

# MCEN30014 Mechanical Design

| Credit Points:                           | 12.50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
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| Level:                                   | 3 (Undergraduate)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Dates & Locations:                       | 2012, 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 14 hours of workshop sessions Total Time Commitment: 120 hours                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Prerequisites:                           | <p>Postgraduate -</p> <p># Admission into the Master of Engineering (Mechanical)</p> <p>Undergraduate -</p> <table><tr><th>Subject</th><th>Study Period Commencement:</th><th>Credit Points:</th></tr><tr><td>MCEN30017 Mechanics &amp; Materials</td><td>Semester 1</td><td>12.50</td></tr></table> <p>AND either:</p> <table><tr><th>Subject</th><th>Study Period Commencement:</th><th>Credit Points:</th></tr><tr><td>MAST20029 Engineering Mathematics</td><td>Summer Term, Semester 1, Semester 2</td><td>12.50</td></tr></table> <p>OR</p> <table><tr><th>Subject</th><th>Study Period Commencement:</th><th>Credit Points:</th></tr><tr><td>MAST30029 Partial Differential Equations</td><td>Semester 2</td><td>12.50</td></tr></table> <p>MAST30029 can be studied concurrently.</p> |                |  | Subject | Study Period Commencement: | Credit Points: | MCEN30017 Mechanics & Materials | Semester 1 | 12.50 | Subject | Study Period Commencement: | Credit Points: | MAST20029 Engineering Mathematics | Summer Term, Semester 1, Semester 2 | 12.50 | Subject | Study Period Commencement: | Credit Points: | MAST30029 Partial Differential Equations | Semester 2 | 12.50 |
| Subject                                  | Study Period Commencement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Credit Points: |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| MCEN30017 Mechanics & Materials          | Semester 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 12.50          |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Subject                                  | Study Period Commencement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Credit Points: |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| MAST20029 Engineering Mathematics        | Summer Term, Semester 1, Semester 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 12.50          |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Subject                                  | Study Period Commencement:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Credit Points: |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| MAST30029 Partial Differential Equations | Semester 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 12.50          |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Corequisites:                            | None                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Recommended Background Knowledge:        | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Non Allowed Subjects:                    | 436-285 Design and Materials 1<br>436-286 Design and Materials 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| 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: <a href="http://www.services.unimelb.edu.au/disability">http://www.services.unimelb.edu.au/disability</a>                                                                                                                                      |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Coordinator:                             | Dr Colin Burvill                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Contact:                                 | Dr Colin Burvill<br><a href="mailto:colb@unimelb.edu.au">colb@unimelb.edu.au</a> (mailto: colb@unimelb.edu.au)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |
| Subject Overview:                        | Topics covered include: general approach to design problems; invention, analysis, decision making; terminologies such as 'goal', 'objectives', 'criteria' and 'constraints'; strategies for                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |  |         |                            |                |                                 |            |       |         |                            |                |                                   |                                     |       |         |                            |                |                                          |            |       |

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|                                               | <p>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.</p>                                                                                              |
| <b>Objectives:</b>                            | <p>At the conclusion of this subject students should be able to -</p> <ul style="list-style-type: none"> <li>• Describe engineering design methodologies that can assist the creation of mechanical artifacts and systems</li> <li>• Synthesize solutions to reasonably ill-defined design problems</li> <li>• Manage relatively complex mechanical engineering design projects</li> <li>• Determine the integrity of structures and machines, to design against failure</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Assessment:</b>                            | <ul style="list-style-type: none"> <li>• One two-hour end-of-semester examination (40%).</li> <li>• Four assignments (projects) total of 60% - Assignment 1 (42%) assessed tasks in weeks, 2, 4, 6 &amp; 8; Assignment 2 (6%) week 9; Assignment 3 (6%) week 10; Assignment 4 (6%) week 11. Reports are submitted at the end of the scheduled workshop session. All assignments must be submitted and earn a mark of at least 50% (per assignment) as a prerequisite for admission to the written examination.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Prescribed Texts:</b>                      | <p>Budynas, R.G. and Nisbett, J.K, "Shigley's Mechanical Engineering Design", McGraw-Hill, 2009/2011</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Breadth Options:</b>                       | <p>This subject potentially can be taken as a breadth subject component for the following courses:</p> <ul style="list-style-type: none"> <li># <b>Bachelor of Arts</b> (<a href="https://handbook.unimelb.edu.au/view/2012/B-ARTS">https://handbook.unimelb.edu.au/view/2012/B-ARTS</a>)</li> <li># <b>Bachelor of Commerce</b> (<a href="https://handbook.unimelb.edu.au/view/2012/B-COM">https://handbook.unimelb.edu.au/view/2012/B-COM</a>)</li> <li># <b>Bachelor of Music</b> (<a href="https://handbook.unimelb.edu.au/view/2012/B-MUS">https://handbook.unimelb.edu.au/view/2012/B-MUS</a>)</li> </ul> <p>You should visit <b>learn more about breadth subjects</b> (<a href="http://breadth.unimelb.edu.au/breadth/info/index.html">http://breadth.unimelb.edu.au/breadth/info/index.html</a>) and read the breadth requirements for your degree, and should discuss your choice with your student adviser, before deciding on your subjects.</p> |
| <b>Fees Information:</b>                      | <p>Subject EFTSL, Level, Discipline &amp; Census Date, <a href="http://enrolment.unimelb.edu.au/fees">http://enrolment.unimelb.edu.au/fees</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Generic Skills:</b>                        | <p>On completion of this subject, students should have developed the following generic skills -</p> <ul style="list-style-type: none"> <li>• Ability to apply knowledge of science and engineering fundamentals</li> <li>• Ability to undertake problem identification, formulation, and solution</li> <li>• Capacity for creativity and innovation</li> <li>• Ability to utilise a systems approach to complex problems and to design and operational performance</li> <li>• Proficiency in engineering design</li> <li>• Ability to conduct an engineering project</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Related Course(s):</b>                     | <p>Bachelor of Engineering</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Related Majors/Minors/Specialisations:</b> | <p>B-ENG Mechanical Engineering stream<br/>Master of Engineering (Mechanical)<br/>Mechanical Systems<br/>Science-credited subjects - new generation B-SCI and B-ENG. Core selective subjects for B-BMED.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |