Model Questions

Department of Physics Government General Degree College, Chapra Course Title- Mechanics Semester – II

• <u>2 marks questions</u>

1. Show that Newton's 2nd law is invariant under Galilean transformation.

2. Determine whether the force field, $\vec{F} = (y^2 z^3 - 6xz^2)\hat{i} + (2xyz^3)\hat{j} + (3xy^2 z^2 - 6x^2 z)\hat{k}$ is "conservative" or not.

3. Find the moment of inertia of a solid circular cylinder of radius *a*, height *h* and mass *M*, about an axis passing through the center of the cylinder and parallel to its height.

4. State Kepler's law of planetary motion.

5. A rod of circular cross-section of length / and radius r is stretched such that the volume of the rod is not changed. Show that Poisson's ratio is $\frac{1}{2}$.

6. The potential energy of a particle is $V = 3x^4 - 8x^3 - 6x^2 + 24x$. Find the points of stable and unstable equilibrium.

7. Show that the equation of motion of a free particle does not change its form under Galilean transformation.

8. Lorentz transformation equations reduce to Galilean transformation equations when v<<c. Explain.

9. The relative kinetic energy of a particle is equal to its rest energy. Find the Lorentz factor.

10. Write down the postulates of special theory of relativity.

11. What I geosynchronous orbit?

12. If the kinetic energy and the potential energy of a particle in a SHM are equal, find the displacement of the particle from its equilibrium position.

13. Show that mutually interacting forces on a system of particles have no effect on its total linear momentum.

14. Prove that areal velocity of a particle moving under a central force field is constant.

15.What is the rotational period of a binary star consisting of two equal masses, M and separated by distance L?

• <u>5 marks questions</u>

- 1. State and prove Einstein's velocity addition theorem.
- What is damped oscillation? Write down the differential equation of damped oscillation. Distinguish among critical damping, under damping and over damping.
- 3. Two particles of mass m₁ and m₂ are travelling in the same straight line. If they undergo a perfectly elastic collision, show that the total kinetic energy of the particles before collision equals that kinetic energy after collision.
- 4. Write down the Lorentz transformation equations. Using them, obtain the rules for length contraction and time dilation.
- 5. If y, k, and σ represent Youngs's modulus, Bulk modulus and Poisson's ratio respectively, prove that Y = 3k(1-2 σ). State the liming values of σ .
- 6. What do you mean by inertial and non-inertial frame? Show that if a frame is an inertial frame, then a frame, moving with constant velocity relative to it, is also inertial.
- 7. Using Newtonian mechanics, deduce the linear and angular momentum conservation laws for a particle in motion.
- 8. What is modulus of rigidity? What is an elastic collision? Why is gravitational potential negative?
- 9. Find the gravitational potential at an external point due to a thin uniform spherical shell.
- 10. (i) What do you mean by conservative force? Explain with example. (ii) Deduce an expression for the amount of energy stored in an elastic body due to longitudinal strain?
- 11. (i) What is a geo-stationary satellite? What is utility? (ii) What is weightlessness?