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MPHY-603

Electrodynamics

M.Sc. Physics (MSCPHY)

3rd Semester Examination, 2023 (June)

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. Candidates should limit their answer to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

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. Describe the polarization in dielectric materials. Derive an expression of electric field due to polarized dielectric.

2. Derive the boundary conditions for electric field (E) and electric displacement vector (D) for a dielectric-dielectric boundary (or interface). There are no free surface charges at the interface.

3. Derive *Maxwell's* correction of *Ampere's* law and explain the significance of displacement current.

4. Deduce the equation for the propagation of the plane electromagnetic wave in free space and prove that the electromagnetic waves are transverse.

5. Derive an expression for the radiated energy from a high velocity electorn moving with an acceleration parallel to the velocity.

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 and explain the *Poisson's* and *Laplace* equations in electrostatics.

2. Discuss the notion of motional and transformer emf with mathematical derivation.

3. State *Gauss's law* in electrostatics. Using this law prove that, $\nabla . D = \rho$. Where D is electric displacement vector and ρ is volume charge density.

4. State *Biot-Savart* law. Write down the expression for magnetic field B, due to current (I) carrying thin infinite wire at a distance R from the wire (perpendicular direction).

5. For a given potential $V= 10 (x^2 + xy)$, calculate electric field intensity (E) at a point P (2,1,3).

6. For a conductor having conductivity $\sigma = 5.8 \times 10^7$ mho/m and relative dielectric constant, $\varepsilon_r = \lambda$, calculate the relaxation time for the charge carrier.

7. Write *Maxwell's* equations in differential and integral forms with their physical significance.

8. Write short notes on *Bremsstrahlung* and *Cerenkov* radiation.
