(i) Printed Pages: 3 Roll No. .....

(ii) Questions : 7 Sub. Code : 0150

Exam. Code : 0002

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

(2042)

PHYSICS

(Electricity and Magnetism–II)

Paper–C

Time Allowed : Three Hours] **[Maximum Marks : 44**

Note :— (1) Attempt **five** questions in all, by selecting **two** questions each from Unit-I and Unit–II.

(2) Unit-III is compulsory.

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

UNIT–I

1. (a) Show that the transformation laws of transforming electric field from one inertial frame of reference to another are given by $E'_x = E_x, E'_y = rE_y, E'_z = rE_z$ where

$$r = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}.$$

6

(b) There is a proton lying in a frame of reference which is moving with a velocity of 0.8C along the x direction in space in which an electric field $\vec{E} = 4\hat{i} + 3\hat{j}\ vm^{-1}$ is acting. Calculate the parallel and perpendicular components of the force acting on proton. 3

2. (a) Prove that magnetic moment due to orbital motion of an electron must be integral multiple of $\frac{eh}{4\pi m}$ S.I. units. 6

(b) Derive the relation $\mu = \mu_0(1 + X_m)$ where the symbols have usual meaning. 3

3. (a) Derive and discuss the equation of continuity $\vec{\nabla} \cdot \vec{J} + \frac{\partial p}{\partial t} = 0$. 5

(b) Define free and bound currents. Show that curl $\vec{H} = \vec{J}$ free. 4

UNIT–II

4. (a) State and prove Ampere's circuital law. Use this law to find magnetic field due to long solenoid. 6

(b) Calculate the current in a circular coil of radius 10 cm and 100 turns to produce a magnetic field of 0.1 mT at its centre. 3

5. (a) State and prove reciprocity theorem of mutual induction. 7

(b) Calculate mutual inductance between two coils, when a current of 4A changes to 8A in 0.5s and induces an emf of 50 mV in the secondary. 2

6. (a) Define vector potential and derive an expression for it. Show that divergene of vector potential is zero. 6

(b) Show that energy density in magnetic field B set up in a solenoid is $\frac{B^2}{2\mu_0}$. 3

UNIT–III

Attempt any **eight** of the following :

7. (a) What is the difference between conservation and invariance of charge ?

(b) Write down the equation which shows that magnetic monopole do not exist.

(c) Define drift velocity. How it varies with :

(i) Current flowing though the conductor

(ii) Relaxation time ?

(d) What are paramagnetic substances ? Give examples.

(e) What is Hall effect ?

(f) What is the significance of non-diverging $\vec{J}$?

(g) What is the value of $\vec{\nabla} \cdot \vec{B}$ and $\vec{\nabla} \times \vec{B}$ for points inside the current loop ?

(h) What is Gauss law in magnetism ?

(i) Explain why the coils of the resistance box are wound over themselves.

(j) Why inductance is called electrical inertia ? $1 \times 8 = 8$