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DCPH101

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I Semester B.Sc. Degree Examination, February/March - 2024

PHYSICS**Mechanics and Properties of Matter****(NEP Scheme Freshers + Repeaters - 2021-22 Onwards)****Paper : PHY. DSCT.1 (DSC)****Time : 2½ Hours****Maximum Marks : 60****Instructions to Candidates:**

- 1) Follow Instructions under each Part.
- 2) Use of Non programmable scientific calculator is allowed.

PART - A**Answer ALL the questions. Each question carries 1 mark.****(5×1=5)**

1. Dimensional formula for force is :

- | | |
|---------------|-----------------|
| a) MLT^{-1} | b) ML^2T^{-2} |
| c) ML^2T^3 | d) MLT^2 |

2. If the momentum of a body is doubled, its kinetic energy.

- | | |
|-------------------------|------------------------|
| a) Remains constant | b) Decreases to half |
| c) Increases four times | d) Increases two times |

3. Moment of inertia of a rectangular lamina of mass **M** and length **L** about an axis passing through its centre and perpendicular to its plane.

- | | |
|---|---|
| a) $M\left(\frac{L^2 + B^2}{12}\right)$ | b) $M\left(\frac{L^2 + B^2}{12}\right)$ |
| c) $M\left(\frac{L + B^2}{12}\right)$ | d) $M\left(\frac{L + B}{12}\right)$ |

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4. Time period of torsional oscillations is:

a) $2\pi\sqrt{\frac{I}{c}}$

b) $4\pi\sqrt{\frac{I}{c}}$

c) $2\pi\sqrt{\frac{c}{I}}$

d) $2\pi^2\sqrt{\frac{I}{c}}$

5. SI unit of co-efficient of viscosity is :

a) Nsm

b) Nsm⁻²

c) Ns

d) N²sm

PART- B

Answer any **THREE** of the following questions. Each question carries 10 marks.

(3×10=30)

6. a) What is mean deviation ? Explain. (3+7)
- b) What is proper length ? Derive an expression for length contraction based on special theory of relativity.
7. a) What is centre of mass of the system of particles? Derive the expressions for the velocity and acceleration of centre of mass in a system of particles.
- b) State and prove perpendicular axes theorem. (6+4)
8. a) State Hooke's law. Hence define the three moduli of elasticity.
- b) Derive an expression for couple per unit twist of a cylindrical rod. (4+6)
9. a) Derive an expression for the work done per unit volume in stretching a wire.
- b) What is Searle's double bar? Derive an expression for Young's modulus using Searle's double bar. (4+6)
10. a) What is viscosity? Distinguish between streamline flow and turbulent flow.
- b) Derive Poiseuille's formula for the rate of flow of a liquid through capillary tube. (3+7)



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PART - C

Answer any **THREE** of the following questions. Each question carries 5 marks.

(3×5=15)

11. A constant force $\vec{F} = (6\hat{i} + 4\hat{j})$ N act on a particle and it undergoes a displacement of $\vec{s} = (5\hat{i} + 4\hat{j})$ m. calculate the work done by the force.
12. A flywheel of mass 4 kg and diameter 0.18 m is rotating at 500 rpm. Calculate the kinetic energy.
13. The force of attraction between two spheres of masses 40 kg and 80 kg is equal to weight of a body of mass 8.7×10^{-8} kg. If the distance between the centres of the spheres is 0.5 m. Calculate the value of G. Given: $g = 9.8 \text{ ms}^{-2}$.
14. The modulus of rigidity and Poisson's ratio of the material of the wire are $2.87 \times 10^{10} \text{ Nm}^{-2}$ and 0.379 respectively. Find the value of Young's modulus of the wire.
15. Calculate the work done in blowing a spherical soap bubble of diameter 0.02 m if the surface tension of soap solution is $2 \times 10^{-2} \text{ Nm}^{-1}$.

PART - D

Answer any **FIVE** of the following questions. Each question carries 2 marks.

(5×2=10)

16. a) A light body and heavy body have the same momentum which one has a larger kinetic energy? Explain.
 - b) Is earth an inertial frame? Explain.
 - c) What is moment of inertia of a rigid body? Mention its SI unit.
 - d) Define escape velocity and orbital velocity.
 - e) Which is more elastic, iron or rubber? Explain.
 - f) What is Poisson's ratio? Mention the theoretical limits.
 - g) Mention any two factors affecting surface tension.
 - h) Define critical velocity and terminal velocity.
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