PHYSICS Paper-C

(Electricity and Magnetism-II)

Time : 3 Hours **Max. Marks : 22**

Note : (i) Attempt *five* questions in all by selecting *two* questions from each of Units I and II .

(ii) Unit III is compulsory.

(iii) Use of non-programmable calculator is allowed.

Unit – I

1. Show that transformation equations of electric field from one frame at rest to other moving frame with constant velocity are given by

$E_{x'} = E_x$, $E_{y'} = \gamma E_y$ and $E_{z'} = \gamma E_z$ where, $E_{x'}$, $E_{y'}$ and $E_{z'}$ are the components of electric field in moving frame that is moving along X-axis. 4

2. (a) Derive the relation $\mu = h_0(1+x_m)$; where the symbol have their usual meaning.

(b) In a lab system, an electric field $\vec{E} = (2\hat{i} + 4\hat{j})$ V/*m*. Calculate electric field as measured in a frame of reference moving with velocity of $4(3\hat{i}+4\hat{j})\times 10^7$ m/sec. 2,2

3. (a) Derive the differential and integral form of Ampere's law in magnetism.

(b) A magnetic field of 1.6×10^3 Tesla produces a flux of 2.4×10^{-5} wb. in a bar of iron of cross-section 0.2 cm^2. Derive the permeability and susceptibility of specimen. 2,2

Unit – II

4. (a) State Biot and Savart's law and derive the magnetic field due to a straight conductor carrying current.

(b) What is the singnificance of $\vec{\nabla} \cdot \vec{B} = 0$ and $\vec{\nabla} \times \vec{B} = 0$. $2^1/_2, 1^1/_2$

5. (a) By using Ampere's law, derive the relation for magnetic field due to a toroid.

(b) Calculate the mutual inductance between two coils, when a current of 4.0 A changes to 8.0 A in 0.5 sec. and induces an e.m.f. of 50 mV in the secondary coil. 2,2

6. State and prove reciprocity theorem in mutual induction. 4

Unit – III

7. Attempt any *six* :

(i) What are Ohmic and non-Ohmic conductors?

(ii) Differentiate between microscopic and macroscopic currents.

(iii) Why ferromagnetism is not found in liquids and gases?

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

(v) State the Gauss's law in magnetism.

(vi) Is the source of magnetic field is analogous to the source of electric field?

(vii) State the condition under which the equation $\vec{\Delta} \times \vec{B} = \mu_0 \vec{J}$ is valid. 1×6=6