

## PHYSICS Paper-B

(Vibrations, Waves and E.M. Theory-II)

Time Allowed : 3 Hours]

[Maximum Marks : 22

- Note: (i) Attempt five questions in all, selecting two questions from each from Units I and II.
- (ii) UNIT-III is compulsory.
- (iii) Use of non-programmable calculator is allowed.
- (iv) Logarithmic tables may be asked for if needed.

### UNIT-I

- (a) Derive the formula for velocity of transverse waves propagating through a string. 3

(b) What are the differences between a progressive wave and a stationary wave? 1
- (a) Define particle velocity, wave velocity and group velocity. Establish a relation between wave velocity and group velocity in a dispersive medium. 3

(b) Find the speed of propagation of transverse wave on a 0.8 mm diameter wire which is under a tension of 700 N. The density of steel is  $7.9 \times 10^3 \text{ kg/m}^3$ . 1
- (a) Derive an expression for characteristic impedance of a string in terms of linear density and wave velocity. 3

(b) Distinguish between normal and anomalous dispersion. 1

## UNIT-II

4. (a) Derive an expression for the Intensity of a plane of electromagnetic wave propagating in a medium of permeability  $\mu$  and permittivity  $\epsilon$ .  
(b) Define Poynting Vector. What is its physical significance? 3, 1
5. A plane electromagnetic wave incident normally on the interface between two dielectric media of impedance  $Z_1$  and  $Z_2$  are partly reflected and partly transmitted. Find an expression for reflection and transmission coefficients of Intensity for these waves. 4
6. (a) Find out the equation of em wave in a medium having finite permittivity  $\epsilon$  and permeability  $\mu$  but with conductivity  $\sigma = 0$ . 3  
(b) A plane electromagnetic wave of frequency 3 MHz travels in a good conductor made of copper having conductivity  $5.8 \times 10^7$  mho m<sup>-1</sup> and permeability  $4\pi \times 10^{-7}$  N/A<sup>2</sup>. Find skin depth. 1

## UNIT-III

7. Attempt any six parts, each part carries 1 mark :
- (a) What is skin effect? Discuss.  
(b) Write down Maxwell's equations in electromagnetic theory for dielectric medium.  
(c) Distinguish between unpolarised and polarised electromagnetic waves.  
(d) Distinguish between mechanical waves and electromagnetic waves.  
(e) What is the minimum distance between two particles vibrating in phase?  
(f) Prove that the distance between two particles of medium whose phase, differ by  $2\pi$  is equal to wavelength of the wave.  
(g) Define Skin depth. What is its value for a perfect conductor?

6×1=6