

MECHANICAL VIBRATIONS

CourseCode	20ME4701A	Year	IV	Semester	I
Course Category	Professional Elective- III	Branch	ME	Course Type	Theory
Credits	3	L – T – P	3 – 0 – 0	Prerequisites	Nil
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	BTL	Units
CO1	Understand the basic principles of vibrating systems and acoustics.	Understand	L2	1,2,3,4,5
CO2	Compute the natural frequency and vibration response of single degree freedom systems under free and forced vibrations	Apply	L3	1,2
CO3	Determine the response of Two-degree freedom systems under free and forced vibrations	Apply	L3	3,4
CO4	Determine the equation of motion and find the natural frequencies and corresponding mode shapes of a multi degree of freedom system	Apply	L3	5

Contribution of Course Outcomes towards achievement of Program Outcomes Strength of correlations (3: High, 2: Moderate, 1: Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1									3	1
CO2	3	3	1	1									3	1
CO3	3	3	1	1									3	1
CO4	3	3	1	1									3	1

Syllabus

UNIT	Contents	Mapped COs
I	<p>UNDAMPED FREE VIBRATIONS OF SDOF SYSTEMS Introduction, basic concepts of vibration, importance of vibration study, elements of a vibrating system, types of vibration, methods of vibration analysis, harmonic motion, Equation of motion, free vibration of undamped translational system, free vibration of undamped torsional system, Raleigh's energy method.</p> <p>DAMPED FREE VIBRATIONS OF SDOF SYSTEMS Introduction, types of damping, free vibration with viscous and coulomb damping, logarithmic decrement.</p>	CO1, CO2
II	<p>HARMONICALLY EXCITED VIBRATIONS Introduction, equations of motion, response of undamped and damped systems under harmonic excitation, response of a damped system under harmonic motion of the base, response of a damped system under rotating unbalance, vibration, measuring instruments- vibrometer and accelerometer, critical speed.</p>	CO1, CO2

III	TWO DEGREE OF FREEDOM SYSTEMS: Introduction, equations of motion for forced vibration, free vibration analysis of an undamped system, torsional system, coordinate coupling and principal coordinates, forced vibration analysis. Dynamic vibration absorber.	CO1, CO3
IV	MULTI-DEGREE OF FREEDOM SYSTEMS: Introduction, modeling of continuous systems as multi degree of freedom systems, using Newton's second law to derive equations of motion, influence coefficients, Determination of natural frequencies and mode shapes.	CO1, CO3
V	FUNDAMENTALS OF ACOUSTICS: Human Perception of Sound, Sound Wave Propagation in 1-D, Some Important Acoustic Quantities and Relations, Acoustic Transducers and types of Microphones, acoustic excitors, Sound Level Measurement, Sound Intensity Measurement, Sound Absorption Measurement	CO1, CO4

Learning Recourse(s)**Text Book(s)**

1. S.S.Rao, Mechanical Vibrations, 5/e, Pearson Education Inc., 2011.
2. G. K. Grover, Mechanical Vibrations, 8/e, Nem Chand & Bros
3. C. Sujatha, Vibration And Acoustics Measurement and Signal Analysis , Tata McGraw Hill

Reference Book(s)

1. L.Meirovich, Elements of Vibration Analysis, 2/e. Tata McGraw Hill, 2007.
2. J.S.Rao and, K.Gupta, Introductory Course on Theory and Practice of Mechanical Vibrations, 2/e, New Age International, 1999.

E-Resources & other digital material

1. <https://nptel.ac.in/courses/112/103/112103112/>
2. <https://nptel.ac.in/courses/112/103/112103111/>