

ELECTRICITY AND MAGNETISM - II

Paper - III
Semester - II

Time : Three Hours]

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

[Maximum Marks : 30

Section - A

1. Define \vec{M} and \vec{H} . Derive their relation with free and bound currents.

5

2. Discuss the Langewin's theory of para-magnetism. Give two difference between Para and Dia magnetic materials. 5
3. What is Hysteresis ? Derive an expression for loss of energy per unit volume per cycle during one cycle of magnetisation is given by $\frac{1}{\mu_0}$ times the area of B-H loop. 5
4. (a) Define magnetic susceptibility and permeability, and derive an expression between them. 4
 (b) The magnetic susceptibility of B is $-2.10 \times 10^{-11} \text{ Nm}^{-1}$. Calculate Relative permeability. 1

Section - B

5. Explain the cause that led Maxwell to modify the relation $\nabla \times \vec{B} = \mu_0 \vec{J}$ with the introduction of the concept of displacement current. Hence arrive at

$$\nabla \times \vec{B} = \mu_0 \left(\vec{J} + \epsilon_0 \frac{\partial E}{\partial T} \right).$$
 5
6. State and explain Biot-Savart's law. Using Biot-Savart's law, find an expression for the intensity of magnetic induction field at a point on the axis of a circular coil carrying steady current. 5
7. Explain the phenomenon of Hall effect. How does the Hall effect decide that current in a metallic conductor is due to negatively charged particle. Derive the value of Hall voltage and show that
 Hall coefficient $R_H = \frac{1}{ne}$. Give the application of Hall effect. 5
8. Derive the expressions for transformation of electric and magnetic field from one inertial frame of reference to another. 5

Section - C

9. Attempt any five parts.
- (a) A solenoid 100 cm long and mean diameter 8 cm and having 500 turns. Find the magnetic field at the mid-point if 10 amp. current is flowing through its windings.
- (b) Bohr Magneton.
- (c) "Diamagnetic susceptibility is independent of temperature". Comment.
- (d) What is Curie Weiss law ?
- (e) Give Ampere circuital law.
- (f) Why inductance is called electrical inertia ?
- (g) Define Power factor. (2×7=14)