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MPHY-603

Electrodynamics

M.Sc. Physics (MSCPHY)

3rd Semester Examination, 2022 (Dec.)

Time : 2 Hours] **[Max. Marks : 35**

Note : This paper is of Thirty Five (35) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A
(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only. (2×9½=19)

1. Explain Gauss law of electrostatics. Using Gauss law, compute the electric field due to continuous surface charge distribution.

2. Derive the equation of continuity $\frac{\partial \rho}{\partial t} = -\vec{\nabla} \cdot \vec{j}$ and discuss its physical significance.

3. Write Maxwell's equations in differential and integral forms. Explain and show how displacement current led to the modification of Ampere's law.

4. Derive an energy conservation principle (Poynting's Theorem) from Maxwell equations.

5. What are Lienard Wiechert potentials? Calculate the electric and magnetic field vectors for a uniformly moving charged particle using Lienard Wiechert potentials.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. Write Poisson's equation. Explain the importance of Poisson's equation in electrostatics.

2. Describe the magnetic interaction between two current loops.

3. Write an expression for skin depth in case of good conductor. Find the ratio of skin depth in Copper at 1 KHz to 100 MHz.

4. How a potential V can be expressed in multiple expansion with r in monopole, dipole and quadrupole.

5. State the Farady's law of induction for moving medium.

6. Find the displacement current density for a filed E = 250 Sin $10^{10}t$ V/m in a medium having conductivity 5 S/m and dielectric constant (εr) = 1.

7. Using Maxwell equations derive the expression for electromagnetic waves in conducting medium.

8. Explain why it is not possible to have a consistent model for a stable atom based on the laws of classical mechanics and electrodynamics.