LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

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

FIFTH SEMESTER – **NOVEMBER 2024**

PH 5512 – ELECTRICITY AND MAGNETISM

Date: 22-11-2024 Dept. No. Max. : 100 Marks

Time: 01:00 pm-04:00 pm

SECTION A

Answer ANY FOUR of the following **4 x 10 = 40 marks**

1. Derive Laplace's equations from Gauss's law and explain their significance in electrostatics.
2. State Kirchhoff's laws and explain their use in finding the EMF and internal resistance of a cell.
3. What are the principles and applications of the Carey Foster's bridge potentiometer?
4. State Biot-Savart's law and apply it to derive the magnetic field due to a straight current-carrying conductor and a circular coil.
5. Define self and mutual inductance. Explain experimental methods for determining self-inductance and mutual inductance of coils.
6. Explain Ampere's circuital law and its application to determine the magnetic field inside a long solenoid.
7. Explain the working of a transformer and discuss how the power factor affects the performance of AC circuits.
8. Discuss the differences between diamagnetic, paramagnetic, and ferromagnetic materials.

SECTION B

Answer ANY THREE of the following **3 x 20 = 60 Marks**

9. Discuss the concept of polarization in dielectrics and derive the relationship between D, E, and P (displacement, electric field, and polarization).
10. Explain the Clausius-Mossotti equation and discuss the relationship between dielectric constant, electric susceptibility, and permittivity.
11. Explain Peltier, and Thomson effects in thermoelectricity. Discuss how thermo emf can be determined and the applications of thermoelectric power.
12. Discuss the theory of a moving coil ballistic galvanometer, including its construction, working principle, and damping correction.
13. Explain the concepts of peak, average, and RMS values of alternating current and their importance in AC circuit analysis.
14. State Maxwell's equations and derive the wave equation for electromagnetic waves in free space.

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