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I Semester B.Sc. Degree Examination, August - 2021

PHYSICS

Mechanics and Properties of Matter
(CBCS Semester Scheme Freshers)

Paper - I



Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates :

- 1) All multiple choice questions in PART - A are to be compulsorily answered in Page-1.
- 2) Non - programmable scientific calculators are allowed.

PART - A

Answer **ALL** questions. Each question carries **ONE** mark.

(10×1=10)

1. A force of 36N acts at an angle of 60° with the horizontal on a block of mass 18kg, the acceleration produced in the block along the horizontal direction is _____.
a) 5 ms^{-2} b) 3 ms^{-2} c) 1 ms^{-2} d) 2 ms^{-2}
2. A vehicle is moving on a rough road with uniform speed along a straight line, then
a) No force is acting on the vehicle
b) A force must act on the vehicle
c) An acceleration is being produced in the vehicle
d) No work is being done on the vehicle
3. The maximum value of static friction is called
a) Limiting friction b) Rolling friction
c) Normal reaction d) Coefficient of static friction
4. Work done in holding a mass of 50kg at a height of 2m above the ground is
a) 25J b) 100J c) Zero d) 980J
5. If the momentum of a body is doubled, its kinetic energy is
a) Doubled b) Halved
c) Quadrupled d) Unchanged
6. A ball is being projected upwards. As it rises, there is increase in its
a) Momentum b) Kinetic energy
c) Potential energy d) a and c

[P.T.O.]



7. The moment of inertia of a body does not depend on
a) angular velocity of the body b) mass of the body
c) distribution of mass of the body d) axis of rotation of the body
8. A particle is executing SHM of amplitude 4cm, time period 12s. Time taken by the particle for 2cm displacement from its mean position is
a) 1s b) 4s c) 3s d) 6s
9. Surface tension is due to
a) Adhesive force b) Gravitational force
c) Cohesive force d) Elastic force
10. The viscosity of a liquid
a) increases with temperature b) decreases with temperature
c) does not depend on temperature d) depends on the liquid

PART - B

Answer any **FIVE** questions. Each question carries **TWO** marks.

(5×2=10)

11. What is inertia of a body? What does it depend on?
12. What is Foucault's pendulum? Mention its important application.
13. Write a note on work done by a constant force.
14. Distinguish between inertial and gravitational mass of an object.
15. Mention the expression for the moment of inertia of a rectangular plate about an axis perpendicular to its plane and passing through its centre and explain the symbols.
16. Derive an expression for the instantaneous velocity of a particle executing SHM.
17. What is deforming force? Which property of the body resists deformation?
18. Define co-efficient of viscosity and mention its SI unit.

PART - C

Answer any **FIVE** questions. Each question carries **6** marks.

(5×6=30)

19. a) Distinguish between inertial and non inertial frames of reference.
b) Arrive at Galilean transformation equations. (2+4)
20. What is an ideal Atwood machine? With a relevant diagram, arrive at the expression for the acceleration of a system of two masses connected by a long inextensible string of negligible mass run over a frictionless pulley. (6)
21. Arrive at the expressions for the velocity of two bodies of different masses undergoing one dimensional elastic collision. Also show that the velocities are just interchanged in case of equal masses. (6)



22. a) State and explain Newton's law of gravitation.
b) State Kepler's laws of planetary motion. (3+3)
23. a) Define angular velocity and angular acceleration.
b) State and prove perpendicular axis theorem. (2+4)
24. What is a compound pendulum? Arrive at the expression for its time period. (6)
25. Define surface tension of a liquid and the angle of contact. Mention the factors that affect surface tension of a liquid. (6)
26. Derive an expression for the couple per unit twist of the material of a wire fixed at one end and twisted at the other. (6)

PART - D

Answer **FOUR** questions. Each question carries **FIVE** marks. (4×5=20)

27. A block is placed at the top of an inclined plane 5m long. The plane makes an angle of 60° with the horizontal. If the coefficient of friction between the block and the plane is 0.3, using free body diagram, find the acceleration of the block.
28. A stone of mass 4.5kg tied to one end of a string of length 2m is set into circular motion holding it at the other end along a horizontal plane by whirling. If the stone completes 40 rotations in one minute, find the centrifugal force that balances the tension in the string.
29. A cricket ball of mass 500g travelling at a speed of 20ms^{-1} is caught by a fielder and in doing so, he withdraws his hands back through 40cm. Calculate the work done by him and the average force exerted by the ball on his hands.
30. A satellite of 1000kg is supposed to orbit the earth at a height of 2000km above the earth's surface. Find its orbital speed and kinetic energy. Given: $G = 6.67 \times 10^{-11} \text{Nm}^2\text{kg}^{-2}$, Mass and radius of the earth are $6 \times 10^{24} \text{kg}$ and 6400km respectively.
31. A circular disc of mass 4kg and diameter 0.2m initially at rest attains an angular velocity of 400rpm in 5s. Find the torque on the disc.
32. A body of mass 1kg is executing SHM according to the equation $y = 6 \cos\left(100t - \frac{\pi}{4}\right) \text{cm}$. Determine its amplitude, frequency and maximum kinetic energy.
33. A mass of 5kg is hung using a steel wire of diameter 2mm and length 2m. Find the extension produced in the wire. Given Young's modulus of steel $= 20 \times 10^{10} \text{Nm}^{-2}$.
34. An iron ball of radius 3mm falling through a column of oil of density 940kgm^{-3} attains terminal velocity $5 \times 10^{-3} \text{ms}^{-1}$. Find the viscosity of the oil. Given density of iron is 7800kgm^{-3} .