MECHANICAL VIBRATIONS

Course Code	23ME4601A	Year	III	Semester	II
Course Category	Professional Elective-II	Branch	ME	Course Type	Theory
Credits	3	L-T-P	3-0-0	Prerequisites	Strength of Materials
Continuous Internal Evaluation:	30	Semester End Evaluation:	70	Total Marks:	100

Course Objectives:
1. To learn basic principles of mathematical modeling of vibrating systems
2. To understand the basic concepts free and forced multi degree freedom systems
3. To get concepts involved in the torsional vibrations
4. To learn the principles involved in the critical speed of shafts
5. To understand the basic concepts of Laplace transformations response to different inputs

Course Outcomes: At the end of the course, student will be able to

CO1	Understand the concepts of vibrational analysis
CO2	Understand the concepts of free and forced multi degree freedom systems
CO3	Summarize the concepts of torsional vibrations
CO4	Solve the problems on critical speed of shafts
CO5	Apply and Analyze the systems subjected to Laplace transformations response to different inputs

UNIT – 1
Relevance of and need for vibrational analysis – Basics of SHM - Mathematical modelling of vibrating systems - Discrete and continuous systems - single-degree freedom systems - free and forced vibrations, damped and undamped systems.

UNIT – 2
Free and forced vibrations of multi-degree freedom systems in longitudinal, torsional and lateral modes - Matrix methods of solution- normal modes - Orthogonality principle-Energy methods, Eigen values and Eigen vectors, modal analysis.

UNIT – 3
Torsional vibrations - Longitudinal vibration of rods - transverse vibrations of beams –

Governing equations of motion - Natural frequencies and normal modes - Energy methods, Introduction to non- linear and random vibrations.

UNIT – 4
Vibration Measuring Instruments and Critical Speeds of Shafts: Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Critical speed of a light shaft having a single disc without damping and with damping, critical speeds of shaft having multiple discs, secondary critical speed, critical speeds light cantilever shaft with a large heavy disc at its end.

UNIT – 5
Laplace transformations response to an impulsive input, response to a step input, response to pulse(rectangular and half sinusoidal pulse), phase plane method

Text books:
    1. S.S.Rao, "Mechanical Vibrations ", 5th Edition, Prentice Hall, 2011.
    2. L.Meirovitch, "Elements of vibration Analysis", 2nd Edition, McGraw-Hill, New York, 1985.
References:
    1. W.T. Thomson, M.D. Dahleh and C Padmanabhan, "Theory of Vibration with Applications", 5th Edition,Pearson Education, 2008.
    2. M.L.Munjal, "Noise and Vibration Control", World Scientific, 2013.
    3. Beranek and Ver, "Noise and Vibration Control Engineering: Principles and Applications",JohnWiley and Sons, 2006.
    4. Randall F. Barron, "Industrial Noise Control and Acoustics", Marcel Dekker, Inc., 2003.