MECHANICAL VIBRATIONS

Subject Code: 13ME2201 **L P C**
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Course Outcomes:

At the end of the course, a student will be able to

CO1: Determine the natural frequency of transverse vibrations of the shaft and torsional vibrations of rotor systems

CO2: Analyze the mathematical modeling of the two degrees of freedom systems and explain about the working principle of vibration absorber

CO3: Compute the natural frequencies and mode shapes of a multi degree of freedom system and explain the modal analysis of a vibrating system

CO4: Describe the numerical methods to determine natural frequencies of the beam and rotor systems

CO5: Describe the vibration measurement by using transducers and vibration exciters

UNIT – I

Transverse vibrations, single concentrated load, uniformly distributed load, several loads, Dunkerley's method, energy method, whirling of shafts. Torsional vibrations – single rotor, two-rotor, three-rotor systems, torsionally equivalent shaft, geared system.

UNIT – II

Two degree of freedom systems – Principal modes of vibration – two masses fixed on tightly stretched string – double pendulum – torsional system with damping – forced vibration with harmonic excitation – undamped dynamic vibration absorber – untuned viscous damper

UNIT – III

Multi degree of freedom systems – exact analysis - free vibrations – equations of motion – influence coefficients - generalized co-ordinates – Co-ordinate coupling – natural frequencies and mode shapes – eigenvalues and eigenvectors - orthogonal properties of normal modes – modal analysis.

UNIT – IV

Multi degree of freedom systems – Numerical methods – Rayleigh`s method – Dunkerley`s method – Stodola's method – Rayleigh Ritz method – Method of matrix iteration – Holzer's method for natural frequencies of multi rotor systems.

UNIT – V

Continuous systems – vibration of strings – longitudinal vibrations of bars – torsional vibrations of circular shafts - lateral vibration of beams Critical speeds of shafts – Critical speed of a light shaft having a single disc – without damping and with damping. Critical speed of a shaft having multiple discs – secondary critical speed

TEXT BOOK:

1. Rao S.S. ,"*Mechanical Vibrations*",4e, Pearson Education Inc.,2004.

REFERENCES:

1. G.K. Grover, "*Mechanical Vibrations*", Nemchand & Bros, Roorkee, 8e, 2009.
2. William T Thomson & Marie Dillon Dahleh, "*Theory of Vibrations with application*", 5e, Pearson Education Publication, 2007.
3. Tse, Morse and Hinkel, "*Mechanical Vibrations*", Chapman and Hall, 1991.
4. Den Hartong J.P., "*Mechanical Vibrations*", McGraw Hill, 1986.
5. V.P.Singh, "*Mechanical vibrations*",3e, Dhanpat Rai& Co.,2006.