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B.A./B.Sc. (General) 2nd Semester

(2053)

PHYSICS

Paper : C Electricity and Magnetism–II

Time Allowed : Three Hours] [Maximum Marks : 44

Note :—Attempt FIVE questions in all, selecting TWO questions each from Unit–I and Unit–II, Unit–III is compulsory.

UNIT—I

1. (a) Derive and discuss the force that one moving charge exerts on another moving charge.

(b) Two parallel wires separated by distance of 5 cm, each carrying a current of 2 mA. Calculate the force between them if the current in both wires is in same direction. 6,3

2. (a) Distinguish between current and current density. Derive continuity equation

$$\frac{\partial P}{\partial t} + \vec{\nabla}.\vec{J} = 0.$$

(b) Define magnetic susceptibility and permeability. Prove that $\mu_r = 1 + \chi_m$. 5,4

3. (a) Define $\bar{M}$ and $\bar{H}$. How they are related with free and bound currents.

(b) Differentiate between ferromagnetic, paramagnetic and diamagnetic substances. 5,4

UNIT—II

4. (a) Explain the phenomenon of Hall effect. Derive an expression for Hall coefficient.

(b) The magnetic vector potential is :

$$\bar{A} = 8(2x^2 + 3y^2 + z^2)\hat{i}.$$

Evaluate magnetic field at point (4, 2, 1). 6,3

5. (a) State and prove Ampere's circuital law. Use it to find the magnetic field due to an infinite hallow cylinder carrying current.

(b) An electron is moving with velocity $\bar{v} = (8\hat{i} + 2\hat{j}) \times 10^3$ m/sec. in uniform magnetic field $\bar{B} = 0.02\hat{i}$ T. Find the force experienced by electron. 6,3

6. (a) Derive Biot-Savart Law from vector potential. Show that divergence of vector potential is zero.

(b) What is mutual inductance and coefficient of mutual inductance ? 6,3

UNIT—III

7. Attempt any **EIGHT** of the following :—

(a) What are the limitations of ohm's law ?

(b) What are invariance of charge ?

(c) What is the uses of hysteresis loop ?

(d) Define drift velocity. On what factors it depends ?

(e) What is Lorentz's force ? Find its value for stationary charge.

(f) Define Gauss's Law in magnetism.

(g) Define Faraday's law of electromagnetic induction.

(h) What is displacement current ?

(i) What is Bohr magneton ? Calculate its value.

(j) Why an ordinary iron piece does not behave as magnet ?

8×1