A–090

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MSCPH–508

M.Sc. PHYSICS (MSCPH)

(Electrodynamics)

2nd Semester Examination, 2024 (June)

Time : 2:00 Hrs. Max. Marks : 70

Note* :–** This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these Sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

Section–A

(Long Answer Type Questions) 2×19=38

***Note* :–** Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. What are electrostatic boundary conditions ? Describe briefly their applications.

2. Write short notes on :

   (a) Bremstralung

   (b) Time, space and light like separations

   (c) Larmor's formula and its relativistic generalization.

3. What is the concept of magnetic vector potential ? A spherical shell of radius R, carrying a uniform surface charge σ, is set spinning at spinning at angular velocity ω. Find the vector potential it produces at point r.

4. Explain the boundary conditions in Maxwell's equations. How these conditions are useful to describe the theory of reflection and refraction of electromagnetic waves.

5. Establish an expression for the total energy stored in electromagnetic field. What is the differential version of Pointing's theorem ? Compare it with continuity equation, expressing conservation of charge.

Section–B

(Short Answer Type Questions) 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Determine the amount of outward electrostatic pressure on the surface of a conductor having surface charge density σ.

2. A metallic sphere of radius '*a*' carries a charge Q. It is surrounded by another sphere of radius '*b*' filled with linear dielectric material of permittivity $\in$. Find the potential at the center.

3. What is the Susceptibility, Permittivity and Dielectric constant of any dielectric ? Establish a relation between these parameters.

4. Find the magnetic field at a distance *z* above the center of a circular loop of radius R, which carries a current I.

5. Find the vector potential of an infinite solenoid with '*n*' turns per unit length, radius R and current I.

6. Show that the energy stored per unit volume in a magnetic field is $B^2/2\mu o$.

7. Derive an expression for the momentum per unit time flowing through the surface.

8. What do you understand by guided wave ? Prove that TEM wave cannot occur in a hollow wave guide.

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