NP – 091

First Semester B.Sc. Examination, May 2022
(NEP – 2021-22 and Onwards)
PHYSICS
DSC 1 : Mechanics and Properties of Matter

Time : 2½ Hours

Max. Marks : 60

Instructions : *i) Answer **any four** questions from **each** Part.*
*ii) **Use** of non-programmable scientific calculator is **permitted**.*

PART – A

Answer **any 4** questions. **Each** question carries **2** marks. **(2×4=8)**

1. Can dimensional analysis be used to check the correctness of a formula or an equation ? Explain with an example.

2. Two bodies A and B, have the same momentum. If A is very heavy compared to B, determine which one has more kinetic energy.

3. Which is more elastic, steel or rubber ? Explain.

4. Is there a modulus of elasticity that exists for all the three states of matter ? Give an example.

5. What property of water allows insects to run on the surface of water, without sinking or drawing ? Explain.

6. How does temperature affect the viscosity of a liquid ? Explain with an application.

PART – B

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

7. Convert 10 N into dyne using dimensional analysis.

8. Two objects of mass 5 kg and 10 kg have position vectors of $\left(3\hat{i} + 6\hat{j} - 3\hat{k}\right)$ m and $\left(3\hat{i} - 9\hat{j} + 3\hat{k}\right)$ m respectively from the origin of a coordinate system. Calculate the position vector and the distance of their center of mass from the origin.

P.T.O.

9. The Poisson's ratio for glass is 0.4 and its Youngs' modulus is 2×10^{10} Nm^{-2}. Calculate the rigidity modulus, η, of glass.

10. Find the work done in twisting a steel wire of radius 1×10^{-3}m and length 0.25 m through an angle of 45° : given, the rigidity modulus, η, for steel is 8×10^{10} Nm^{-2}.

11. Calculate the excess pressure inside a soap bubble of radius 3×10^{-3} m, and also its surface energy, given the surface tension of the soap solution $= 20 \times 10^{-3}$ Nm^{-1}.

12. A sphere of mass 1.6×10^{-4} kg and radius 2.2×10^{-3} m takes 6.4 s to fall steadily through a height of 0.32 m inside a large volume of an oil of density 900 kgm^{-3}. If the density of steel is 7850 kgm^{-3}, calculate stokes coefficient of viscosity, η, of the oil.

PART – C

Answer **any four** questions. **Each** question carries **8** marks. **(8×4=32)**

13. a) Define work.

    b) Derive an expression for the work done by a variable force. **(2+6)**

14. a) State the postulates of special theory of relativity.

    b) Explain time dilation and obtain an expression for it. **(2+6)**

15. a) Define the moment of inertia of a body.

    b) Derive an expression for the moment of inertia of a rectangular lamina about an axis passing through its centre and perpendicular to its plane. **(2+6)**

16. a) State Keplers' laws of planetary motion.

    b) Derive an expression for the orbital velocity of a satellite in a circular orbit around earth at a height, h, above the surface of the earth. **(3+5)**

17. a) Define Youngs' modulus, rigidity modulus and Poissons ratio.

    b) Obtain an expression for the work done in stretching a wire. **(3+5)**

18. a) Define viscosity.

    b) Derive Poisuelles formula for the flow of a viscous fluid through a narrow horizontal tube of length, l, and radius (r). **(2+6)**