# MCEN30014 Mechanical Design

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| **Credit Points:** | 12.5 |
| **Level:** | 3 (Undergraduate) |
| **Dates & Locations:** | 2015, 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 and up to 24 hours of practical work Total Time Commitment: 170 hours |
| **Prerequisites:** | **Postgraduate students:**<br>Admission into the Master of Engineering (Mechanical) OR (Mechanical with Business).<br>**Undergraduate students:** |

| Subject | Study Period Commencement: | Credit Points: |
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| MCEN30017 Mechanics & Materials | Semester 1 | 12.50 |

AND either:

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

OR both of the following subjects

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

MAST20030 Differential Equations can be taken concurrently.

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| **Corequisites:** | None |
| **Recommended Background Knowledge:** | Postgraduate students will be disadvantaged by not having met the prerequisite subjects (or equivalents) as listed for undergraduate students. |
| **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 |
| **Coordinator:** | Dr Colin Burvill |
| **Contact:** | **colb@unimelb.edu.au (mailto: colb@unimelb.edu.au)** |
| **Subject Overview:** | **AIMS** |

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| | Topics covered include: general approach to design problems; invention, analysis, decision making; terminologies such as 'goal', 'objectives', 'criteria' and 'constraints'; strategies for synthesis and decision making; technical, ergonomic and economic factors; appraisal of benefit and cost; fault and failure analysis; probability, uncertainty, and assessment of risk; and interfacing geometric and mathematical models, sensitivity analyses, combinatorial search, structured approaches to material selection; failure modes for engineering systems, failure predictors for engineering components under multi-axial stress conditions; rational assessment of safety factors and maximum credible accident; integrity of structures and machines, design against failure; modelling of complex load-bearing systems in terms of simple engineering components; design of elements of structures and machines from first principles; and approaches to uncertainty in design problems, including those related to the environment.<br>**INDICATIVE CONTENT**<br>Introduction to strategies for creative idea generation in engineering design -<br># The design process – specifying problems and generating solutions<br># Making decisions – decision-making strategies, cost benefit analysis, economic and human factors<br># Fault / failure analysis.<br><br>Introduction to engineering graphical communication -<br># Sketching<br># Orthographic (multiview), layout, assembly and detailed drawings<br># Dimensioning.<br><br>Introduction to structural integrity in engineering design -<br># Structural integrity and the nature of failure<br># Structural distillation – decomposition of structural systems into elementary engineering components<br># Estimation, units and calculation<br># Failure predictors and factors of safety<br># Fatigue – What is fatigue? Time-varying stresses, fatigue strength, design against failure. S-N diagram, A-M diagram. Shafts as an example of fatigue-based structural integrity design. |
| **Learning Outcomes:** | **INTENDED LEARNING OUTCOMES (ILOs)**<br>Having completed this unit the student is expected to have the skills to:<br>1 Describe engineering design methodologies that can assist the creation of mechanical artefacts and systems<br>2 Synthesize solutions to reasonably ill-defined design problems<br>3 Manage relatively complex mechanical engineering design projects<br>4 Determine the integrity of structures and machines, to design against failure. |
| **Assessment:** | • One two-hour end-of-semester examination (40%)• Three assignments (projects) total of 60% - Assignment 1 (48%) assessed tasks in weeks, 2, 4, 6 8 - approximately 40 hours work per studentAssignment 2 (6%) week 9 - 8 to 10 hours work per studentAssignment 3 (6%) week 10 - 8 to 10 hours work per studentReports are submitted at the end of the scheduled practical sessions. Hurdle requirement: Students must pass all assignments and the end of semester exam in order to pass the subject. ILOs 1, 2 and 4 will all be assessed by both assignment and examination. ILO3 will be assessed by assignment work. |
| **Prescribed Texts:** | Budynas, R.G. and Nisbett, J.K (2011), Shigley's Mechanical Engineering Design, McGraw-Hill. |
| **Breadth Options:** | This subject potentially can be taken as a breadth subject component for the following courses:<br># **Bachelor of Arts (https://handbook.unimelb.edu.au/view/2015/B-ARTS)**<br># **Bachelor of Commerce (https://handbook.unimelb.edu.au/view/2015/B-COM)**<br># **Bachelor of Music (https://handbook.unimelb.edu.au/view/2015/B-MUS)** |

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| | 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 -<br>• The ability to apply knowledge of science and engineering fundamentals<br>• The ability to undertake problem identification, formulation, and solution<br>• The capacity for creativity and innovation<br>• The ability to utilise a systems approach to complex problems and to design and operational performance<br>• Proficiency in engineering design<br>• The ability to conduct an engineering project. |
| **Notes:** | **LEARNING AND TEACHING METHODS**<br>The subject will be delivered through a combination of lectures, tutorials and workshops that will feature student-centred activities including a substantial design-build-test-evaluate assignment.<br>**INDICATIVE KEY LEARNING RESOURCES**<br>Budynas, R.G. and Nisbett, J.K (2011), *Shigley's Mechanical Engineering Design, 9th SI Edition,* McGraw-Hill.<br>Additional notes on LMS<br>Lecture slides<br>Assignment sheets<br>**CAREERS / INDUSTRY LINKS**<br>Design-build-test-evaluate assignment is usually completed within a national competition organised by the National Committee on Engineering Design (http://www.ncedaust.org/) within Engineers Australia (http://www.engineersaustralia.org.au/). |
| **Related Majors/Minors/ Specialisations:** | B-ENG Mechanical Engineering stream<br>Master of Engineering (Mechanical with Business)<br>Master of Engineering (Mechanical)<br>Mechanical Systems<br>Science-credited subjects - new generation B-SCI and B-ENG. |