

SEMESTER 1st
MAJOR COURSE

PHY122J: PHYSICS (MECHANICS)

CREDITS: 04 + 02

THEORY (04 CREDITS)

Unit - I

Cartesian co-ordinate system, spherical & cylindrical coordinate system with expression for velocity and acceleration, Laws of motion: Inertial and non-inertial frames of references, uniformly rotating frame, Coriolis force & its applications, Newton's laws of motion, dynamics of a system of particles. centre of mass.

Unit - II

Momentum and energy: Conservation of linear momentum in system of particles. Work and energy, Conservation of energy. Motion of rockets (principle and equation). Rotational motion: Angular velocity and angular momentum. Torque. Conservation of angular momentum in system of particles. Special theory of relativity: Galilean and Lorentz transformations. Postulates of special theory of relativity. Length contraction. Time dilation. Relativistic addition of velocities.

Unit - III

Gravitation: Newton's laws of Gravitation. Motion of a particle in a central force field. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and potential energy. Total energy and their time averages. Damped oscillations

Unit - IV

Elasticity: Hooke's, Stress-strain diagram. $\frac{\text{Elastic moduli}}{\text{Poisson's ratio}}$ -Relation between elastic constants. Poisson's ratio-expression for Poisson's ratio in terms elastic constants. Work done in stretching and work done in twisting a wire * Twisting couple on a cylinder. Viscosity. Streamline and turbulent motion: Derivation of Poiseuille's Equation, Stoke's law. Effect of temperature on viscosity.

TEXTBOOK:

Mechanics Berkeley Physics course, Volume-I: Charles Kittel, et.al. 2007, Tata McGraw-Hill.

REFERENCE BOOKS:

1. University Physics. F. W. Sears, M. W. Zemansky and H. D. Young, 1986. Addison Wesley
2. Physics, Resnick, Halliday & Walker 9/e, 2010, Wiley.
3. Engineering Mechanics, Basudeb Bhattacharyya 4th edn., 2015, Oxford U
4. University Physics, Ronald Lane Reese. 2003, Thomson Brooks/Cole
5. Special Theory of Relativity, Robert Resnik, Addison-Wiley.

LABORATORY COURSE (PRACTICAL) (CREDITS: 02)

1. Measurements of length (or diameter) using vernier calliper, screw gauge and travelling microscope.
2. To determine the Height of a Building using a Sextant.
3. To determine the Moment of Inertia of a Flywheel.
4. To determine the Young's Modulus of a Wire by Optical Lever Method/bending of beam.
5. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
6. To determine the Elastic Constants of a Wire by Searle's method.
7. To determine g by Bar Pendulum.
8. To determine g by Kater's Pendulum.
9. To determine g and velocity for a freely falling body using Digital Timing Technique.
10. To study the Motion of a Spring and calculate (a) Spring Constant (b) value of g.

REFERENCE BOOKS:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.