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

(ii) Questions : 9 Sub. Code : 3711

Exam. Code : 0473

M.Sc. Physics 2nd Semester

(2042)

CLASSICAL ELECTRODYNAMICS–I

Paper : PHY-8023

Time Allowed : Three Hours] [Maximum Marks : 80

Note :— Attempt **FIVE** questions in all, taking **ONE** question each from Units I to IV and the compulsory question from Unit V.

UNIT—I

1. (a) Discussing the case of multipole expansion of the scalar potential of an arbitrary charge distribution, calculate expression for dipole field. 10

   (b) Find the charge density and the total charge of the system which gives rise to the electric field :

$$E(x) = \frac{qe^{-ar}}{r^3} x .$$ 6

2. (a) Find force between two current carrying circuits and show that it obeys Newton's third law. 6

   (b) Show that the field produced by a current I flowing in a long straight wire at a point at a distance r is 2I/cr. 5

(c) Starting from the definition of magnetic field given by Biot Savart's law, calculate divergence of magnetic field. 5

UNIT—II

3. (a) A slab of polar molecules is kept in external electric field. Discuss its polarization. Obtain your results for weak and strong fields. 8

(b) Derive Clausius Mossotti relation. 8

4. (a) Two line charges having linear charge densities $+\lambda$ and $-\lambda$ are placed d distance apart. Prove that locus of all the points having zero potential is a cylinder. Find radius of that cylinder. 10

(b) Explain the concept of uniqueness of solution of Laplace equation. 6

UNIT—III

5. (a) What do mean by choosing a gauge ? What is Gauge transformation ? Discuss Lorentz Gauge. 10

(b) Derive law of conservation of energy for an electromagnetic field. 6

6. (a) Discussing the case of propagation of em wave through a conducting medium, show that electric and magnetic field vectors and in phase when conduction current is much smaller than displacement current. 8

(b) Discuss motion of an em wave through ionosphere. Explain the concept of critical frequency of a layer of the ionosphere. 8

UNIT—IV

7. (a) An em wave with its electric field vector parallel to the plane of incidence strikes an dielectric-dielectric interface. Deduce the reflection and transmission coefficients of energy. 10

   (b) Explain total internal reflection on the basis of pointing vector. 6

8. (a) Explain the concept of retarted potentials. Also derive expressions for retarted scalar and vector potentials. 8

   (b) Two electric dipoles lying on x-axis and oriented along z-axis oscillate exactly out of phase. Their coordinates are separated by $\lambda/2$. Calculate Poynting vector at large distance. 8

UNIT—V

9. (a) Write a short note on centre fed antenna. 3

   (b) Explain the concept of skin depth in a conductor. 3

   (c) Show that equation of continuity also holds for bounded charge. 3

   (d) Give the physical significance of negative value of quadropole moment of a charge distribution. 2

   (e) Find the vector potential for a long straight conductor I. 3

   (f) Explain linear isotropic dielectrics. 2