

I Year M.Tech. Machine Design, II Semester L T P TO C

(ME 504) MECHANICAL VIBRATIONS (MTech I Year II Semester)

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Objective of the Course : To enlighten the concepts of natural frequencies and resonance of mechanical systems.

UNIT-1

Introduction:Harmonic and periodic motions, vibration terminology, Vibration model, Single-DOF Free Vibrations: Equation of motion-Natural Frequency,Energy method, Rayleighmethod, damping models.Viscously damped free vibrationSpecial cases: oscillatory, non-oscillatory and critically damped motions.Logarithmic decrement, Experimental determination of damping coefficient.Forced harmonic vibration, Magnification factor.Rotor unbalance, Transmissibility, Vibration Isolation, Equivalent viscous damping, Sharpness of resonance.

UNIT-2

Two-DOF Free Vibrations: Generalized and Principal coordinates, derivation of equations of motion, Lagrange's equation, Coordinate coupling, Forced Harmonic vibration, Vibration Absorber:Tuned absorber, determination of mass ratio.Tuned and damped absorber,

UNIT-3

Multi-DOF: Derivation of equations of motion, influence coefficient method, Properties of vibrating systems: flexibility and stiffness matrices, reciprocity theorem, Modal analysis: undamped, Modal analysis: damped Calculation of natural frequencies: Rayleigh method, Stodala method, Matrix iteration method, Holzer method and Dunkerley's method Torsional vibration: Simple systems with one or two rotor masses, Multi-DOF systems-transfer matrix method, Geared system

UNIT-4

Continuous systems: closed form solutions, Vibration of strings, Longitudinal and torsional vibration of rods, Transverse vibration of beams: equations of motion and boundary conditions, Transverse vibration of beams: natural frequencies and mode shapes Continuous systems: Approximate solutions, Rayleigh's energy method, Rayleigh-Ritz method, Assumed modes and Galerkin's method

UNIT-5

Signature analysis and preventive maintenance: Vibration testing equipment's: signal generation, measuring and conditioning instruments, Vibration testing equipment's: signal analysis instruments

TEXT BOOKS:

1. Meirovitch, "Fundamentals of Vibration Analysis", 3rdEdition, McGraw Hill, 2001.

2. G.K. Groover, "Mechanical Vibrations", 8thEdition, S Chand and Brothers, 1996.

3. S. Graham Kelly, "Theory and Problems of Mechanical Vibrations", 8th Edition, REFERENCE BOOKS:

1. W.T. Thomson, "Theory of vibration with applications", 5thEdition, Prentice Hall, 1997.

? Singiracu S Rao "Vibration of Continuous Systems John Wiley & Sone 2007