I Year M.Tech.   Machine Design,   II Semester

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(ME 504) MECHANICAL VIBRATIONS

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

UNIT - I
Single degree Freedom systems : Undamped and damped free vibrations: forced vibrations – Viscous damper – Coulomb damper– Vibration isolation and transmissibility - Torsional vibrations. Vibration measuring instruments. Response to non periodic excitations unit impulse, unit step and unit ramp functions; response to arbitary exicitations.

UNIT - II
Two degree freedom systems : Principal modes – undamped and damped free and forced vibrations – undamped and damped vibration absorbers, response to non periodic excitations by the convolution sum.

UNIT - III
Multi degree freedom systems : Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by modal analysis; method of matrix inversion; Torsional vibrations of multi – rotor systems and geared systems: Discrete-time systems.

UNIT - IV
Numerical Methods : Rayliegh's, stodola's, Matrix iteration, Rayleigh-Ritz Mathod and Holzer's methods. Continuous Systems: Free vibration of strings – longitudinal oscillations of bars – traverse vibrations of beams – torsional vibrations of shafts.

UNIT - V
Non – linear vibrations : Undamped free vibrations with non-linear spring forces; forced undamped vibrations with non-linear spring forces; self-excitated vibrations; stability.

TEXT BOOKS:
1.   Meirovitch, "Fundamentals of Vibration Analysis", 3rd Edition, Mc Graw Hill, 2001.
2.   G.K. Groover, "Mechanical Vibrations", 8th Edition, Chand and Brothers, 1996.
3.   S. Graham Kelly, "Theory and Problems of Mechanical Vibrations", 8th Edition, Schawn's outline series, Mc Graw Hill, 2006.

REFERENCE BOOKS:
1.   W.T. Thomson, "Theory of vibration with applications", 5th Edition, Prentice Hall, 1997.
2.   S.P. Thimoshenk, D.H. Young, "Vibration Problems in Engineering", 5th Edition, Wiky Interscience, 1990.