LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

THIRD SEMESTER – **NOVEMBER 2023**

UPH 3501 – ELECTRICITY AND MAGNETISM

Date: 31-10-2023   Dept. No.   Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

PART – A

Q.No Answer ALL questions   **(10 × 2 = 20 Marks)**

1. Define electric dipole and its moment.
2. What is electric flux? Provide its unit.
3. State Coulomb's fundamental law.
4. What is a dielectric? Can you provide some examples?
5. Define Ampere's circuital law.
6. Under what condition is Laplace's equation, $\Delta^2 \varphi = 0$ valid.
7. Define one Henry.
8. List any four characteristics of EM wave.
9. State Faraday's law of electromagnetism.
10. What does "displacement current" mean?

PART B

Answer any FOUR questions   **(4 × 7.5 = 30 Marks)**

11. State Gauss's law in electrostatics and provide its proof.
12. Compare the electric displacement vector with electric field. Derive the relationship between D, E and P.
13. Using Ampere circuital law, determine the magnetic field at any point (i) on (ii) inside and (iii) outside the toroid.
14. What is the Gyromagnetic ratio? Provide an explanation.
15. Explain mutual induction and derive an expression for the mutual-inductance of two long co-axial solenoids.
16. By applying Maxwell's equations, deduce the equation for the propagation of plane electromagnetic waves in free space.

PART C

Answer any FOUR questions   **(4 × 12.5 = 50 Marks)**

17. Using Biot-Savart's law, derive an expression for the magnetic field due to current carrying (a) a straight line conductor and (b) along the axis of a circular coil.
18. Define dielectric breakdown and discuss its various types.
19. Explain the operation of Helmholtz coils and derive an expression for the resultant magnetic field at the midpoint between the coils.
20. Detail the motion of a charged particle when subjected to crossed electric and magnetic fields.
21. Contrast self and mutual inductions. Also derive an expression for the self-inductance of a long solenoid.
22. Provide interpretations and derivations for all four Maxwell equations.