

2022-26

Full Marks : 60

Time : 3 Hours

Candidates are required to give their answer in their own words as far as practicable. Their figures in the margin indicate full marks.

Answer from **both** the Groups as directed.

Group – A

(Compulsory)

1. Answer **all** questions : 1×5=5

(i) A vector is solenoidol if div $\vec{A}$ = ...

(ii) In forced oscillator, velocity resonance in the presence of damping occurs when frequency of impressed force is ..... natural frequency of oscillator.

(iii) The surface tension of water ..... with temperature.

(iv) Order and degree of differential equation $\left[1+\left(\frac{dy}{dx}\right)^2\right]=\frac{d^2y}{dx^2}$ are ..... .

(v) Write an expression for length of an arc in curvilinear coordinates.

2. What is a geo-stationary satellite ? Find the time period of its revolution around the earth. 5

3. Explain the physical meaning of divergence of a vector. 5

Group – B

Answer any **three** : 15×3=45

4. (a) Obtain an expression for gradient of a scaler and divergence of a vector in spherical polar coordinates. 10

(b) Prove that, $\text{div}\left(Q\vec{A}\right)=Q\left(\text{div}\,\vec{A}\right)+\left(\text{grad}\,Q\right).\vec{A}$. 5

5. (a) Derive differential equation of motion under central force. 10

(b) Prove that, angular momentum is conserved in central force. 5

6. State and explain fundamental postulates of special theory of relativity and deduce Lorentz transformation. 15

7. What are ripples and gravity waves ? Obtain an expression for velocity of waves when both gravity and surface tension is dominant on the wave. Discuss the special cases. 15

8. Obtain relations between different elastic constants. Discuss the limitations of Poisson's ratio. 15

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