Roll No. .....

(05/24)

15412

M.Sc. EXAMINATION

(For Batch 2021 & Onwards)

(Second Semester)

PHYSICS

MSc/Phy/2/CC7

Classical Electrodynamics

Time : Three Hours *Maximum Marks : 70*

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory.

1. Discuss in brief : 5×2=10

   (i) Dipole moment

   (ii) Atomic polarizability

   (iii) Ampere's law

(iv) Plane e.m. waves in free space

(v) TE and TM waves.

Unit I

2. (a) State and prove Gauss's law. 8

(b) What are Dielectrics ? Derive Clausius-Mossoti equation. 7

3. (a) What is an electret ? Express Poisson's and Laplace equations in Cartesian, spherical and cylindrical co-ordinates. 8

(b) What is method of images ? Apply it to find the potential due to a point charge above a grounded conducting plane. 7

Unit II

4. (a) State and prove Biot-Savart law. 7

(b) Two wires carrying current in same direction 5000 Amp and 10000 Amp which are placed with their axis 5 cm. apart. Calculate force between then in Newton per meter. 8

5. (a) What is Faraday Law of induction ? Derive Maxwell's equation from Faraday law. 8

(b) Discuss physical significance of the Maxwell's equations : 7

$$\nabla . E = \frac{e}{\epsilon_0} \text{ and } \nabla . B = 0 .$$

Unit III

6. (a) State and prove Poynting theorem. Discuss physical significance and units of Poynting vector. 10

(b) What is Coloumb gauge condition ? Discuss vector magnetic potential. 5

7. (a) Derive the equations for the propagation of e.m. fields in a conducting medium. 10

(b) What is skin depth ? Discuss skin depths for different materials. 5

Unit IV

8. (a) State and prove laws of reflection and refraction of light at plane dielectrics interface using classical e.m. field theory. 8

(b) State and prove total internal reflection of light using classical e.m. field theory. 7

9. (a) What is a wave guide ? Obtain the propagation parameters of a wave guide for two parallel conducting plates. 8

(b) Obtain Fresnel amplitude relations for the electric field (E) polarized perpendicular to the plane of incidence using interface of two dielectric media. 7