



I Semester B.Sc. Examination, February/March 2023
(NEP Scheme)
PHYSICS
Mechanics and Properties of Matter

Time : 2½ Hours

Max. Marks : 60

Instruction : Answer **any four** questions from **each Part**.

PART – A

Answer **any four** of the following. **Each** question carries **two** marks. (4×2=8)

1. Mass, length and time are considered as fundamental physical quantities. Justify.
2. Does the mass of a body remain constant under all circumstances ? Explain.
3. Action and reaction are equal and opposite but they do not cancel each other. Justify.
4. What are torsional oscillations ?
5. Define surface tension and surface energy.
6. When does the flow of liquid become turbulent ?



PART – B

Answer **any four** of the following. **Each** question carries **five** marks. (4×5=20)

7. A force of magnitude $F = (6x^2 + 2x + 3)$ N acting on a body moving parallel to the X-axis and displaces the body from $x = 2$ to $x = 3$. Calculate the amount of workdone by the force.
8. Calculate the total energy of an electron of rest mass 9.1×10^{-31} kg is moving with a speed of $0.99 C$. And also find the ratio of Newtonian kinetic energy to the relativistic kinetic energy.
9. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of the escape velocity from the surface of the earth. Calculate the height above the surface of the earth at which the satellite is moving. Given : Radius of the earth = 6400 km and $g = 9.8 \text{ ms}^{-2}$.

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10. One end of a steel wire of length 0.5 m and of radius 2 mm is fixed. Calculate the workdone in twisting the free end of the wire through 45° . Given : Rigidity modulus of the steel is 8×10^8 Nm.
11. A liquid of density 900 kgm^{-3} rises to a height of 7 mm in a capillary tube of internal diameter 2 mm. If the angle of contact of the liquid with the glass is 30° , calculate the surface tension of the liquid. Given $g = 9.8 \text{ ms}^{-2}$. $\gamma_0 = m \frac{a^2 + b}{12} \text{ kgm}^{-2}$
12. Water flows through a horizontal tube of length 0.4 m and of internal radius 6×10^{-4} m under constant pressure head of the liquid 0.4 m height. If $8.64 \times 10^{-4} \text{ m}^3$ of water flows out of the tube in 12 minutes, calculate the coefficient of viscosity of water. (Density of water = 1000 kgm^{-3} and $g = 9.8 \text{ ms}^{-1}$).

PART - C

Answer **any four** of the following. **Each** question carries **eight** marks. **(4×8=32)**

13. What is Lorentz contraction ? Derive an expression for the length contraction on the basis of Lorentz transformation equations.
14. Show that linear momentum of a system of particles is equal to the product of the mass of the system and velocity of centre of mass of the system.
15. State and prove perpendicular axis theorem.
16. Obtain the relation between elastic constants.
17. What is cantilever ? Obtain an expression for the depression at the free end of a thin light beam clamped horizontally at one end and loaded at the other end.
18. Obtain an expression for the difference of pressure between the two sides of a curved liquid surface.

