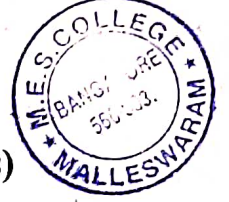Reg. No. ☐☐☐☐☐☐☐☐

I Semester B.Sc. Degree Examination, April - 2023
PHYSICS
Mechanics and Properties of Matter
(NEP Scheme Freshers + Repeaters 2021-22 and Onwards)
Paper : DSCT I

Time : 2½ Hours   Maximum Marks : 60

Instructions to Candidates:

1. Follow the instructions under **each** part.
2. Use of non programmable scientific calculators is allowed.

PART - A

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

1. The SI unit of surface tension is
   - a. Nm
   - b. Nm^{-1}
   - c. Nm^{-2}
   - d. Js

2. Dimensional formula for work is
   - a. MLT^{-1}
   - b. MLT^{-2}
   - c. ML^2T^{-2}
   - d. M^0LT^{-1}

3. According to Newton's 3ʳᵈ law action and reaction.
   - a. Act on different bodies.
   - b. Have equal magnitude.
   - c. Have opposite directions
   - d. All the above.

4. The theoretical limiting values of Poison's ratio are
   - a. $-1 < \sigma < 0.5$
   - b. $-0.5 < \sigma < 1$
   - c. $0.5 < \sigma < 1$
   - d. $-1 < \sigma < 1$

5. A liquid will not wet the surface if the angle of contact is
   - a. Acute
   - b. Obtuse.
   - c. Zero
   - d. 90°

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PART - B

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

6. a. State the postulates of special theory of relativity.

    b. Derive an expression for relativistic addition of velocities.   (2+8)

7. a. Define centre of mass of a system of particles and obtain an expression for its position vector.

    b. State and prove parallel axes theorem.   (4+6)

8. a. Define Young's modulus and bulk modulus of a material.

    b. Derive the relation between elastic constants, $q = \dfrac{9km}{3k+n}$.   (2+8)

9. a. Explain the molecular theory of surface tension.

    b. Obtain an expression for the pressure difference across a curved liquid surface.(3+7)

10. a. What is dimensional formula? Give an example.

     b. What is torsional pendulum? Derive an expression for time period of Torsional oscillations.

     c. Explain the factors that affect the surface tension.   (2+4+4)

PART - C

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

11. A constant force $\vec{F} = (6\hat{i} + 4\hat{j})$ N acts on a particle and it undergoes a displacement $\vec{S} = (3\hat{i} + 4\hat{j})$. Calculate the work done by the force.

12. A particle of mass 5kg at 1m from the origin is moving with a velocity of 3ms^{-1} along x-axis. Another particle of mass 8kg at 2m from the origin is moving at a velocity of -1ms^{-1} along the x axis. Find the position and velocity of centre of mass.

13. Calculate moment of inertia of a uniform disc of mass 0.5 kg and radius 0.1m about an axis passing through its edge and perpendicular to the plane of the disc.

14. What force is required to stretch a steel wire 1cm² in cross section to increase its length by 1%? Given q = 2×10^{11}Nm^{-2}.

15. Calculate the volume of water flowing in 10 minutes through a tube of diameter 0.1 cm and length 40 cm, if there is a constant pressure head of 1960 Nm-2. The coefficient of viscosity of water is 8.9×10^{-4} Nsm^{-2}.

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PART - D

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

16.   a.   Mention any two types of errors in measurement.

    b.   Why does a moving clock appear to run slower?

    c.   Does the escape velocity of a body from a planet depend on the mass of the body? Explain.

    d.   Why is most of the mass concentrated at the rim in a fly wheel?

    e.   Which is more elastic, iron or rubber? Explain.

    f.   State and explain Hooke's law.

    g.   Why are falling tiny rain drops spherical?

    h.   Distinguish between streamline flow and turbulent flow.

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