(i) Printed Pages : 4] Roll No. .....

(ii) Questions : 9] **Sub. Code :** 3 7 0 5

Exam. Code : 0 4 7 2

M.Sc. 1st Semester Examination

1127

PHYSICS

(Classical Electrodynamics-I)

Paper : PHY–6004

Time : 3 Hours] **[Max. Marks : 60**

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

Unit–I

1. (a) Electric field at any point $\vec{x}$, due to a charge q at origin is $\vec{E}(\vec{x}) = q\frac{\vec{x}}{r^3}$, where $r = (x^2 + y^2 + z^2)^{\frac{1}{2}}$. Show by direct calculation that $\vec{\nabla}\cdot\vec{E} = 4\pi\rho$. 6

(b) Show that the magnitude of magnetic field produced by a current I flowing in a long straight wire at a point at a distance r is $\frac{2I}{cr}$. 6

2. (a) Starting from Biot-Savart law, obtain curl equation for $B \cdot [\vec{\nabla} \times \vec{B} = \frac{4\pi}{c} \vec{J}]$. 6

(b) State and explain :

(i) Coulomb's Law and

(ii) Gauss Law 3,3

Unit–II

3. (a) Obtain Clausius-Mossotti relation. 6

(b) A point charge $+q$ is lying at a distance d in front of an infinite conducting plane which is grounded. Using Method of Images find out the electric field at any point. 6

4. (a) Show that solution of Laplace's equation is unique. 6

(b) Obtain the expression for energy of a charge distribution in dielectric medium. 6

Unit–III

5. (a) State four Maxwell equations and explain their physical significance. 6

   (b) Explain the phenomenon of reflection of electromagnetic waves by ionosphere. 6

6. (a) Starting from four Maxwell equations, obtain wave equation for B field. 6

   (b) State and prove Pyonting theorem. 6

Unit–IV

7. (a) What are Electromagnetic waveguides ? What are characterstics of EM waves that are propagating in wave guides ? 6

   (b) Write a note on center fed linear antenna. 6

8. (a) Explain the features of reflection and refraction of plane EM waves at a plane interface. 6

   (b) Qualitatively describe the field produced by a harmonically oscillating source at a great distance. 6

Unit–V

2 each

9. (a) State Faraday law of induction.

   (b) Show that trace of quadrapole tensor is zero.

   (c) What are Dirichlet, Neumann conditions ?

   (d) What is Green's function ? How and where it is used in electrodynamics ?

   (e) What are gauge transformations ? Explain.

   (f) What is Skin depth ?