

School of Civil and Environmental Engineering

Term3, 2021

CVEN4308

STRUCTURAL DYNAMICS

COURSE DETAILS

Figure 1. How this course relates to other courses in Civil Engineering.

HANDBOOK DESCRIPTION

Fundamentals of structural dynamic analysis for discrete and continuous structures; free and forced vibration of single and multiple-degrees-of-freedom systems; normal modal analysis; transient dynamic analysis by numerical integration; response spectrum; introduction to nonlinear dynamic analysis of structures; earthquake excitation: definitions and effects on structures; design of structures to resist dynamic loads.

<https://www.handbook.unsw.edu.au/undergraduate/courses/2021/CVEN4308/>

OBJECTIVES

The objective of this course is to enable students to gain a thorough understanding of the nature of dynamic loads and the key factors influencing the dynamic behaviour of structures. The course will provide you with an appreciation of the fundamental concepts of structural dynamics and earthquake engineering to be used in the design of structures against dynamic action.

These objectives contribute to the achievement of civil and environmental program outcomes in the following way:

- x By studying the theoretical background concepts of structural dynamics and their application to realistic structural problems you will engage in depth with disciplinary knowledge in structural engineering.
- x By applying the theoretical concepts learned to defined and open-ended class problems you will develop a capacity for analytical and critical thinking and for creative problem solving.
- x By working on an assignment that requires you to find information beyond what was conveyed in the classroom you will engage in independent and reflective learning.
- x By documenting your assignment work in a standard that would be expected in a real consultancy environment you will acquire skills for effective communication as well as collaborative and multi-disciplinary work.
- x The assessment strategies used in this course will assist in achieving these objectives. Assessment consists of a mix of short pre-class quizzes, which encourage you to revise the theoretical background material learned in a timely and

attacking an exercise and go to your classmate with a relevant question. Your classmate then can learn from your question as well as help you.

EXPECTED LEARNING OUTCOMES

This course is designed to address the learning outcomes below and the corresponding Engineers Australia Stage 1 Competency Standards for Professional Engineers as shown. The full list of Stage 1 Competency Standards may be found in Appendix A.

After successfully completing this course, you should be able to:

Learning Outcome	EA Stage 1 Competencies
1. Understand and apply the fundamental concepts of system dynamics with specific focus and application to civil/structural engineering.	PE1.1, PE1.2
2. Identify and specify various types of dynamic loading for structural analysis.	PE1.3
3. Apply the laws of dynamics to establish simple and realistic mathematical models of engineering structures.	PE1.2, PE2.1
4. Analyse the dynamic response to a dynamic load and other important parameters for structural design.	PE2.1, PE2.3

5.

25/10/2021 (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 Rayleigh's Method, Selection of Shape Function	Various solved examples on Modal Analysis; Various solved examples on Generalised SDOF Systems and Rayleigh's Method
01/11/2021 (Week 8)	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 Spectrum	Various solved examples on the Earthquake Response of Linear SDOF Systems
08/11/2021 (Week 9)	Earthquake Response of Linear Systems (MDOF) Introduction to Wind Loading	MDOF Equation of Motion, Response Spectrum Analysis, Modal Combination Rules; Wind-induced vibrations, random vibration/spectral approach	Various solved examples on the Earthquake Response of Linear MDOF Systems
15/11/2021 (Week 10)	Structural Dynamics in the Finite Element Method	Introduction to finite element analysis of structural dynamics by p9 c (a)2.1g0 Tc 0 Tw 9.1028.216 ()Tj 0.003 Tc -0.003 Tw 10.0	

Appendix A: Engineers Australia (EA) Competencies
 Stage 1 Competencies for Professional Engineers

	Program Intended Learning Outcomes
PE1: Knowledge and Skill Base PE2: Engineering Appl IDT ()TJ ET EMC /F	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