Semester I

PHYSICS-DSC 1 A: MECHANICS (Credits: Theory-04, Practicals-02)

Theory: 60 Lectures

Vectors: Vector algebra. Scalar and vector products.Derivatives of a vector with respect to a parameter.

(4 Lectures)

Ordinary Differential Equations:1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.

(6 Lectures)

Laws of Motion: Frames of reference. Newton's Laws of motion.Dynamics of a system of particles.Centre of Mass.

(10 Lectures)

Momentum and Energy: Conservation of momentum. Work and energy.Conservation of energy.Motion of rockets.

(6 Lectures)

Rotational Motion: Angular velocity and angular momentum. Torque.Conservation of angular momentum.

(5 Lectures)

Gravitation: Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only).Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness.Basic idea of global positioning system (GPS).

(8 Lectures)

Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions.Kinetic and Potential Energy, Total Energy and their time averages.Damped oscillations.

(6 Lectures)

Elasticity: 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 and work done in twisting a wire - Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion - Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σby Searles method

(8 Lectures)

Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity.Length contraction.Time dilation.Relativistic addition of velocities.

(7 Lectures)

Note: Students are not familiar with vector calculus. Hence all examples involve differentiation either in one dimension or with respect to the radial coordinate.

Reference Books:

- Mechanics- J.C.Upadhyaya, Ram Prasad & Sons
- Mechanics- D.C.MathurS.Chand& Co.
- Mechanics of particles, Rigid Bodies and Continous Media (In Hindi) by Kalra, Bhandari and Kakani
- Mechanics Berkeley Physics course,v.1: Charles Kittel, et. Al. 2007, Tata McGrawHill.
- Physics – Resnick, Halliday& Walker 9/e, 2010, Wiley
- Engineering Mechanics, Basudeb Bhattacharya, 2nd edn., 2015, Oxford University Press
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

PHYSICS LAB: DSC 1A LAB: MECHANICS   60 Lectures

1. Measurements of length (or diameter) using verniercaliper, 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.

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:

- A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11th Edition, 2011, KitabMahal, New Delhi
- Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop, 1971, Asia Publishing House.

- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- Engineering Practical Physics, S.Panigrahi& B.Mallick,2015, Cengage Learning India Pvt. Ltd.