LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

THIRD SEMESTER – **NOVEMBER 2022**

UPH 3501 – ELECTRICITY AND MAGNETISM

Date: 24-11-2022   Dept. No.   Max. : 100 Marks
Time: 09:00 AM - 12:00 NOON

PART – A

Answer ALL the questions   **(10 x 2 = 20 Marks)**

1. State Coulomb's law.
2. Show that curl of electric field is zero.
3. Define current density.
4. Calculate the voltage needed to balance an oil drop carrying 10 electrons when located between the plates of a capacitor which are 5mm apart. The mass of oil drop is 3×10^{-16} Kg.
5. Define 1 Ampere.
6. Calculate the magnetic field intensity due to a long straight conductor carrying a current of 150 A at a distance of 5 cm.
7. State Faraday's I and II law.
8. What is mutual induction?
9. Distinguish between displacement current and conduction current.
10. Write any two characteristics of electromagnetic waves.

PART – B

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

11. State and prove Gauss's law in electrostatics.
12. Define electric potential and derive an expression for electric potential at a point 'r' due to a point charge q.
13. What is electronic polarization? Derive an expression for electronic polarizability of an atom.
14. What is meant by self-induction? Derive an expression for the self-inductance of a long solenoid.
15. Derive Maxwell's fourth equation in differential form.
16. Deduce the equation for the propagation of the plane electromagnetic waves in free space.

PART – C

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

17. Derive an expression for electric potential and field at a point 'r' due to an electric dipole.
18. Find the electric field strength due to a uniformly charged ring of radius 'a' at a point located on the axis of the ring at a distance 'x' from its center.
19. What is dielectric break down? Explain all the types of dielectric breakdown.
20. State Biot-Savart Law. Derive an expression for magnetic induction at a point due to an infinite straight conductor carrying current.
21. (i) Derive an expression for potential energy of a dipole in a uniform electric field. (8 marks)

    (ii) Write a note on different mechanisms for producing change of magnetic flux. (4.5 marks)

22. State and prove Poynting theorem for the flow of energy in an electromagnetic field.