Module Definition Form (MDF)

Module code: MOD007106	**Version:** 5 **Date Amended:** 03/Jul/2024

1. Module Title
Structural Dynamics

2a. Module Leader
Mariantonietta Morga

2b. School
School of Engineering and the Built Environment

2c. Faculty
Faculty of Science and Engineering

3a. Level
6

3b. Module Type
Standard (fine graded)

4a. Credits
15

4b. Study Hours
150

5. Restrictions			
Type	**Module Code**	**Module Name**	**Condition**
Pre-requisite:	MOD007113	Advanced Engineering Mathematics	Compulsory
Pre-requisite:	MOD007044	Structural Analysis	Compulsory
Co-requisites:	None		
Exclusions:	None		
Courses to which this module is restricted:	BEng/ MEng Civil Engineering		

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description

You will be introduced to how different structures respond under dynamic actions, focusing on wind and earthquakes, which are natural loads. This will help you to acquire the knowledge necessary to analyse different types of dynamic loads and carry out modal analysis, using the mass and stiffness of a structure to find its natural frequency. This is the frequency at which a system tends to oscillate and can result in critical structural damage. You will apply your mathematical knowledge by using manual calculations and finite element analysis (FEA) as well as quasi-static and dynamic analysis methods to design structures resistant to these dynamic loads. Finally, you will understand the impact of vibrations produced in human activities on the natural and built environment.

6b. Outline Content

Knowledge and Understanding:

Learning and understanding the characteristics, generation, and effects of different types of dynamic loads: natural (e.g., wind and earthquakes) and produced by human activities (e.g., traffic, and construction sites), and their definition in the design standards.

Classification and fundaments of quasi-static and dynamic analysis including references to the design standards

Fundamental period of a structure

structure modelling under dynamic load using a Finite Element software

Definition of simplified models: Single Degree Of Freedom (SDOF) system, Multi-Degree Of Freedom (MDOF) System and lumped masses frames

Fundamentals of modal analysis (natural periods and mode shapes)

Evaluation of the dynamic response of SDOF and MDOF structural systems

Comparison between results of computer software-based analyses and hand calculation

Impact of vibrations produced by human activities on the natural environment (animals), built environment (structures) and people.

Understanding of the dynamic load transmission through soil and air and the combination of soil-foundation-structure as an integrated system

Use of Finite Element software to apply a dynamic load to a structure model.

Skills Analysis

Applying engineering principles, such as material properties and structural element geometry to modify the dynamic characteristics of structures

Identifying the risks for the natural and built environment and people caused by dynamic loads and managing them through design solutions

Produce calculations in a clear and standard format.

Correct use of specialised terminology commonly used within the industry.

Managing time effectively.

Developing appropriate undergraduate study skills related to the acquisition and use of design information.

Questioning current theories and practice.

Tackling and solving mathematical problems in relation to structural calculations and design.

Accessing, storing and retrieving information.

Assimilating, memorising and recalling knowledge.

6c. Key Texts/Literature

The reading list to support this module is available at: https://readinglists.aru.ac.uk/

6d. Specialist Learning Resources
None

7. Learning Outcomes (threshold standards)		
No.	**Type**	**On successful completion of this module the student will be expected to be able to:**
1	Knowledge and Understanding	Evaluate dynamic actions, including ground-borne actions and air-borne actions, and analyse the consequent dynamic responses of structures
2	Knowledge and Understanding	Analyse the dynamic characteristics of a structure, including natural periods and vibration shapes.
3	Intellectual, practical, affective and transferrable skills	Verify and analyse a structure model in a Finite Element software using the results of modal analysis and identify the model components influencing the dynamic response.
4	Intellectual, practical, affective and transferrable skills	Model and analyse a structure under dynamic loads using Finite Element software.

8a. Module Occurrence to which this MDF Refers				
Year	**Occurrence**	**Period**	**Location**	**Mode of Delivery**
2024/5	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence			
Learning Activities	**Hours**	**Learning Outcomes**	**Details of Duration, frequency and other comments**
Lectures	24	1-2	Lecture 2 hr x 12 weeks
Other teacher managed learning	12	2-4	Tutorial 1 hr x 12 weeks
Student managed learning	114	1-4	Self Directed Learning
TOTAL:	150		

9. Assessment for the above Module Occurrence					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
010	Coursework	3,4	35 (%)	Fine Grade	30 (%)
Coursework (1000 Words or equivalent); this assessment maps AHEP4 C3 (LO3 and LO4)					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
011	Examination Chelmsford	1,2	65 (%)	Fine Grade	30 (%)
Exam (2 Hours); this assessment maps AHEP4 C2 (LO1 and LO2)					

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).

In addition, students are required to:
(a) achieve the qualifying mark for each element of fine graded assessment as specified above
(b) pass any pass/fail elements

[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]