MECHANICAL VIBRATIONS

Sub Code	: 10ME 72	**IA Marks**	: 25
Hrs/week	: 04	**Exam Hours**	: 03
Total Lecture Hrs	: 52	**Exam Marks**	: 100

PART- A

UNIT - 1

Introduction: Types of vibrations, Definitions, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM, Beats, Fourier theorem and problems.

06 Hours

UNIT -2

Undamped (Single Degree of Freedom) Free Vibrations: Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, Torsional and transverse vibrations, Effect of mass of spring and Problems.

07 Hours

UNIT - 3

Damped free vibrations (1DOF): Types of damping, Analysis with viscous damping - Derivations for over, critical and under damped systems, Logarithmic decrement and Problems.

06 Hours

UNIT - 4

Forced Vibrations (1DOF): Introduction, Analysis of forced vibration with constant harmonic excitation - magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes), force and motion transmissibility, Energy dissipated due to damping and Problems.
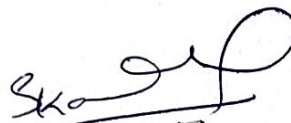
07 Hours

PART – B

UNIT – 5

Vibration Measuring Instruments and Whirling of shafts: Seismic Instruments – Vibrometers, Accelerometer, Frequency measuring instruments and Problems. Whirling of shafts with and without damping, discussion of speeds above and below critical speeds and Problems.

06 Hours

UNIT – 6

Systems with two degrees of Freedom: Principle modes of vibrations, Normal mode and natural frequencies of systems (without damping) – Simple spring mass systems, masses on tightly stretched strings, double pendulum, torsional systems, combined rectilinear and angular systems, geared systems and Problems. Undamped dynamic vibration absorber and Problems.

06 Hours

3

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UNIT - 7

Numerical Methods for multi degree freedom of systems: Introduction, Maxwell's reciprocal theorem, Influence coefficients, Rayleigh's method, Dunkerley's method, Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and Problems.

09 Hours

UNIT – 8

Modal analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, Experimental modal analysis, Machine condition monitoring and diagnosis.

05 Hours

TEXT BOOKS:

1. **Mechanical Vibrations,** S. S. Rao, Pearson Education Inc, 4th edition, 2003.

2. **Mechanical Vibrations,** V. P. Singh, Dhanpat Rai & Company, 3rd edition, 2006.

REFERENCE BOOKS:

1. **Theory of Vibration with Applications,** W. T. Thomson, M. D. Dahleh and C. Padmanabhan, Pearson Education Inc, 5th edition, 2008.

2. **Mechanical Vibrations:** S. Graham Kelly, Schaum's outline Series, Tata McGraw Hill, Special Indian Edition, 2007.

3. **Theory and Practice of Mechanical Vibrations:** J. S. Rao & K. Gupta, New Age International Publications, New Delhi, 2001.

4. **Mechanical Vibrations,** G. K.Grover, Nem Chand and Bros, 6th edition, 1996.

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