
FACULTY OF ENGINEERING, SCIENCE AND THE BUILT ENVIRONMENT

Unit title:	Earthquake Engineering
Unit number:	BCE/M/431
Unit Level	M
Unit value:	1.0
Unit co-ordinator:	I Kraincanic
Contact time:	Lectures 26 hours
	Tutorials 13 hours
	Laboratory 3 hours
Private study time:	108 hours
Unit pre-requisites:	None

SHORT DESCRIPTION

The basics of vibration of single and multiple degree-of-freedom systems are covered. Students apply the eigenvalue analysis to analyse mode shapes in MDOF structures. The concepts of natural frequency, damping, mode shapes will be demonstrated experimentally and on FE models. Simplified methods for calculating the dynamic response of structures to earthquake loading will be introduced.

AIMS

To develop a thorough understanding of causes and nature of vibration in structures and to appreciate problems associated with structural response to earthquake.

LEARNING OUTCOMES

The student should be able to:

- Recognise principal parameters in structures undergoing vibration
- Carry out modal analysis of a MDOF structure
- Apply experimental and FE modelling to assess dynamic properties of structures;
- Calculate the response of a structure to earthquake.

TEACHING AND LEARNING PATTERN

Lectures and tutorials supplemented by printed handouts and supported by laboratory experiments.

INDICATIVE CONTENT

- Causes of vibration and dynamically sensitive structures
- Vibrations of single degree of freedom systems, free and damped vibrations
- Vibrations in SDOF systems due to harmonic loading, step loading, impulse load. Duhamel integral method.
- Vibrations due to movement of supports
- Vibrations of multi-degree-of-freedom systems. Formation of stiffness and mass matrix. Eigenvalue analysis. Natural frequencies and mode shapes.
- Forced vibrations of MDOF systems. Uncoupling equations of motion
- Dynamic analysis in laboratory and computer modelling using FE software.
- Characteristics of earthquakes.
- Analysis of structural response to earthquake.

ASSESSMENT METHOD

70% - 3 hour end of unit written examination

30% - one assignment: Report on evaluation of dynamic properties and mode shapes of a multi-storey frame; comparison of experimental, analytical and numerical methods.

INDICATIVE SOURCES

Core

- Clough, R.W. and Penzien J., Dynamics of Structures, 2nd edition, McGraw Hill, 1993.
- Chopra, A., Dynamics of Structures, Prentice Hall, 1995.

Optional

- Paz, M, and Leigh, W, Structural dynamics: theory and computation, Kluwer Academic Publishers, Boston, 2004.
- Warburton, G., The dynamical behaviour of structures, Pergamon, Oxford, 1976.