Total number of printed pages–7

63/1 (SEM–1) CC2/PHYHC 1026

2024

PHYSICS

Paper : PHYHC 1026

(Mechanics)

Full Marks : 60

Pass Marks : 24

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct answer : ***(any five)*** 1×5=5

   (i) The point where whole weight may be assumed to act is called

   (a) Centre of mass

   (b) Centre of weight

   (c) Centre of gravity

   (d) Centre of acceleration

Contd.

(ii) Projectile will attain its maximum range, if fired at an angle

(a) 30°

(b) 47°

(c) 90°

(d) 45°

(iii) Rate of change of momentum of a body in equal to

(a) displacement

(b) applied force

(c) speed

(d) velocity

(iv) Moment of inertia of an object does not depend on

(a) Mass of object

(b) Mass distribution

(c) Angular velocity

(d) Axis of rotation

(v) Product of force and time is known as

(a) impulse

(b) distance

(c) momentum

(d) velocity

(vi) Elastic collision is a collision in which kinetic energy is

(a) conserved

(b) not conserved

(c) increases

(d) decreases

(vii) By applying force, the shape of a body is changed, then the corresponding stress is known as

(a) Tensile stress

(b) Bulk stress

(c) Shearing stress

(d) Compressive stress

(viii) Energy of a system executing SHM is

(a) increasing

(b) decreasing

(c) constant

(d) variable

(ix) According to special theory of relativity which one is not an absolute quantity

(a) time

(b) mass

(c) height

(d) Both time and mass

(x) According to equation of continuity when water falls its speed increases, while its cross-sectional area

(a) increases

(b) decreases

(c) remain same

(d) different

2. Answer the following questions : ***(any five)*** 2×5=10

(i) What are the differences between elastic and inelastic collision ?

(ii) What is mass-energy equivalence relation ?

(iii) When we feel weightlessness ?

(iv) Define Hooke's law of elasticity.

(v) Explain the term G.P.S.

(vi) What is inertial mass and gravitational mass ?

(vii) Distinguish between inertial and noninertial frames of reference.

3. Answer the following questions : ***(any five)*** 5×5=25

(i) Show that the kinetic energy of a rotating body

$$E_k = \frac{1}{2} I\omega^2$$

where I moment of inertia of the body about the axis of rotation and ω is the angular velocity.

(ii) State three Kepler's law of planetary motion with diagram.

(iii) Derive differential equation of SHM.

(iv) What is free vibration, forced vibration and resonance ?

(v) Explain the basic postulates of the special theory of relativity.

(vi) What is an artificial satellite ? Calculate the minimum velocity and periods of revolution of an artificial satellite at height h from the surface of the earth.

(vii) A particle of mass m_1 moving with a velocity v_1 collides head on with a particle of mass m_2 at rest such that after the collision they travel with velocity v_1 and v_2 respectively. If the collision is perfectly elastic one, show that

$$v_2 = \frac{2m_1v_1}{m_1 + m_2}$$

(viii) What are Galilean transformations? Prove that Newton's laws of motion are invariant under Galilean transformation.

(ix) Write short notes on : *(any two)*

(a) Radius of Gyration

(b) Geostationary Satellite

(c) Conservative and non-Conservative force

4. Answer the following questions : ***(any two)*** 10×2=20

(i) What is simple harmonic motion ? Show that total energy of the body oscillating with SHM remain constant. Give graphical representation. 2+6+2=10

(ii) Calculate the moment of inertia of a solid cylinder, about an axis passing through its centre and perpendicular to its length. Given *R*-Radius, *L*-Length, *M*-Mass of the solid cylinder.

(iii) What are the co-efficient of elasticity, Young's modulus (Y), Bulk modulus (K) and Poisson's ratio (σ). Establish the relation

$$K = \frac{Y}{3(1-2\sigma)}$$ 1+1+1+1+6=10

(iv) On the basis of Lorentz transformation describe an expression for time dilation, why moving clock appears to run slow. Define twin paradox. 6+2+2=10