

UNIVERSITY DEPARTMENT OF PHYSICS
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B.SC. PHYSICS

SEMESTER - I

PAPER – GENERIC ELECTIVE

MODEL QUESTION PAPER

GROUP- A

Multiple Choice Questions

1. Newton's first law of motion describes the following
 - (a) Energy
 - (b) Work
 - (c) Inertia
 - (d) Moment of inertia
2. Which of the following is a scalar quantity
 - (a) Displacement
 - (b) Electric Field
 - (c) Acceleration
 - (d) Work
3. The force of gravitation is
 - (a) Repulsive
 - (b) Electrostatic
 - (c) Conservative
 - (d) Non-conservative
4. As we go from the equator to the poles, the value of g
 - (a) Remains the same
 - (b) Decreases
 - (c) Increases
 - (d) Decreases upto a latitude of 45°
5. The escape velocity of a sphere of mass m from earth having mass M and radius R is given by

(a) $\sqrt{\frac{2GM}{R}}$

(b) $2\sqrt{\frac{GM}{R}}$

(c) $\sqrt{\frac{2GMm}{R}}$

(d) $\sqrt{\frac{GM}{R}}$

6. Which of the following equation does not represent a simple harmonic motion

(a) $y = a \sin \omega t$ (b) $y = a \cos \omega t$

(c) $y = a \sin \omega t + b \cos \omega t$ (d) $y = a \tan \omega t$

7. The velocity of a particle in simple harmonic motion at displacement y from mean position is

(a) $\omega\sqrt{a^2 + y^2}$ (b) $\omega\sqrt{a^2 - y^2}$

(c) ωy (d) $\omega^2\sqrt{a^2 - y^2}$

8. The total energy of a particle executing S.H.M. is proportional to

(a) Displacement from equilibrium position

(b) Frequency of oscillation

(c) Velocity in equilibrium position

(d) Square of amplitude of motion

9. If the temperature increases, the modulus of elasticity

(a) Decreases (b) Increases

(c) Remains constant (d) becomes zero

10. The relationship between Young's modulus (Y), Bulk modulus (K) and modulus of rigidity (η) is

(a) $Y = \frac{9\eta K}{\eta + 3K}$ (b) $\frac{9YK}{Y + 3K}$

(c) $Y = \frac{9\eta K}{3 + K}$ (d) $Y = \frac{3\eta K}{9\eta + K}$

11. The force constant of a wire does not depend on

(a) Nature of the material (b) Radius of the wire

(c) Length of the wire (d) none of the above

12. If the density of the material increases, the value of Young's modulus

(a) Increases

(b) Decreases

(c) First increases then decreases

(d) First decreases then increases

13. Which of the following statements is correct

(a) Hooke's law is applicable only within elastic limit

(b) The adiabatic and isothermal elastic constants of a gas are equal

(c) Young's modulus is dimensionless

(d) Stress multiplied by strain is equal to the stored energy

14. The units of Young 's modulus of elasticity are
(a) Nm^{-1} (b) Nm
(c) Nm^{-2} (d) Nm^2
15. Reason of weightlessness in a satellite is
(a) Zero gravity (b) Centre of mass
(c) Zero reaction force by satellite surface (d) None
16. The force of gravitation is
(a) Repulsive (b) Electrostatic
(c) Conservative (d) Non-conservative
17. The gravitational force between two objects does not depend on
(a) Sum of the masses
(b) Product of the masses
(c) Gravitational constant
(d) Distance between the masses
18. When a body is taken from the equator to the poles, its weight
(a) Remains constant (b) Increases
(c) Decreases (d) Increases at *N*-pole and decreases at *S*-pole
19. A person sitting in an open car moving at constant velocity throws a ball vertically up into air. The ball falls
(a) Outside the car
(b) In the car ahead of the person
(c) In the car to the side of the person
(d) Exactly in the hand which threw it up
20. Swimming is possible on account of
(a) First law of motion
(b) Second law of motion
(c) Third law of motion
(d) Newton's law of gravitation
21. Newton's third law of motion leads to the law of conservation of
(a) Angular momentum (b) Energy
(c) Mass (d) Momentum

22. A force $\vec{F} = 5\hat{i} + 6\hat{j} - 4\hat{k}$ acting on a body, produces a displacement $\vec{s} = 6\vec{i} + 5\vec{k}$. Work done by the force is
- (a) 18 units (b) 15 units
(c) 12 units (d) 10 units
23. If force and displacement of particle in direction of force are doubled. Work would be
- (a) Double (b) 4 times (c) Half (d) $\frac{1}{4}$ times
24. A man pushes a wall and fails to displace it. He does
- (a) Negative work
(b) Positive but not maximum work
(c) No work at all
(d) Maximum work
25. Hook's law defines
- (a) Stress (b) Strain
(c) Modulus of elasticity (d) Elastic limit
26. Torque is the rotational analogue of:
- (a) Kinetic energy (b) linear momentum (c) acceleration (d) force (e) mass
27. Moment of inertia depends on
- (a) Distribution of particles (b) Mass
(c) Position of axis of rotation (d) all of these
28. If a body is rotating about an axis, passing through its centre of mass then its angular momentum is directed along its
- (a) Radius (b) Tangent
(c) Circumference (d) Axis of rotation
29. The centre of mass of two particles lies on the line
- (a) joining the particles
(b) perpendicular to the joining
(c) at any angle to this line
(d) None of these
30. A couple produces
- (a) rotational motion (b) linear motion
(c) both (d) none of these

GROUP- B

Short Answer Type Questions

1. State and Explain Newton's laws of motion.
2. State the limitations of Newton's laws of motion.
3. Distinguish between inertial and non-inertial frame of reference.
4. State and explain Kepler's laws of planetary motion.
5. What are free, damped, and forced harmonic vibrations? Give examples.
6. What do you mean by damped harmonic oscillator? Establish the differential equation of motion for a damped harmonic oscillator.
7. Give the graphical representations of physical quantities (displacement, velocity and acceleration) executing Simple Harmonic Motion.
8. Explain simple harmonic motion and discuss its characteristics.
9. What is the physical significance of Moment of inertia? Write down the parallel and perpendicular axes theorem on moment of inertia.
10. State and prove the theorem of perpendicular axis for moment of inertia.

GROUP- C

Long Answer Type Questions

1. What are central and non-central forces? Give two examples of central and non-central forces. When a particle moves under the influence of central force, prove that the angular momentum of a particle is conserved.
2. A particle is moving along a curve in a plane. Derive expression for its radial and transverse components of velocity and acceleration.
3. Write the characteristics of central force. Show that the differential equation of motion of a particle of mass m under the influence of a central force can be written as

$$\frac{d^2u}{d\theta^2} + u = -\frac{m}{h^2u^2} f\left(\frac{1}{u}\right)$$

where, $u = \frac{1}{r}$, and (r, θ) are the plane polar coordinates of the particle and h , the angular momentum.

4. Define elastic constants. Establish relation between Young's modulus (Y), the bulk modulus (K), rigidity modulus (η).
5. Explain the terms stress and strain. Define Young's modulus (Y), the bulk modulus (K), rigidity modulus (η) and Poisson's ratio (σ). Write dimensions of σ .
6. What are torsional oscillations? Derive an expression for the twisting couple per unit angular twist for a hollow cylinder.
