

SEMESTER 1st MAJOR / MINOR

Course: Physics

Course Title: Mechanics

Course Code: PHY122M

Credits: 04 + 02 Theory (04 Credits), Practical (02 Credits)

Course Objectives:

- ❖ To review the basic concepts of classical mechanics and mechanical properties of matter
- ❖ To study the laws of motion and their implications
- ❖ To understand the basics of relativistic motion and special theory of relativity
- ❖ To understand the basics of rotational dynamics
- ❖ To understand the basics of fluid mechanics

Learning outcomes:

- ❖ Acquiring the basic skills of mathematical tools for study of physical systems
- ❖ Understanding of mechanics as a systematic tool for problem solving
- ❖ Understanding the laws of planetary motion and the satellites
- ❖ Understanding concepts of Elasticity and fluid dynamics
- ❖ Understanding the general working of universe through the concepts of gravitation and relativity

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. Momentum and energy: Conservation of linear momentum in system of particles. Work and energy, Conservation of energy.

Unit - II

Rotational motion: centre of mass, Angular velocity and angular momentum, Torque, Conservation of angular momentum in system of particles. Special theory of relativity: Galilean and Lorentz transformations. Michelson-Morley Experiment, significance of its negative result, Postulates of special theory of relativity. Length contraction. Time dilation. Relativistic addition of velocities. Mass-energy equivalence relation.

Unit - III

Gravitation: Newton's law of Gravitation. Kepler's Laws. Motion of a particle in a central force field. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness.

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and potential energy and their time averages. Total energy of SHM.

Unit - IV

Elasticity and plasticity: Hooke's law, Stress-strain diagram. Elastic moduli -Relation between elastic constants. Poisson's ratio-expression for Poisson's ratio in terms of elastic constants. Work done in stretching a wire.

Viscosity. Streamline and turbulent motion, Reynold's number, equation of continuity, Stoke's law, Effect of temperature on viscosity.

Books Recommended:

1. D. Kleppner, R.J. Kolenkow, An introduction to mechanics, 1973, McGraw-Hill
2. E.M. Purcell. Ed. "Berkeley Physics Course; Vol. 1; Mechanics"; McGraw Hill.
3. R.P.Feynman; R.B.Leighton and M.Sands; "The Feynman Lectures in Physics" Vol. 1 (B.I.Publications; Bombay; Delhi; Calcutta; Madras).
4. D.P. Khendewal: "Oscillations and Waves" (Himalaya Publishing House; Bombay).
5. Physics, Resnick, Halliday & Walker 9/e, 2010, Wiley
6. Properties of matter, D.S. Mathur
7. Waves and Oscillations, H.J.Pain

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 surface tension of fluid by capillary rise method
4. To determine the Moment of Inertia of a Flywheel.
5. To determine the Young's Modulus of a Wire by Optical Lever Method/bending of beam.
6. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
7. To determine the Elastic Constants of a Wire by Searle's method.
8. To determine g by Bar Pendulum.
9. To determine g by Kater's Pendulum.
10. Determination of Young's Modulus by using bending beam method.
11. To determine g and velocity for a freely falling body using Digital Timing Technique.
12. 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,
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn,
3. Engineering Practical Physics, S. Panigrahi & B. Mallick
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna
5. Practical Physics by C.L. Arora.

