MCEN90029 Advanced Solid Mechanics

Credit Points:	12.5
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2016, Parkville This subject commences in the following study period/s: Semester 1, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 36 hours of lectures and 12 hours of tutorials. Total Time Commitment: 200 hours
Prerequisites:	

Subject	Study Period Commencement:	Credit Points:
MCEN90026 Solid Mechanics	Semester 2	12.50

Corequisites:	None
Recommended Background Knowledge:	None
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 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 David Ackland
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Subject Overview:	**AIMS** This course will expand on the basic principles established previously in Solid Mechanics. Methods of three-dimensional stress and strain analysis will be extended to allow the student to obtain solutions using analytical and/or numerical methods. These will include the analyses of principal stresses and strains, three dimensional Mohr's circles, strain gauge experimentation and failure criteria. In addition, this unit will focus on plastic deformation of solids, including the analysis of residual stresses and the collapse load of structures. The responses of materials to fatigue and fracture, as well as their creep and viscoelastic behaviour, will also be explored. Finally, this unit will provide a number of examples of experimental applications of solid mechanics analysis based on modern research techniques. The goal of Advanced Solid Mechanics is to consolidate the solid mechanics principles presented in the student's Engineering degree, and the equip students with skills required to solve a range of engineering problems they have not seen before. In addition, this subject seeks to teach a number of modern research methods, techniques and skills by drawing on biomechanical research in the field of solid mechanics, and the major challenges in the field. **INDICATIVE CONTENT** The following topics, delivered through lectures, guest seminars, group problem solving activities, and tutorials, will be assessed: # Three dimensional stress-strain analysis (weeks 1-2) # Strength theories and yield criteria (weeks 3-4) # Plastic behaviour of materials (weeks 5-6)

	# Fracture Mechanics(weeks 7-8) # Contact (weeks 9-10) # Creep and Viscoelasticity (week 11) # Biomechanics (week 12)
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILOs)** At the completion of this subject the student is expected to be able to: 1 Understand advanced stress/strain correlations 2 Obtain simple mathematical and physical relationships between mechanics and materials 3 Model the plastic behaviour, as well as the fatigue, fracture and creep response, of common engineering materials 4 Model an engineering structure without detailed instruction 5 Establish links between theoretical and practical applications; identify problems and formulate solution strategies 6 Expand their analytical and cognitive skills through learning experiences in a diverse range of solid mechanics topics 7 Develop skills in collaborative leaning through small-group problem solving and communication 8 Understand contemporary issues in solid mechanics research.
Assessment:	One small-group problem solving activity assessed in class during week 4 (10%), requiring approximately 15 hours work. Assesses ILO 7. Two assignments of equal weight totalling no more than 1000 words, due in weeks 7 and 10 (2 x 20%), requiring approximately 25-30 hours work each. Assesses ILOs 4, 5, 6. One written three hour end of semester exam (50%), assesses ILOs 1, 2, 3. Hurdle - students must pass the end of semester exam to pass the subject.
Prescribed Texts:	None
Recommended Texts:	# Ugural & Fenster 5th Edition, *Advanced Mechanics of Materials and Applied Elasticity* # Benham, Crawford and Armstrong, 2nd edition, *Mechanics of Engineering Materials* # Juvinall and Marshek, 5th edition, *Fundamentals of Machine Component Design* # Budynas, 2nd edition, *Advanced Strength and Applied Stress Analysis* # Boresi and Schmidt, 6th edition, *Advanced Mechanics of Materials* # Anderson, 3rd edition, Fracture Mechanics
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 subject students should have the following skills: # Critical thinking and critical judgement of assumptions adopted # Interpretation and analysis of data # Ability to undertake problem identification, formulation, and solution # Ability to apply knowledge of science and engineering fundamentals.
Notes:	**LEARNING AND TEACHING METHODS** The end of semester examination will gauge students' ability to synthesise stress/strain correlations and mathematically model a common engineering design problem, for example, determining the correct geometry of a loaded body to avoid crack propagation (ILO 1 and 2). The exam will assess student's ability to describe a contemporary issue in biomechanics research (ILO 8). The examination will also evaluate the student's capacity to model material behaviour, for example, stresses and strains of materials under loading (ILO 3). The two assignments focus on problem solving in the context of a specific engineering principle presented in the lectures. Students will be expected to analyse an engineering structure using mathematical modelling (ILO 4), and to formulate analytical solutions to loading a loading problem (ILO 5). In so doing, they will expand their capacity to think laterally and gain a

	degree of independence in the overall learning experience (ILO 6). The small-group problem solving activity (set in laboratory classes) aims to encourage peer-to-peer communication, expression of ideas, team-building, and development of oral skills (ILO 7). In order to evaluate the effectiveness of the group learning experience, the group activity will be assessed based on an inter-group peer-review evaluation and a short self-reflection piece. Feedback for the solution to the problem solving activity will be provided formatively by the lecturer. It is intended that this activity and the feedback prepare students for the two assignments tasks. **ASSESSMENT CRITERIA** Students will be assessed relative to the following criteria: # Ability to undertake problem identification, formulation, and solution. # Ability to critically think and critical judge assumptions adopted. # Ability to interpretation and analysis of data. # Ability to apply knowledge of science and engineering fundamentals. # Ability to reflect on the work of others during group activities. **INDICATIVE KEY LEARNING RESOURCES** Students will have access to all lecture slides, lecture example problems and worked solutions as well as tutorial problem solutions through the LMS. The LMS will also contain links to electronic resources relevant to the course, publications, and will host active discussion forums where students may interact in a thread-forum-style medium.
Related Course(s):	Bachelor of Engineering (Mechanical and Manufacturing Engineering) Doctor of Philosophy - Engineering Master of Philosophy - Engineering
Related Majors/Minors/ Specialisations:	B-ENG Mechanical Engineering stream Master of Engineering (Mechanical) Master of Engineering (Mechatronics)