

**St. Xavier's College Jaipur
Department of Science
PHYSICS**

Mechanics & Oscillations

UG0803-PHY-51T-101

Paper: I

Class: BSc. SEM-1

Question Bank

Short answer type questions

1. What is frame of reference?
2. Define inertial and non-inertial frame of reference.
3. State the law of conservation of linear and angular momentum.
4. Define fictitious and pseudo forces.
5. Define Coriolis force.
6. Explain the state of stable and unstable equilibrium.
7. Prove that linear restoring force is a conservative force.
8. Define centre of mass.
9. Differentiate clearly between laboratory and centre of mass frame of reference.
10. State the principle of rocket.
11. What is rigid body? Define the axis of rotation.
12. Define the inertial coefficient of a rigid body.
13. What is a precessional motion?
14. For a conservative force, prove that $\nabla \times \mathbf{F} = 0$

Long answer type questions

1. Prove that a reference frame moving with constant velocity with respect to an inertial frame is also an inertial frame.
2. Prove that the displacement vector between two points is invariant under Galilean transformation.
3. Prove that length is invariant in Galilean transformation but velocity is not.
4. Derive an expression for Coriolis force acting on a moving particle of mass m in rotating frame of reference.
5. Find the displacement due to effect of Coriolis force on a body falling vertically downward on the earth.
6. A body falls from a height of 200 m at a place where altitude is 45° N. Find the eastward deviation of the body with respect to the place directly below due to rotation of earth.
7. Discuss the potential energy curve for the motion of a particle.
8. Prove that the total kinetic energy of the centre of mass of the many particle system is equal to a sum of the kinetic energy of the centre of mass of the system and the total kinetic energy of all the particles about the centre of mass of the system.
9. Prove that in two particle system the ratio of the distances of the particle from the centre of mass is equal to the inverse ratio of their masses.
10. Describe the principle of rocket. Obtain the expression for the final speed of rocket.
11. Prove that angular momentum of a system of particle about a certain point is the vector sum of the angular momentum of the centre of mass about that point and the angular momentum of the system of particles about the centre of mass.
12. Obtain an expression for the rotation motion of a rigid body.
13. Derive the expression for inertial coefficients. Explain the terms moment of inertia and product of inertia.
14. Describe the rotational kinetic energy in terms of components of inertial coefficients and angular velocity.
15. Describe the precession of a spinning top and calculate its precessional frequency.