

Term End External Examination 1st Semester (Session-Feb 2025)

Subject: Physics

Course No and Title: PHY122M/ Mechanics

Time: 2.15 hours

Max Marks:100

Min. Marks:40

Section A: Objective Type Questions

- Q1. Choose the appropriate Answer: (8x1.5=12)**
- The Coriolis force experienced by a moving particle in rotating frame is**
 A Conservative force B Non conservative
 C Central force D None of the above
 - Earth is bulged outside at the equator because of the action of**
 A Gravity B Coriolis Force
 C Centrifugal Force D Air Friction
 - The angular momentum of a system of particle is conserved.**
 A When no external force acts upon the system B When no external torque acts upon the system
 C When no external impulse acts upon the system D Both A & B.
 - Two Photons approach each other. What will be their relative velocity (c is the velocity of light)**
 A c B 2c
 C Zero D 0.5c
 - Central Forces are**
 A Conservative B Non Conservative
 C Nuclear forces D None of the Above
 - SHM can be regarded as a projection of**
 A Linear Motion B Uniform Linear Motion
 C Uniform Circular Motion D None of the above
 - The unit of Strain is**
 A Nm⁻³ B Nm⁻²
 C Nm D It has no Unit
 - In a streamline flow of liquid, the total energy of liquid is constant at**
 A Inner Points B Outer points
 C At the centre D All points

Section-B: Descriptive Type Questions (Short Type)

Q2: Answer all the Questions (8 x 4 =32)

- Derive relation between Cartesian and spherical polar coordinates
- What are the limitations of Newton's laws of motion?
- State and prove law of conservation of angular momentum in a system of particles.
- On the basis of Lorentz Transformation, discuss length contraction.
- What are central and Non-Central forces? Give one examples of each.
- What are geosynchronous satellites? A satellite does not need fuel to circle around the earth. Why?
- Show that work done per unit volume in a stretching wire is

$$\frac{1}{2}(\text{stress} \times \text{strain})$$
- What causes viscosity in liquids and in gases? How it differs.

Section – C: Descriptive Type Questions (Medium Type)

Answer all the questions: (4 x 7=28)

- Q3.** State conservation of linear momentum? Prove that in absence of external force, linear momentum remains constant.
OR
 What causes the Coriolis Effect? Discuss its three geographical consequences.
- Q4.** Distinguish between inertial and non-inertial frames of reference. Prove that earth is Non-inertial frame of reference.
OR
 Derive Einstein's mass energy relation? Show that

$$E = \sqrt{p^2 c^2 + m_0^2 c^4}$$
- Q5.** Using Kepler's 2nd law show that the time period of a planet about the sun is proportional to the cube of the semi-major axis of the elliptical orbit.

OR

Give graphical description of displacement, velocity and acceleration of a particle executing simple Harmonic motion.

- Q6. Using Stress-Strain Diagram, Discuss Elastic Limit, Yield Point and Breaking Point.

OR

What do you understand from equation of continuity? Derive it for incompressible fluid.

Section – D: Descriptive Type Questions (Long Type)

Answer any two of the following: (2 x 14=28)

- Q7. What are spherical polar coordinates? Show that for a particle moving in space, its velocity can be expressed as $\vec{v} = \dot{r}\hat{r} + r\dot{\theta}\hat{\theta} + r\sin\theta(\dot{\phi}\hat{\phi})$.
- Q8. What are the postulates of special theory of light? Obtain Lorentz Transformation equation for two inertial frames of references.
- Q9. Derive an expression for total energy of a body executing SHM.
- Q10. What are Elastic constants? Derive the relation;

$$\sigma = \frac{3K-2\eta}{6K+2\eta}, \text{ also discuss limiting values of } \sigma.$$

Where σ, K & η are Poisson's ratio, Bulk Modulus of elasticity and Modulus of rigidity.