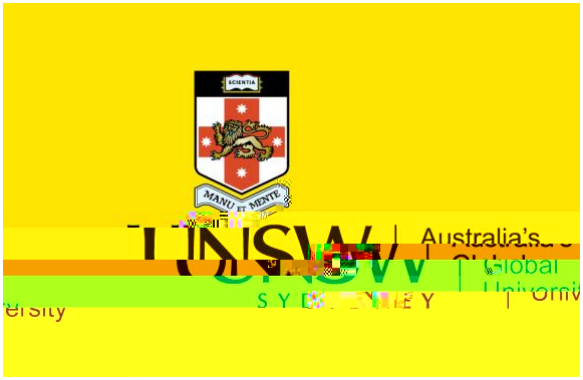

COURSE DETAILS

Units of Credit	**6**			
Contact hours	5 hours per week			
Lecture	Monday,	15:00	18:00	online
Workshop	Tuesday,	12:00	14:00	online
	Tuesday,	14:00	16:00	online
	Tuesday,	16:00	18:00	online
	Thursday,	14:00	16:00	online
	Thursday,	16:00	18:00	online

Course Coordinator and Lecturer Dr Sascha Eisenträger
email: s.eisentraeger@unsw.edu.au
office: Civil Engineering Building (H20), Level 6, Room CE614

INFORMATION ABOUT THE COURSE

The aim of this course is to introduce students to the concepts and techniques involved in structural dynamics and their practical applications in structural engineering. The course begins with an introduction of the dynamics of simple structures and then develops the fundamental knowledge of vibration analysis of multi-degree-of-freedom structures and continuous structures. Students will develop an understanding of the nature of dynamic loads produced by various sources including earthquakes and acquire the ability to assess the response of civil engineering structures to such loads. The material covered in this course is essential to the analysis and design of large-scale structures such as multi-story buildings, towers and long-span bridges that are susceptible to vibration. Much of the knowledge acquired in this subject is also applicable to dynamic problems in other areas such as geotechnical engineering, mechanical engineering and material science.

relevant problems, a major assignment, that challenges your engineering abilities and a final exam. Further details are provided in the Assessment section.

TEACHING STRATEGIES

This subject consists of a mixture of lectures, workshops, and laboratory sessions.

Lectures will cover the basic theories of structural dynamics and its applications to structural engineering. Application of the theories to formulate guidelines in the analysis of practical engineering problems will be emphasized.

The workshops provide you with the opportunity to discuss the lecture material with your demonstrators and to solve the set exercise problems. To understand the subject matter well, it is essential to attend the

12/10/2020 (Week 5)	**Multi-Degree-of-Freedom (MDOF) Systems** **Free Vibration Analysis of MDOF Systems**	Simple MDOF System, General Approach for Linear MDOF System; Natural Vibration Frequencies and Modes, Modal and Spectral Matrices, Orthogonality and Normalisation of Modes, Solution Methods of Eigenvalue Problem, Vector Iteration Method, Modal Expansion of Displacements, Free Vibration Response of Undamped and Damped MDOF Systems;	Various solved examples on Free Vibration Response of MDOF Systems
19/10/2020 (Week 6)		***Flexibility week for all courses (non-teaching)***	
26/10/2020 (Week 7)	**Modal Analysis** **Generalised SDOF Systems & Rayleigh's Method**	Modal Equations for Undamped and Damped Systems; System with Distributed Mass and Elasticity, Natural Vibration Frequency by of Shape Function	Various solved examples on Modal Analysis; Various solved examples on Generalised SDOF Systems
02/11/2020 (Week 8)	**Quiz 2** **Earthquake Response of Linear Systems (SDOF)**	Earthquake Excitation, SDOF Equation of Motion, Response History, Response Spectrum Concept, Deformation, Pseudo-Velocity Pseudo-Acceleration Response Spectrum, Response Spectrum Characteristics, Elastic Design Spectrum, Elastic Design Spectrum vs Response	

16/11/2020 (Week 10)	**Structural Dynamics in the Finite Element Method**	Introduction to finite element analysis of structural dynamics by using commercial software: modelling issues, natural frequencies and mode shapes, response in frequency and time-domain	Examples of dynamic finite element simulations
	Assignment Submission **Revision**	**Revision**	**Revision**

ASSESSMENT

The assessment of this course will be based on two comprehensive quizzes, one assignment and a final exam. The final grade will be based on the sum of the scores from each of the assessment tasks. The lecturer reserves the right to adjust the final scores by scaling.

Two in-class quizzes are scheduled for Weeks 4 and 8, respectively. They will be online and open book. The duration of the quizzes is 60 minutes. The quizzes will be held under exam conditions. The purpose of the quizzes is to test your understanding of the fundamental concepts and your ability to apply learned strategies to relevant problems.

One assignment is to be submitted in Week 10. The purpose of the assignment is to expose you to a realistic structural dynamics problem, which requires you to apply what you have learned. Similar to engineering practice, this will require you to find additional information by asking, reading or discussing with your classmates, to critically evaluate your model and to formulate conclusions. Here, documentation is equally important as results. It is expected that you submit a report that is similar in scope, form, and style to what you would submit to a private or public client who has commissioned you with the dynamic analysis.

A mark of at least 40% in the final examination is required before the class work is included in the final mark. The formal exam scripts will not be returned.

Students who perform poorly in the in-class quizzes and workshops are recommended to discuss progress with the lecturer during the semester.

Details of each assessment component, the marks assigned to it, the criteria by which marks will be assigned, and the dates of submission are set out below.

Supplementary Examinations for Term 3 2020 will be held on Monday 11th January Friday 15th January 2021 (inclusive) should you be required to sit one. You are required to be available during these dates. Please do not to make any personal or travel arrangements during this period.

PENALTIES

Late submissions of the assignment will be penalised at the rate of 25% of the maximum achievable mark per day after the due time and date have expired. Submissions that are more than 4 days late (unless special considerations have been granted) are not accepted and 0 marks are awarded.

Late submissions of the quiz paper will be penalised by 25% of the maximum achievable mark per 5min and are not accepted after 15+ min past the due date and time.

ASSESSMENT OVERVIEW

Item	Length	Weighting	Learning outcomes assessed	Assessment Criteria	Due date and submission requirements	Deadline for absolute fail	Marks returned
1.Quizzes							
Quiz 1	45 min	10%		Application of taught concepts on SDOF systems	Week 4	Week 4	Week 4
Quiz 2	45 min	10%		Application of taught concepts on MDOF systems	Week 8	Week 8	Week 8
2. Assignment							

RELEVANT RESOURCES

Textbook (recommended):
Chopra, A. K. Dynamics of Structures, 4th ed.: Prentice-Hall 2015.
Available online from UNSW Library and in print at Main Library Level 7 (624.1762/92) and other locations.

Recommended Reading:

1. Clough, R. W. and Penzien, J. Dynamics of Structures, 2nd ed.: McGraw-Hill 1993.
   Available at Main Library Level 7 (P 624.171/112 A)
2. Bolton, A. *Structural Dynamics in Practice: a Guide for Professional Engineers*, McGraw-Hill 1994.
   Available at Main Library Level 7 (P 624.171/212)
3.

Appendix A: Engineers Australia (EA) Competencies

Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base	PE1.1 Comprehensive, theory-based understanding of underpinning fundamentals
	PE1.2 Conceptual understanding of underpinning maths, analysis, statistics, computing
	PE1.3 In-depth understanding of specialist bodies of knowledge
	PE1.4 Discernment of knowledge development and research directions
	PE1.5 Knowledge of engineering design practice
	PE1.6 Understanding of scope, principles, norms, accountabilities of sustainable engineering practice
PE2: Engineering Application Ability	PE2.1 Application of established engineering methods to complex problem solving
	PE2.2 Fluent application of engineering techniques, tools, and resources
	PE2.3 Application of systematic engineering synthesis and design processes
	PE2.4 Application of systematic approaches to the conduct and ma