

Que. 2 Write answers of any ten questions in brief.

[20]

- 1 Define: (i) Scalar quantity, (ii) Vector quantity.
- 2 State Stoke's theorem.
- 3 Find the volume of parallelopiped whose adjacent sides are made up of following three vectors.

$$\vec{A} = \hat{i} + 2\hat{j} + \hat{k}$$

$$\vec{B} = \hat{j} + \hat{k}$$

$$\vec{C} = \hat{i} - \hat{j}$$

- 4 If no external force is acting on a particle then show that,
Linear momentum $\vec{p} = \text{constant}$
- 5 Define conservative and non-conservative forces.
- 6 Write down Newton's first and second laws of motion.
- 7 What is simple pendulum?
- 8 Enlist any two drawbacks of simple pendulum.
- 9 Define Centre of oscillation and axis of oscillation for a compound pendulum.
- 10 Define (i) event and (ii) inertial frame of reference.
- 11 State Einstein's postulates of special theory of relativity.
- 12 Obtain energy momentum relation as

$$E = C \sqrt{m_0^2 C^2 + p^2}$$

Que. 3 [A] Obtain analytical form of scalar triple product $\vec{A} \cdot (\vec{B} \times \vec{C})$ of three [06]
vectors \vec{A}, \vec{B} & \vec{C} . Explain its geometrical interpretation.

[B] For vectors:

[04]

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$\vec{B} = B_x \hat{i}$$

$$\vec{C} = C_x \hat{i} + C_y \hat{j}$$

Show that

$$\vec{A} \times (\vec{B} \times \vec{C}) = \vec{B}(\vec{A} \cdot \vec{C}) - \vec{C}(\vec{A} \cdot \vec{B})$$

OR

Que. 3 [A] For a vector point function \vec{V} , show that:

$$\text{curl } \vec{V} = \vec{\nabla} \times \vec{V}.$$

[06]

Also discuss briefly physical significance of curl of a vector quantity.

[B] State and explain Gauss' theorem.

[04]

(2)

Que. 4 [A] Discuss Atwood's machine and obtain; [06]

$$\ddot{x} = \left(\frac{m_2 - m_1}{m_2 + m_1} \right) g$$

for its acceleration. Also derive

$$T = \left(\frac{2m_1m_2}{m_1 + m_2} \right) g$$

for the tension produced in the string of the machine.

[B] Prove that the work done by the force in displacing a particle from a position-1 to position -2 is given by [04]

$$W_{1,2} = V_2 - V_1.$$

OR

Que. 4 [A] For an electron of charge e moving in uniform electric field (\vec{E}), show that [06]

$$\frac{1}{2}mv^2 + e\phi = \text{constant}.$$

[B] Show that if no torque is applied on a particle then; [04]
Angular momentum $\vec{L} = \text{constant}$.

Que. 5 [A] What is compound pendulum? Derive an expression for its time period as; [06]

$$T = 2\pi \sqrt{\frac{(k^2/l) + l}{g}}$$

[B] Discuss the conditions for the maximum and minimum time periods of oscillations of a compound pendulum. [04]

OR

Que. 5 [A] Explain how to determine acceleration due to gravity "g" using bar pendulum. Also derive an expression for its radius of gyration as; [06]

$$k = \sqrt{l_1 + l_2}$$

[B] Describe construction of Kater's reversible pendulum. [04]

Que. 6 Enlist properties of aether and describe construction and working of Michelson-Morley experiment. Derive necessary formula for the path difference in Michelson-Morley experiment. Also write down negative results of the above experiment. [10]

OR

Que. 6 Derive Lorentz transformation equations. Also write down inverse Lorentz transformation equations. [10]



