

(i) Printed Pages : 3

Roll No.

(ii) Questions : 9

Sub. Code :

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Exam. Code :

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M.Sc. Physics 2nd Semester

(2056)

CLASSICAL ELECTRODYNAMICS-I

Paper-PHY-8023

Time Allowed : Three Hours]

[Maximum Marks : 80

Note :— Attempt **five** questions in all, taking **one** question each from Unit I to IV and a compulsory question from Unit V.

UNIT-I

1. (a) Discuss the case of multipole expansion of the scalar potential of an arbitrary charge distribution, calculate expression for dipole field. 10
- (b) Find a charge distribution that will produce a Yukawa potential $\phi = \frac{e^{-\alpha r}}{r}$ where 'r' is the radial distance from origin to the point of observation and ' α ' is constant. 6
2. (a) Calculate expression of vector potential from Gauss's law in magnetism. Find vector potential for a long straight current I. 8
- (b) Show that force of interaction between two current carrying circuit is equal and opposite. 8

UNIT-II

3. (a) Explain the energy of a charge distribution in dielectric media. 8
- (b) Discuss orientational polarization of polar molecules in molecular polarizability. 8
4. (a) 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
- (b) Show the uniqueness of the solution of Laplace's equation. 6

UNIT-III

5. (a) What do you mean by choosing a gauge? Show that it is the transverse component of current density which is the source of vector potential in Coulomb gauge. 8
- (b) Derive law of conservation of energy for an electromagnetic field. Also explain Poynting vector for a wire carrying constant current. 8
6. (a) Explain the phenomenon of reflection of electromagnetic waves by the ionosphere. 8
- (b) Explain Poynting theorem for a complex vector field. 8

UNIT-IV

7. (a) An electromagnetic wave with its electric field vector perpendicular to the plane of incidence strikes a dielectric-dielectric interface. Deduce the reflection and transmission coefficients of energy. 9

- (b) What are TM modes, TE modes, TEM modes in a waveguide? 7
8. (a) Show that for a charge oscillating according to the harmonic law $x = x_0 \cos(\omega_0 t + \alpha)$, the total mean intensity of radiation emitted is $P = \frac{(e^2 \omega_0^4 x_0^2)}{3c^3}$. 7
- (b) Write a note on center-fed linear antenna. 9

UNIT-V

9. (a) Explain the term Brewster's angle in EM wave. 3
- (b) Explain the differential form of Faraday's law. 3
- (c) Explain the differential form of Gauss's law. 3
- (d) What are Dirichlet and Neumann conditions? 2
- (e) What is skin depth? 2
- (f) Show that equation of continuity also holds for bounded charge. 3