



K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

Rollno.....

End Semester Examination, December 2024
B.Sc. (Hons./Hons. with Research) – 1st Semester
ELECTRICITY AND MAGNETISM (SCPH103)

Time: 2.5 hrs.

Max Marks: 50

Note: *All Questions are compulsory. Marks are indicated against each question.*

PART-A

Q.1 *First question consists of 7 small questions out of which student has to attempt 5 questions and understanding level will be assessed.*

- (a) Describe Solid angle. Obtain the solid angle subtended by sphere at its centre. [CO-1] [L-2] 2
- (b) Define electric flux density. [CO-1] [L-] 2
- (c) Write the expression for force on a charge q_0 moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$.
Discuss the case when the force is maximum? [CO-1] [L-2] 2
- (d) Explain susceptibility [CO-1] [L-2] 2
- (e) Write Maxwell's first equation and give its significance. [CO-1] [L-2] 2
- (f) Why soft iron is used to make core of transformers? [CO-1] [L-2] 2
- (g) Show that the function $\phi = x^2 - y^2 + z$ satisfies Laplace's equation [CO-1] [L-2] 2

2x5

PART-B

There are four questions each covering one specific Course Outcome from the complete syllabus. There is an internal choice in each of the questions covering the same (set) of COs and BL.

- Q.2 Apply Ampere's Circuital Law to calculate the magnetic field due to an infinite hollow cylinder carrying current. [CO-2] [L-3] 10

OR

Determine the effect of electric field on a dipole? What is the torque acting on it? An electric dipole consists of two opposite charges of magnitude $q = 3 \times 10^{-6}$ C separated by 4 cm. Dipole is placed in field of 4×10^5 N/C. Calculate the work done to turn the dipole through 180° , starting from position $\Theta = 0$. [CO-2] [L-3] 10

- Q.3 Analyze the relationship between the magnetic flux, current and number of turns to obtain the self inductance of a coil. What is its relation with induced emf in the circuit? [CO-3] [L-4] 10

OR

Analyze the relationship between Biot-Savart's law and Gauss's law in magnetism. Use the Biot-Savart law to examine why the divergence of the magnetic induction through any closed surface is zero.

[CO-3] [L-4] **10**

- Q.4 Evaluate the significance of displacement current in modifying Ampere's Law to derive Maxwell's equations. Why is it essential for charge conservation? [CO-4] [L-5] **10**

OR

Evaluate the electric field at a given point near a conducting plane. Critically analyze the effect of the conducting plane on the field distribution. Justify the mathematical approach suitable for evaluating the potential and electric field at the given point.

[CO- 4] [L-5] **10**

- Q.5 Consider the polarization of dielectric and analyze the relation between three electric vectors. Also for a potential given by $V(x,y,z) = (4x^2 + 3y^2 + 9z^2)^{-1/2}$ volt, Calculate the electric field strength at the point (1,2,3) [CO-3] [L-4] **10**

OR

Categorize different types of magnetic materials. Analyze the hysteresis loop for a ferromagnetic material. How is it helpful in understanding the behaviour of the Ferromagnetic material

[CO- 3] [L-4] **10**