



FACULTY OF ENGINEERING & TECHNOLOGY

First Year Master of Engineering

Semester I

Course Code: 102320106

Course Title: Mechanical Vibration

Type of Course: Program Elective II

Course Objectives: Understand the concepts of Mechanical vibrations starting from single, two, Multi degree freedom systems and advanced topics like continuous, Non-linear and Random Vibration concepts.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
Lecture	Tutorial	Practical		Internal		External		Total
				Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	40/16	20/08	60/24	30/12	150/60

* J: Jury; V: Viva; P: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	Fundamentals of Vibration: Basic concepts; free vibration of single degree of freedom systems with and without damping, forced vibration of single DOF-systems, Natural frequency. Two degree and multi degree freedom system, Vibration Absorber, Vibration isolation, Flexibility Matrix and Stiffness matrix, Eigen values and eigen vectors, Orthogonal properties, Modal Matrix-Modal Analysis, Forced Vibration by matrix inversion.	11
2	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, Vibration of plates.	6
3	Transient and Random Vibrations: Impulse excitation, arbitrary excitation, Laplace transform formulation, Pulse excitation and risetime, Shock response spectrum, Shock isolation. Random phenomena, Time averaging and expected value, Frequency response function, Fourier transforms and response.	7
4	Nonlinear Vibrations: Introduction, Sources of nonlinearity, Qualitative analysis of nonlinear systems. Phase plane, Conservative systems, Stability of equilibrium, Method of isoclines, Self-excited oscillations.	5
5	Vibration Measurement: FFT analyzer, vibration exciters, signal analysis, time domain and frequency domain analysis of signals, experimental modal analysis, machine conditioning and monitoring, fault diagnosis	4



6	Vibration Control: Sources of vibration; vibration basics; vibration analysis of continuous structures; finite element analysis of structures; vibration isolation and absorption; passive and active vibration control.	6
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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						R: Remembering; U: Understanding; A: Application, N: Analyze; E: Evaluate; C: Create
R	U	A	N	E	C	
10	25	20	25	15	05	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1	Mechanical Vibrations, Rao, S.S, Addison Wesley Longman.
2	Mechanical Vibration Analysis, Shrinivasan P, Tata McGraw Hill.
3	Mechanical vibrations, V. P. Singh, Dhanpat Rai & Co.
4	Theory of Vibrations with Applications, W. T. Thomson, CBS Publishers, Delhi
5	Mechanical Vibrations, S. S. Rao, Addison-Wesley Publishing Co.
6	Fundamentals of Vibration, Leonard Meirovitch, McGraw Hill International Edison.
7	Principles of Vibration Control, Ashok Kumar Mallik, Affiliated East-West Press.
8	Mechanical Vibrations, A H Church, John Wiley & Sons Inc.
9	Mechanical Vibrations, J P Den Hartog, McGraw Hill.
10	Mechanical Vibration Analysis, Srinivasan, McGraw Hill.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Develop the equation of motion for single degree of freedom by using various methods.	18
CO-2	Analyze the vibration effect of two degree of freedom mechanical systems.	17
CO-3	Evaluate the vibration effect of multi-degrees of freedom system by using various methods.	22
CO-4	Analyze the effect of vibration in continuous system.	18
CO-5	Determine the natural frequency of mechanical system by using vibration instruments.	25
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CO-7	Click or tap here to enter text.	Click
CO-8	Click or tap here to enter text.	Click
CO-9	Click or tap here to enter text.	Click
CO-10	Click or tap here to enter text.	Click



List of Practicals / Tutorials:

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1	Introduction to mechanical vibration
2	Study of Single DOF forced vibration
3	Study of two DOF systems
4	Study of Multi DOF system
5	Solution of SDOF and MDOF problems using MATLAB
6	Study of vibrations of continuous system
7	Study of different vibration measurement instruments
8	Study the machine fault diagnostic system based on vibration analysis
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Supplementary learning Material:

1	NPTEL: https://nptel.ac.in/courses/112/103/112103111/
2	NPTEL: https://nptel.ac.in/courses/112/107/112107212/
3	NPTEL: https://nptel.ac.in/courses/112/103/112103112/
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Curriculum Revision:

Version:	1
Drafted on (Month-Year):	Apr-20
Last Reviewed on (Month-Year):	Jul-20
Next Review on (Month-Year):	Apr-22