

(i) Printed Pages : 3

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(ii) Questions : 9

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Exam. Code :

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M.Sc. Physics 2nd Semester
(2055)

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 compulsory question from Unit-V.

UNIT-I

1. (a) Find the charge density and the total charge of the system which give rise to the electric field

$$E(x) = \frac{qe^{-\alpha r}}{r^3} \times \quad 6$$

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

2. (a) Starting from the definition of magnetic field given by Biot Savart's law, calculate curl and divergence of magnetic field.

8

- (b) Find force between two current carrying circuits and show that it obeys Newton's third law. 8

UNIT-II

3. (a) Derive Clausius Mossotti relation. 8
- (b) Discuss the polarization of the material when field applied distort the spherical distribution of charge and produces induced dipole moment in case of non-polar molecules. 8
4. (a) Show that there is a potential drop of $4\pi D$ across a dipole layer distribution of strength $D(x)$. 6
- (b) A point charge is placed near a grounded conducting sphere. Find the surface density of charge induced on the sphere and force between the charge and the sphere. 10

UNIT-III

5. (a) Derive law of conservation of energy for an electromagnetic field. Also explain Poynting vector for a wire carrying constant current. 8
- (b) What do you mean by choosing a gauge ? What is gauge transformation ? Discuss Lorentz gauge. 8
6. (a) Explain the propagation of electromagnetic waves in rare field plasma. 7
- (b) Discussing the case of propagation of electromagnetic wave through a conducting medium, show that for the case of poor conductors, electric and magnetic fields are in phase. 9

UNIT-IV

7. (a) Explain the terms :
- (i) Brewster angle
 - (ii) Total internal reflection of EM wave. 8
- (b) An em wave with its electric field vector parallel to the plane of incidence strikes a dielectric-dielectric interface. Deduce the reflection and transmission coefficients of energy. 8
8. (a) Write a note on center fed linear antenna. 8
- (b) Explain the concept of retarded potentials. Also derive expressions for retarded scalar and vector potentials. 8

UNIT-V

9. (a) What is skin depth ? 2
- (b) State Gauss's law in differential and integral form. 3
- (c) What are Dirichlet and Neumann conditions ? 2
- (d) Obtain the boundary condition for the displacement vector. 3
- (e) How is TE mode distinct from TM mode ? 3
- (f) Explain the differential form of Faraday law. 3