Reg. No. ☐☐☐☐☐☐☐☐

I Semester B.Sc. Degree Examination, May/June - 2022
PHYSICS
Mechanics and Properties of Matter
Paper : PHY. DSCT 1
(NEP - Freshers Scheme - 2021-22 and onwards)

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 kinetic energy is

   a. MLT^{-1} b. MLT^{-2}

   c. ML^2T^{-2} d. M^0LT^{-1}

2. Moment of inertia of a cylinder of mass M and radius R about its own axis is

   a. $\dfrac{MR^2}{4}$ b. $\dfrac{MR^2}{2}$

   c. $\dfrac{MR^2}{12}$ d. $\dfrac{2MR^2}{5}$

3. Theoretical limiting values of Poisson's ratio σ are.

   a. -1 and ½   b. 0 and ½

   c. 0 and - ½   d. -1 and +1

4. A liquid wets a solid surface when the angle of contact between them is

   a. $\geq 90''$ b. $< 90''$

   c. $> 90''$ d. $= 180°$

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5. Mercury has _____ viscosity and _____ density compared to water.

   a. High, high
   b. High, low
   c. Low, high
   d. Low, low

PART - B

Answer any **Three** questions. Each question carries 10 marks.   (3×10=30)

6. a. Derive an expression for the final velocity of a rocket without considering the effect of gravity.

    b. Derive an expression for time dilation in a moving frame based on the special theory of relativity.   (5+5)

7. a. Define momentum and give its SI unit.

    b. Obtain an expression for the moment of inertia of a rectangular lamina about an axis in its plane and parallel to its length.   (2+8)

8. a. Define stress, strain and modulus - of elasticity.

    b. Derive the expression for the work done per unit volume in stretching a wire. (3+7)

9. a. Define surface tension, surface energy and obtain the relation between them.

    b. Derive the equation of continuity for a liquid having streamline flow.   (5+5)

10. a. Derive the expression for the depression at the free end of a single cantilever, assuming the expression for the bending moment.

    b. Define streamline flow and turbulent flow.   (8+2)

PART - C

Answer any **Three** questions. Each question carries 5 marks.   (3×5=15)

11. A bullet of mass 0.1 kg is fired from a rifle of mass 10 kg. If the recoil speed of the rifle is 1 ms^{-1}, find the speed of the bullet.

12. A flywheel of mass 5 kg and diameter 0.2 m is rotating at 600 rpm. Calculate its kinetic energy.

13. One end of a steel wire of length 0.25 m and radius 2×10^{-3} m is fixed. Find the work done in twisting the free end of the wire through 45°. Given the rigidity modulus of steel is 8×10^{10} Nm^{-2}.

14. A drop of water falling through air has a terminal velocity of $0.012m\ s^{-1}$. Find its radius.

    Given the coefficient of viscosity of air $= 18\times10^{-5}\ Nsm^{-2}$, density of water $= 1000\ kg\ m^{-3}$ and density of air $= 1.2\ kg\ m^{-3}$.

15. Two bodies of masses 10 kg and 2 kg are moving along X - axis in opposite directions with the same speed of $6\ ms^{-1}$. Find the direction and magnitude of the velocity of their centre of mass.

PART - D

Answer any Five questions. Each question carries **2** marks.   (5×2=10)

16. a. Give an example of a fundamental unit and a derived unit in SI system.

    b. Mention any two types of errors in measurement.

    c. Express kinetic energy in terms of momentum.

    d. Speed of light in glass is not same for all colours. Does this violate the postulate of relativity? Explain.

    e. Action and reaction are equal and opposite. Do they cancel out? Explain.

    f. State Hooke's law.

    g. How does the rate of flow of a liquid through a given capillary vary when its radius is doubled? Explain.

    h. Mention any two factors affecting surface tension of a liquid.

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