

PC-8662/MH**AS/2057****VIBRATIONS AND WAVES - II**

Semester-II

Time Allowed : Three Hours]

[Maximum Marks : 30

Note : Attempt *two* questions each from Section A and B carrying 5 marks each, and any *five* questions from Section C consisting of 7 short answer type questions carrying 2 marks each.

SECTION-A

- I. Derive an expression for the total energy of a stiffness coupled system of two identical pendulums. 5
- II. What is Wave motion ? Discuss the transverse and longitudinal waves. Derive the wave equation for transverse wave in a String. 5
- III. (a) Derive the relation for the characteristic impedance of a string. Give the factors on which it depends. 4
(b) Two electric transmission cables are joined at a point. What special care should be taken for proper transmission of power? 1

- IV. (a) What do you understand by Wave velocity and group velocity ? Derive the relation between the wave velocity and group velocity. 3.5
- (b) A stretched string is observed to vibrate with a frequency 50 Hz in fundamental note when the length of the string is 100 cm. The string has a mass of 5 gm/cm. Find the velocity of the propagation of the transverse wave. 1.5

SECTION-B

- V. Derive the expression for Reflection coefficient (R) and Transmission coefficient (T) for a dielectric medium having refractive index n . 5
- VI. What do you understand by Poynting vector ? What does it represent ? Show that poynting vector measures the flow of energy per unit area per second in a electromagnetic wave. Derive expression for the flow of e.m. energy in a medium. 5
- VII. (a) What is skin depth of a conductor ? Prove that as frequency increases skin depth decreases. Explain skin effect and the electric shielding properties of a conductor. 3
- (b) Calculate the skin depth for a frequency of 10^8 Hz.
 Given $\mu = 4\pi \times 10^{-7} \text{ Am}^{-2}$ and
 $\sigma = 5.6 \times 10^7 \text{ mho m}^{-1}$

- VIII. State Maxwell's equations in electromagnetic theory. Show analytically that e.m. waves are transverse in nature.

5

SECTION-C

- IX. Attempt any *five* of the following :

- (a) An electromagnetic wave in empty space has a maximum electric field of 3×10^8 V/m. What is the maximum value of magnetic field ?
Given $\mu_0 = 4\pi \times 10^{-7} \text{ Am}^{-2}$ and $C = 3 \times 10^8$ m/sec.
- (b) What do you understand by Dispersive medium ?
- (c) What is velocity of e.m. wave in glass ? (For glass refractive index $n = 1.5$)
- (d) Find the coupling coefficient if self-inductance of primary coil is 0.28 H, self-inductance of secondary coil is 0.36 H and mutual inductance is 0.3 H.
- (e) What do you understand by Inductive coupling ?
- (f) Give the meaning of Degree of freedom.
- (g) What is Electromagnetic spectrum ? (5x2=10)