CVEN90018 Structural Dynamics and Modelling

Credit Points:	12.5
Level:	9 (Graduate/Postgraduate)
Dates & Locations:	2015, Parkville This subject commences in the following study period/s: Semester 2, Parkville - Taught on campus.
Time Commitment:	Contact Hours: 49 hours, comprising of three hours of lectures per week plus 12 hours of tutorials and 1 hour of laboratory work per semester Total Time Commitment: 200 hours
Prerequisites:	Admission to the MC-ENG Master of Engineering (Civil) **OR** Admission to the MC-ENG Master of Engineering (Structural) **OR** Admission to the 746ST Master of Engineering Structures
Corequisites:	None
Recommended Background Knowledge:	Learning will be assisted by knowledge gained in the following subjects:

Subject	Study Period Commencement:	Credit Points:
CVEN90049 Structural Theory and Design 2	Semester 1	12.50

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:	Assoc Prof Nelson Lam
Contact:	Associate Professor Nelson Lam **ntkl@unimelb.edu.au (mailto:ntkl@unimelb.edu.au)**
Subject Overview:	**AIMS** This subject introduces students to the fundamental concepts of structural dynamics and finite element modelling and teaches students the skills of undertaking structural analyses which involve dynamic (or transient) actions in a practical engineering context. At the conclusion of this subject students should be able to undertake dynamic analyses by hand calculations (that can be enhanced by the use of EXCEL spreadsheets) and effectively employ a commercial computational package (e.g. Strand 7) for more complex analyses. Emphasis is on the ability to undertake independent checks of results generated by the computer. Improved proficiencies in structural dynamics and modelling will result in more economical design of structures and a more sustainable built environment. This subject builds on students' fundamental knowledge of engineering mathematics, mechanics and structural analysis. For students considering a career in structural design for earthquake resistant structures this is an important subject to prepare for professional practice as a graduate under the supervision of a chartered engineer. **INDICATIVE CONTENT**

	Topics covered include: introduction to finite element formulations for in-plane (membrane) stress analysis, use of finite element modelling packages; the response analyses of single-degree-of-freedom systems, discrete multi-degree-of-freedom systems and distributed mass (continuous) systems in conditions of natural vibrations and forced excitations; numerical time-step integration techniques; excitation simulation techniques, simultaneous equation solution and reduction techniques; frequency domain analyses and processing of time-series data. Skills acquired from the various topics outlined above will be integrated and applied to a number of case studies.
Learning Outcomes:	**INTENDED LEARNING OUTCOMES (ILO)** Having completed this subject the student is expected to: 1 Implement the modelling of the response of single-degree-of-freedom (SDOF) systems to pulse and harmonic excitations 2 Describe and apply the concepts of viscous damping, hysteretic damping, coulomb damping (by friction) and equivalent damping 3 Transform data from time-domain to frequency domain in the form of Fourier Amplitude/ Phase spectra and Power spectra, and apply linear transformation 4 Implement the modelling of the response of discrete lumped mass multi-degree-of-freedom (SDOF) systems involving the use of the participation factor, effective modal mass and modal coefficients based on the principles of modal superposition 5 Obtain classical solutions for the dynamic response behaviour of single-degree-of-freedom (SDOF) systems based on harmonic excitations and common idealised forms of transient excitations 6 Implement on spreadsheets time-step integration procedures for analysing the response of SDOF systems to a range of transient excitations including earthquake excitations, and collation of the response output to produce elastic response spectra of different formats 7 Implement on spreadsheets the response analyses of simple discrete MDOF systems using principles of modal superposition 8 Apply finite element modelling packages to perform static and dynamic response analysis to a variety of dynamic loading options 9 Undertake independent checks of analysis results by hand calculations.
Assessment:	Two assignments, due in week 8 and late semester, each of no more than 1500 words, requiring approximately 40-45 hours of work for both assignments, 30% in total One thirty minutes quiz in week 7 (5%) A written three hour end-of-semester examination (65%). Intended Learning Outcomes (ILOs) 1, 2, 4 & 5 are assessed in the quiz and examination. ILOs 3, 6 and 7 are assessed in the first assignment. ILOs 3, 4, 6, 8 and 9 are assessed in the second assignment.
Prescribed Texts:	None
Recommended Texts:	Anil K. Chopra 2012 *Dynamics of Structures: Theory and Applications to Earthquake Engineering* 4th Edition Pearson/Prentice Hall
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:	# 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 # Proficiency in engineering design # Ability to conduct an engineering project # Ability to communicate effectively, with the engineering team and with the community at large # Understanding of professional and ethical responsibilities, and commitment to them # Capacity for lifelong learning and professional development.
Notes:	**LEARNING AND TEACHING METHODS**

	The subject will be delivered through a combination of lectures and tutorials both of which feature the use of programming with EXCEL spreadsheets for analysis purposes. In addition, students will undertake experiments to reinforce materials covered in the lectures and also a design exercise which involves applying the learnt techniques in solving structural design/ evaluation problems that are likely to be encountered in practice. **INDICATIVE KEY LEARNING RESOURCES** Students will have access to lecture slides. The recommended text is Chopra, A.K., 2012 Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson/Prentice Hall. Other resources include selected journal publications; EXCEL spreadsheets showing examples of numerical simulations and Strand7 computational package. **CAREERS / INDUSTRY LINKS** A practising specialist in the field of structural dynamics will contribute to the teaching of the subject and give advice on the assignment exercises.
Related Course(s):	Master of Engineering Structures Master of Philosophy - Engineering Ph.D.- Engineering
Related Majors/Minors/ Specialisations:	Master of Engineering (Civil) Master of Engineering (Structural)