MECHANICAL VIBRATION

Course Code: 28568
Credits: 3
Course Type: Theoretical
Prerequisites: Differential Equations, Dynamics
Corequisite: -
Course Length: 51 hours

Outline:

1) Basic concepts: Harmonic and periodic motion, oscillatory systems and properties, degree of freedom of oscillatory systems, linear and nonlinear systems, complementary definitions.

2) Free vibration of single degree of freedom systems: deferential equation of system using Newton method and energy method and Rayleigh method, D'Alambert method and effective mass and virtual work and vibration of single degree of freedom without and with viscous damping and with frictional(Coloumb) damping, logarithmic decrement.

3) Harmonic excited vibration: Steady state response of a single degree if freedom excited by harmonic input, using complex variables, time response and frequency response, input force/moment, input support motion, unbalance rotation, whirling, torsional vibration, critical speed, structural damping.

4) Completing discussion: Spring and Damper in serial and parallel, energy dissipation by viscous damping, vibration isolation, equivalent viscous damping, viscoelastic system, vibration instrumentation.

5) General input vibratory system: Fourier method for periodic excitation, impulsive input and unit impulse function, convolution integral method, pulse and shock response spectrum, Laplace transformation.

6) Multi Degree of Freedom Systems: Free vibration of systems with 2 or more degrees of freedom, modal analysis, force method and energy (Lagrange) method, beating, forced vibration, vibration absorber, related systems

vibration, rigid body mode, equation for systems of vibratory and the properties and decoupling methods for systems.

7) Continuous system vibration: Vibration of continuous systems including string, bar, torsional shaft, and Euler-Bernoulli beam.

References:

1- Thomson W.T. and M.D.Dahleh "Theory of Vibration with Applications" 5'th Ed. Printice Hall.
2- Rao, S.S , " Mechanical Vibrations" third Ed., Addison – Wesley , 1995