** | Contact Hours: 36 hours of lectures, up to 24 hours of tutorials and laboratories. Total Time Commitment: 200 hours |
| **Prerequisites:** | See table below |
| **Corequisites:** | None |
| **Recommended Background Knowledge:** | None |
| **Non Allowed Subjects:** | Students cannot enrol in and gain credit for this subject and -<br># MCEN40010 Thermofluids 4 |
| **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 Unitwebsite: http://www.services.unimelb.edu.au/disability/ |
| **Coordinator:** | Dr Yi Yang |
| **Contact:** | **yi.yang@unimelb.edu.au (mailto:yi.yang@unimelb.edu.au)** |
| **Subject Overview:** | **AIMS**<br>This subject is an introduction to combustion theory and applications. In the first part we discuss combustion fundamentals, including thermodynamics, chemical kinetics, conservation equations, and application of these principles to solve simple flames and reacting flows. In the second part we discuss combustion engines and the combustion phenomena in spark-ignition and compression-ignition engines.<br>**INDICATIVE CONTENT**<br># Chemical thermodynamics and kinetics - flame temperatures, Gibbs free energy and equilibrium, chemical kinetics, combustion mechanisms of common fuels.<br># Governing equations - mass, momentum, species and energy conservation for idealized reactors and simplified reacting flows.<br># Flames - theoretical analyses of laminar flames, premixed flame (flame speed, quenching, flame stabilization), diffusion jet flame (flame geometry, conserved scalar, soot formation).<br># Reciprocating engines - engine cycle analysis, turbulent combustion in spark ignition and diesel engines, cylinder-pressure analysis, pollutant formation and emission control, alternative power-trains and fuels. |
| **Learning Outcomes:** | **INTENDED LEARNING OUTCOMES (ILO)**<br>Having completed this subject the student is expected to be able to:<br>1 Analyse the equilibrium and kinetics of combustion of different fuels<br>2 Use computer software to solve combustion kinetics and flame structures with detailed reaction mechanisms |

**Prerequisites:**

| Subject | Study Period Commencement: | Credit Points: |
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| MCEN90015 Thermodynamics | Semester 1 | 12.50 |

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| | 3 Apply the fundamental principles of thermodynamics to numerous engineering devices<br>4 Use a systems approach to simplify a complex problem. |
| **Assessment:** | Two assignments or laboratory reports of equal weight not exceeding 2500 words each, requiring approximately 25-30 hours of work each. Due week 8 and week 12 of semester (20% each, 40% total). The assignments or reports assess ILOs 1, 2, 3 and 4. One 3 hour end of semester written examination (60%), assesses ILOs 1, 3 and 4. |
| **Prescribed Texts:** | Turns S, (2010) An Introduction to Combustion - Concepts and Applications, 3rd Ed. McGraw-Hill. |
| **Recommended Texts:** | Pulkrabek W, (2006) *Engineering Fundamentals of the Internal Combustion Engine, 2nd Ed*. Prentice-Hall.<br>Heywood J, *Internal Combustion Engine Fundamentals*, McGraw-Hill, 1988. |
| **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 completing this subject, students should have:<br># The ability to apply knowledge of science and engineering fundamentals<br># The ability to undertake problem identification, formulation, and solution<br># An understanding of social, cultural, global, and environmental responsibilities and the need to employ principles of sustainable development<br># The ability to utilise a systems approach to complex problems and to design and operational performance<br># The capacity for creativity and innovation. |
| **Notes:** | **LEARNING AND TEACHING METHODS**<br>The subject will be delivered through a combination of lectures and tutorials. Students will also complete one experiment which will reinforce the material covered in lectures.<br>**INDICATIVE KEY LEARNING RESOURCES**<br>Students will have access to the following textbooks, lecture notes, and Chemkin, a combustion simulation software.<br>Stephen R. Turns, (2011) *An Introduction to Combustion: Concepts and Applications*, McGraw-Hill.<br>John Heywood, (1986) *Internal Combustion Engine Fundamentals*, McGraw-Hill.<br>**CAREERS / INDUSTRY LINKS**<br>This subject is linked to power generation and automotive industries. |
| **Related Course(s):** | Bachelor of Engineering (Mechanical and Manufacturing Engineering)<br>Doctor of Philosophy - Engineering<br>Master of Philosophy - Engineering |
| **Related Majors/Minors/ Specialisations:** | Master of Engineering (Mechanical)<br>Master of Engineering (Mechatronics) |