Wrexham glyndŵr UNIVERSITY

MODULE SPECIFICATION PROFORMA

Module Title:	**Structural Vibration**	**Level**:	6	**Credit Value**:	20

Module code:	ENG690	**Is this a new module?**	Yes	**Code of module being replaced**:	N/A

Cost Centre(s):	GAME	**JACS3 code**:	H141

Trimester(s) in which to be offered:	2	**With effect from:**	September 17

School:	Applied Science, Computing & Engineering	**Module Leader:**	Z Chen

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Aeronautical & Mechanical Engineering	✓	☐
BEng (Hons) Aircraft Maintenance	✓	☐
BEng (Hons) Automotive Engineering		✓
BEng (Hons) Aerospace and Modern Optics	☐	✓
BEng (Hons) Mechanical Manufacturing	☐	✓

Pre-requisites

Office use only
Initial approval: February 17
APSC approval of modification: Version: 1
Have any derogations received Academic Board approval? Yes √ No ☐ N/A ☐
If new module, remove previous module spec from directory? Yes ☐ No ☐

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Module Aims
Mechanical and structural vibrations have critical effects on all mechanical systems. It is one of the key factors causing operating noise, wearing of bearings, fatigues, and even structural failures in a mechanical system. In this module, candidates will develop analytical models for vibration systems and conduct critical analysis on free vibrations and forced damped vibrations in multiple-degree-of-freedom systems and continuous systems. Candidates will also develop critical understanding on vibration control. By grasping the skills and knowledge in this module, candidates will be able to conduct critical analysis and design on mechanical systems' vibration performance to minimise the operating noise, wearing, fatigues and structural failures.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Analyse different vibrating systems from first principles;	KS5	KS6
		KS10	
2	Critically evaluate mechanical structures or systems vibrating features;	KS3	KS6
3	Control or minimise vibrations in a mechanical structures or systems;	KS3	KS5
		KS6	
4	Select from a range of analysis methods and possible solutions to suit differing practical and design situations.	KS3	KS5
		KS6	

Transferable skills and other attributes

1. Problem solving;
2. Mathematical applications;
3. Creative thinking and design.

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Assessment:

Assessment is by means of an examination covering all outcomes. It is an unseen time-constrained exam.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,2,3,4	Examination	100%	3 hours	

Learning and Teaching Strategies:

The module will be presented to students through a series of lectures, tutorials and case studies utilising laboratory equipment where appropriate. Use of computer packages, including specially developed computer aided packages from within the department, will be used to aid learning.

Syllabus outline:

Vibration systems and modelling: Free vibrations, calculation of natural frequencies and dynamic deflections etc, determination of modal shapes. Systems incorporating damping and forced vibrations, dynamic stiffness coefficients.

Vibration control: Concept of vibration absorbers, undamped vibration absorbers, merits of damped vibration absorbers.

Multi-degree of freedom systems: Solution by eigenvalues and eigenvectors, matrix iteration etc, modal shapes, orthogonality of principal modes, free vibrations and forced vibrations of multi-degree of freedom system.

Dynamics and vibration of continua: One-dimensional continua; dynamics of one-dimensional continua; free vibrations of one-dimensional continua; forced vibrations of one-dimensional continua.

Vibration Measurement and condition monitoring: Practical measurement of displacement, velocity and acceleration. Measurements in frequency domain by spectral analysis, Vibration analysis for condition monitoring.

Bibliography:
Essential reading
Rao, S.S. (2011) Mechanical Vibrations, 5th edition, Pearson Ed Asia
Other indicative reading
Bottega, W.J. (2015) Engineering Vibrations, 2nd edition, CRC Press Benaroya, H. (2009) Vibration: Analysis, Uncertainties, and Control, 3rd edition, CRC Press Petyt, M. (2010) Introduction to Finite Element Vibration Analysis, 2nd edition, Cambridge University Press Inman, D.J. (2008) Engineering Vibrations, 3rd edition, Pearson. Wowk, V. (2009) Machinery Vibration: Measurement and Analysis, McGraw-Hill.