

VIJAYANAGAR SRI KRISHNADEVARAYA UNIVERSITY, BELLARY

Syllabus for B.Sc Semester I

Optional Physics

PHY101 : Paper 1: Mechanics & Properties of Matter

Total hours of teaching: 50

1. Frames of Reference

8 hrs

Inertial frames. Galilean transformation equation for position, length, velocity, momentum, acceleration. Non inertial frames, fictitious force, Rotating frame of reference, concept of Corioli's force (derivation) and effects of Corioli's force. Centre of mass and it's characteristics. Motion of centre of mass and centre of mass as frame of reference.

2. Conservation laws

14 hrs

Linear momentum

Law of conservation of linear momentum. Elastic collision; head-on collision. Newton's law of impact. Inelastic collision-expression for the loss of kinetic energy in one dimension.

Conservation of momentum in case of variable mass. Examples: single stage rocket,-expression for velocity and multi stage rocket.

Angular momentum

Angular momentum-relation to angular velocity and torque. Conservation of angular momentum. Illustrative examples such as. Ballet dancer, skating motion of a planet around the sun (proof of Kepler's second law of planetary)

Energy

Conservation of energy as a basic principle. Illustrations with verification of law of conservation of energy for a particle executing Simple Harmonic Motion and spiral spring.

3. Rigid bodies

10 hrs

Rotational motion about an axis, concept of moment of inertia (MI), radius of gyration, $L = I\omega$, $\tau = I \times Mg$, Perpendicular and parallel axes theorems with proof. Calculation of moment of inertia of thin uniform rod, uniform bar of rectangular area of cross section, circular disc, annular ring, solid sphere and hollow cylinder-extension to the solid cylinder as a special case of hollow cylinder. Theory of compound pendulum and its properties. Bar pendulum and fly wheel (theory and experiment).

4. Elasticity

10 hrs

Review of elastic behavior of solids in general, origin of elastic forces, stress- strain diagram, elastic limit and hook's Law. Moduli of elasticity, Poisson's ratio, relation among elastic constants: $k = \frac{Y}{(1 - 2\sigma)}$, $n = \frac{Y}{2(1 + \sigma)}$ & $\frac{3}{Y} = \frac{1}{n} + \frac{1}{3k}$ Torsion; Expression for couple per unit twist. Torsion pendulum theory and experiment. Work done in stretching and twisting a wire. Bending: Bending moment, mention of expression for bending moment, theory of light cantilever, uniform bending –beam loaded at the centre and I-section girder.

5. Gravitation

3 hrs

Newton's law of gravitation, Kepler's laws of planetary motion explanation without derivations, elements of satellite motion and geostationary satellite.

6. Viscosity

5 hrs

Streamline, turbulent motion, critical pressure and equation of continuity. Coefficient of viscosity. Poiseuille's equation (derivation). Motion of a body in a viscous medium, Stokes' law, terminal velocity and its significance. Effect of temperature on viscosity of liquids (qualitative).

PHYL1: Practical Course for Semester I

Instructions

1. Two experiments (3 hours duration each) per week should be performed.
2. One practical internal test of 3 hours duration for 15 marks be conducted at the end of practical course in the semester.
3. Minimum of 12 experiments from the list mentioned below should be performed in semester I. Of these, one experiment can be open ended type (Course teacher may develop a new innovative experiment and introduce into the course). Open ended experiment must also be considered for examination.

List of experiments

1. Bar pendulum- T versus L graph.
2. Bar pendulum- L^2 versus LT^2 graph.
3. M.I. of fly-wheel.
4. Moment of inertia of an irregular body.
5. Torsion pendulum –Rigidity modulus.
6. Verification of parallel axes theorem.
7. Verification of perpendicular axes theorem.
8. Y- by stretching – elongation versus load graph.
9. Verification of Hook's law and determination of unknown mass.
10. Y- by uniform bending – load depression method.
11. Y- by cantilever.
12. Y- by oscillation method.
13. Y- by Koenig's method and determination of unknown load.
14. Elastic constants by Searle's double bar.
15. Rigidity modulus by static torsion method.
16. Surface tension and interfacial tension by drop-weight method.
17. Surface tension and angle of contact by Quincke's drop method.
18. Coefficient of viscosity by Stokes' method.
19. Viscosity by Poiseuille's method.
20. Determination of g and unknown mass by spiral spring.
21. Critical pressure for stream line flow.
22. Radius of capillary tube by mercury pellet method.

Reference books

1. Mechanics by D.S. Mathur
2. Mechanics by J.C. Upadhaya
3. Properties of matter by D.S. Mathur
4. Properties of matter by Brijlal & Subramanyam
5. Physics for Degree Students (B.Sc. I year) by C.L. Arora and P.S Hemne
6. Physics Vol. I by Resnick by Halliday and Krane
7. Berkeley Physics Vol I