

PHYSICS Paper-C

(Electricity and Magnetism-II)

Time Allowed : 3 Hours]

[Maximum Marks : 22

- Note: (i) Attempt five questions in all, selecting two questions from each of Units I and II.
(ii) Unit III is compulsory.
(iii) Use of non-programmable scientific calculator is allowed.

UNIT-I

- (a) Discuss and explain Biot and Savart's law.

(b) Derive the expression for magnetic field due to current carrying long and straight conductor. 22
- (a) What is current density \vec{j} ? Prove that $\vec{j} = ne\vec{v}$ where the symbols have usual meaning.

(b) In a region 5×10^{10} doubly charged +ve ions per cm^3 are moving with a speed of 10^7 cm/sec towards west. In the same region there are 10^{11} electrons per cm^3 moving with the speed of 10^8 cm/sec along north east; what is the magnitude and direction of \vec{j} ? 22
- (a) Define \vec{M} and \vec{H} . How they are related with free and bound currents?

(b) Define B-H curve. Prove that the area enclosed by B-H curve is equal to work done in completing one cycle of magnetisation. 22

UNIT-II

- (a) State and prove Ampere Circuital law and show that $\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$ in S.I.

(b) The magnetic vector potential at any point is $\vec{A} = 5(x^2 + y^2 + z^2) \hat{i}$. Evaluate the magnetic field at that point. 22
- (a) State and explain the Self Inductance. Give the units of Self Inductance.

(b) A wire of length 200 cms held perpendicular to X-Y plane is moved with velocity $2\hat{i} + 3\hat{j} + \hat{k}$ m/Sec through a region of uniform induction $\hat{B} = \hat{L} + 2\hat{k}$ wb / m². Calculate the electric field \hat{V} developed in the wire. 22

6. (a) Prove that $\hat{V} \times \hat{B} = \mu \hat{J}$ and $\hat{V} \cdot \hat{B} = 0$ where \hat{B} is magnetic field.

(b) State and explain the Hall's effect. 22

UNIT-III

7. Attempt any six parts :

(i) Can the relation $V = IR$ be used for non ohmic resistors?

(ii) State the conditions under which the conductivity of a medium depends on electric field.

(iii) What do you mean by Invariance of charge? Is volume charge density ρ invariant? Explain.

(iv) State the condition under which the magnetic scalar potential exists.

(v) List the factors on which the magnetic flux linked with the coil depends.

(vi) What is theorem of reciprocity?

(vii) What is difference between resistivity and conductivity?

6×1=6