

**2024**  
**(Session : 2022-26)***Time : 3 hours**Full Marks : 60*

*Candidates are required to give their answers in their own words as far as practicable.*

*The figures in the margin indicate full marks.*

*Answer from both the Groups as directed.*

**Group – A****(Compulsory)**

1. Answer the following questions :  $1 \times 5 = 5$

(a) A proton entering into a uniform magnetic field at right angle to it takes up \_\_\_\_\_ path.

(b) Parallel LCR circuit is also known as \_\_\_\_\_ circuit.

(c) The differential form of Gauss' law in magnetostatic field is \_\_\_\_\_.

(d) The skin depth \_\_\_\_\_ with the frequency of electromagnetic wave.

(increases / decreases)

(e) The tangent of the angle of \_\_\_\_\_ is equal to the refractive index of the reflecting medium.

2. Explain dielectric polarization. Write the relation among the vectors D, E and P. 5

3. Draw B-H curve for a ferromagnetic material subject to a magnetic field. What do you mean by Magnetic hysteresis? 5

#### Group - B

Answer any **three** questions of the following :

15×3 = 45

4. (a) State Ampere's Circuital law. Use Ampere's Circuital law to obtain an expression for magnetic field due to a long solenoid.

(b) Consider a 1m long solenoid having 1000 turns per unit length and carrying current of magnitude 800 A. Calculate magnetic field inside it. Take  $\mu_0 = 4\pi \times 10^{-7}$  H/m.

5. Explain the following features of a series LCR circuit-Resonance, Power dissipation, Quality factor and Bandwidth. Explain why is it also known as Acceptor circuit.

6. (a) Obtain an expression for the torque experienced by a current loop in a uniform magnetic field.

(b) Calculate the magnitude of torque experienced by a square coil of side 10 cm, with 10 turns and carrying a current of 10 A, suspended vertically, and the normal to the plane of coil makes an angle of  $30^\circ$  with the uniform magnetic field of 0.8T.

7. Express your understanding of Maxwell's field equations. Discuss Poynting vector and Poynting theorem.

8. Discuss the propagation of plane electromagnetic wave through vacuum and hence confirm, through computation, that field vectors are mutually perpendicular to each other and also to the plane perpendicular to the direction of propagation.

