WA-5326

M. Sc. (Sem.-II) Examination, June - 2024

PHYSICS

Paper - PHY - 2002

Classical Electrodynamics - I

Time Allowed : **Three Hours**

Max. Marks : **70**

Min. Marks : **28**

*This question paper contains **two** sections as under :*

Section-A ***Max. Marks-20***

*This section will have 10 questions, having **02** questions from each unit with no internal choice. Answer in about **20** words. All questions will have equal marks. **(10×02=20)***

Section-B ***Max. Marks-50***

*This section will have **10** questions, having **02** questions from each unit, one question to be attempted from each unit. Words limit approximately **400-500** words. Questions may have sub divisions. All questions will have equal marks. **(10×05=50)***

SECTION – A

1 (i) State the Dirichlet and Neumann boundary conditions for potential problems.

(ii) Find the volume charge density (ρ) that could produce by the following potential.

$$\phi = \frac{q}{4\pi \in} \frac{e^{-(r/a)}}{r^2}$$

(iii) Why the Coulomb gauge is also called the transverse and radiation gauge?

(iv) Calculate the value of Poynting vectors at the surface of the sun if power radiated by the sun is 3.8×10^{26} watts and radius of sun is 7×10^8 m.

(v) What do you mean by electric images?

(vi) Define Molar polarizability and electric susceptibility.

(vii) Write down the equations for magnetostatics.

(viii) Write the Biot-Savart law for entire current loop.

(ix) What are Gauge transformation?

(x) What is Magnetic Shielding?

2×10=20

SECTION - B

UNIT - I

2 Prove Green's theorem and apply Green's theorem to determine potential in certain bounded space containing continuous charge distribution. **10**

OR

Derive an expression for energy of an electric field of continuous charge distribution. **10**

UNIT - II

3 Deduce Clausius-Mossotti of relation in term of dielectric constant. **10**

OR

A sphere of radius R carries a surface charge $\sigma = \sigma_0 \cos\omega$. Find the potential ϕ due to the charge distribution by using multipole expansion in terms of spherical polar co-ordinates. **10**

UNIT - III

4 For a point charge in the presence of charge insulated conducting sphere using the method of image, calculate the surface density at a point on the sphere. **10**

OR

A conducting sphere is placed in uniform electric field. Calculate the field intensity and the surface charge density by method of Electrical Image. **10**

UNIT - IV

5 Discuss the boundary conditions for B and H at the interface between two homogeneous magnetic. **10**

OR

Discuss the uniformly magnetised sphere in an external magnetic field. **10**

UNIT - V

6 Obtain an expression for energy in the magnetic field. Prove that the electromagnetic field are invariant under gauge transformation.

$$A \rightarrow A + \nabla\xi$$

$$\phi \rightarrow \phi - \frac{1}{C}\frac{\partial \xi}{\partial t}$$

10

OR

Obtain Poynting theorem for the conservation of energy in an electromagnetic field and discuss the physical meaning of each term. **10**
