Semester:	6				
Course Code:	ME5030				
Course Name:	Vibration				
Credits Value:	3 (Notional hours: 150)				
Pre-requisites:	ME3030				
Core/ Optional:	Optional				
Hourly Breakdown	Lectures (hours)	Tutorials (hours)	Practical classes (hours)	Assignments (hours)	Independent Learning & Assessment (hours)
	37			16	97

Course Aim: To introduce the fundamentals of vibrations theory and practice so that the students will be able to model and analyze vibratory systems to estimate, measure, prevent and rectify vibrations in machines and structures.

Intended Learning Outcomes:
On successful completion of the course, the students should be able to;

- **analyze** vibratory systems using frequency response methods;
- **analyze** vibration of distributed parameter systems;
- **identify** the modes of vibration of mechanical systems and estimate the modal parameters;
- **design** methods to minimize vibrations.

Course Content:

- **Frequency response analysis of vibratory systems:** Transform techniques: transfer functions, state-space representation, Mechanical impedance approach: interconnection laws, transmissibility functions, force and motion transmissibility, receptance analysis and applications.
- **Distributed-Parameter Systems:** Flexural vibration of uniform beam, vibration of cables, torsional vibration of uniform shaft, longitudinal vibration of uniform rod, vibration of membranes and plates, whirling of shafts, Approximate methods: influence coefficient method, energy methods, Dunkerley and Raleigh approximations.
- **Damping:** Internal damping, structural damping, fluid damping, interface damping, modelling and measurement of damping
- **Vibration signal analysis and instrumentation:** Frequency spectrum, signal types, Fourier analysis, aliasing and distortion, random signal analysis, signal-generating devices, vibration exciters, sensors and transducers, signal conditioning/modifying devices, signal analysis devices, vibration recording and display devices.

- **Introduction to experimental modal analysis :** Modal representation of multi-degree of freedom (MDOF) systems, curve fitting of transfer functions, experimental observation of natural frequencies, modal damping ratios and mode shape vectors.
- **Vibration Design and Control:** Specification of vibration limits**,** vibration isolation and design**,** balancing of rotating machinery

Teaching/ Learning Methods:

Classroom lectures, in-class exercises and assignments

Assessment Strategy:

Continuous Assessment 50%		**Final Assessment** 50%		
Details:		Theory (%)	Practical (%)	Other (%) (Project)
Assignments/Quizzes	30%	50%		
Mid semester examination	20%			

Recommended Reading:

- de Silva, C. W. (2000). *Vibration-Fundamentals and Practice*. CRC press, NY, USA.
- Anders Brand (2011), *Noise and Vibration Analysis: Signal Analysis and Experimental Procedures* (1st Edition), Wiley Publications, USA.
- MIT Open Courseware, *Mechanical Vibration*. Available online at https://ocw.mit.edu/courses/mechanical-engineering/2-003sc-engineering-dynamics-fall-2011/mechanical-vibration/
- MIT Open Courseware, Vibration analysis by mode superposition. Available online at https://ocw.mit.edu/courses/mechanical-engineering/2-003sc-engineering-dynamics-fall-2011/vibration-analysis-by-mode-superposition/
- de Silva, C. W. (2005). *Vibration and Shock Handbook*, CRC press, NY, USA.