[MSS-112] Physics I (Mechanics, Waves and Vibrations) 3 Credits (3-1-0)

Motion of a particle and special theory of Relativity: Co-ordinate Systems and Motion of a Particle : Volume, velocity and acceleration in Cartesian and Spherical co-ordinate systems. Solid angle.Space Time Symmetry, Relationship of conservation laws and symmetries of space and time. Inertial frames of reference. Galilean transformation and Galilean invariance.Non-inertial frames, Coriolis force and its applications.Focault's pendulum.Concept of stationary universal frame of reference and search for ether. Michelson- Morley experiment, postulates of special theory of relativity. Lorentz transformations.Observer in relativity.Relativity of simultaneity. Effects of Relativity: Length contraction. Time dilation.Relativistic addition of velocities. Relativistic Doppler effect. Variation of mass with velocity and mass energy equivalence. Increase of mass in an inelastic collision, Relativistic momentum and energies. Transformation of momentum , energy. Minkowsky space

Free and Damped Vibrations: Simple harmonic motion, energy of a SHO. Compound pendulum, Electrical oscillations. Transverse vibrations of a mass on a string, composition of two perpendicular SHM of same period and of period ratio1 : 2. Anharmonic oscillations. Decay of free vibrations due to damping. Differential equation of motion, types of damping. Determination of damping co-efficient-logarithmic decrement, relaxation time and Q-Factor. Electromagnetic damping (Electrical oscillator**)**

Forced and Coupled Oscillator: Transient and steady behaviour of forced oscillator. Displacement and velocity variation with driving force frequency. Variation of phase with frequency. Power supplied to an oscillator and its variation with frequency. Q- value and band width. Q-value as an amplification. Stiffness coupled pendulums. Normal co-ordinates and normal modes of vibration.Inductance coupling of electrical oscillators.

Books and References*:*

1. Mechanics, Berkley Physics Course Vol. 1, 2nd edition.
2. The Feynman Lectures in Physics, Vol 1, R.P. Feynman, R.B. Lighton and M sands, Indian Reprint available with BI Publications, Bombay
3. Mechanics, DS Mathur, S Chand and Company
4. The Physics of Vibrations and Waves by H.J.Pain (English Language Book Society)/ John Wiley and Sons.
5. Fundamentals of Vibration and Waves, S.P.Puri, Low Cost Student Edition, Tata Mc-Graw Hill Company, New Delhi.
6. Waves, Berkeley Physics course Vol. III, Frank S. Crawford Jr., Mc-Graw Hill Book Company.
7. University Physics, Francis W Sears, Mark W. Zemanasky, Hugh D. Young, 6th Edition, Addison Wesley, Indian Student Edition Available with Narosa Publishing House, N. Delhi.
8. Vibrations and Waves, I.J. Main, Cambridge University Press.
9. Vibration and Waves, AP French, CBS Publishers.