GUJARAT TECHNOLOGICAL UNIVERSITY

Master of Engineering
Subject Code: 3720817
Noise and Vibrations Analysis
Semester II

Type of course: Engineering Science

Prerequisite: Zeal to learn the subject

Rationale: The course intends to provide intermediate level of knowledge of Mechanical Vibrations and foundations of noise. The course includes analysis of single and multi-degrees of freedom system, analysis of continuous system along with experimental methods

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Topics	Teaching Hrs.
1	**Fundamentals of Vibration:** Introduction to Single degree freedom systems, Duhamel's Integral, Impulse Response function, Virtual work, Lagrange's equation, Single degree freedom forced vibration with elastically coupled viscous dampers, Transient Vibration	06
2	**Two Degrees of Freedom System:** Free vibration of spring-coupled system, Mass coupled system, Vibration of two degree freedom system, Forced vibration of spring-coupled system, Mass coupled system,Nonlinear stiffness, Vibration Absorber, Vibration Isolation.	05
3	**Multi-Degrees Freedom System:** Normal mode of vibration, Flexibility Matrix and Stiffness matrix Eigenvalues and Eigenvectors,Orthogonal properties,Forced Vibration by Matrix inversion,Modal analysis, Modal damping in forced vibration,Matrix iteration, Using Lagrange's equation to derive equation of motion.	07
4	**Vibration of Continuous Systems:** Systems governed by wave equations, Vibration of strings, Vibration of rods,Euler Equation for Beams, Effect of Rotary inertia and shear deformation.	05
5	**Random Vibrations:** Description of random process, Correlation and power spectral density	03
6	**Experimental Methods in Vibration Analysis:** Vibration instruments, Vibration exciters Measuring Devices, Analysers, signal processing; modal parameter identification; vibration trouble-shooting and diagnosis; time-domain and frequency-domain vibration analysis.	06
7	**Noise:** Introduction Relation between vibration and noise pollution, vibration	03

	as noise sources, classification of analysis of machinery vibrations.	
8	**Noise Generated by Vibrating Structures and Control:** Elementary noise radiators; noise radiation by machine; noise source identification; sound intensity measurement; identification of noise source; noise radiation and transmission; design principles for noise reduction.	07

Reference Books:
1. Mechanical Vibrations, S. S.Rao, Pearson Eduction.
2. Mechanical Vibrations S.Graham Kelly and Shashidar K.Kudari, , McGraw-Hill Publishing
3. Engineering Vibration, Inman D J, Pearson Education.
4. Theory of Vibration with Applications Thomson W.T. CBS Publishers & Distributors / Prentice Hall of India
5. Introductory Course on Theory and Practice Mechanical Vibration Rao J.S., & Gupta, K. New Age International (P) Ltd.
6. Principles of Vibrations ControlA.K. Mallik, Affiliated East-West Press Pvt. Ltd.
7. Modal Testing: Theory and PracticeEwins D.JJohn Wiley.
8. Fundamentals of Noise and Vibration Analysis for EngineersNorton M P and Karczub D G Cambridge Press.

Course Outcome:
After learning the course

Sr. No.	Course Outcome	Percentage weightage
CO-1	Students will be able to understand fundamentals of modelling and analysis of mechanical systems.	30%
CO-2	Students will be able to conduct vibration analysis of continuous systems.	20%
CO-3	Students will be able to apply experimental methods for vibration measurement and control.	20%
CO-4	Students will be able to understand fundamentals of noise.	30%

List of Experiments:
Experiments should be designed considering following themes.
1. Study of SDOF forced vibration
2. Study of MDOF system.
3. Solution of SDOF and MDOF problems by MATLAB / SciLab
4. Vibration measurement using FFT analyser
5. Interpretation of FFT results i.e. finding problems like unbalance, misalignment, also finding damping coefficient
6. Study of vibrations of continuous system
7. Noise measurement

Major Equipment:

1. Universal Vibration experimental set up.

2. Accelerometer , Microphone, FFT analyzer.

List of Open Source Software/learning website:

1. **NPTEL courses**
2. **Scilab Software**