

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 2928

L

Name of Course: B.Sc. Prog.–Physical Sciences with Industrial Chemistry NEP:

UGCF-2022

Semester: VI- Semester (DSC Paper)

Name of the Paper: Electricity and Magnetism

Unique Paper Code:

Medium of setting the Question paper: English Language

Maximum marks: 60

Duration: 2 hours

Answer any *four* questions. Q1 is compulsory.

All questions carry equal marks. Use of scientific calculator is allowed

Q1 Answer and *five* questions

- Define electrostatic potential V and hence derive $\mathbf{E} = -\nabla V$
- Calculate the magnetic induction vector $\mathbf{B}$ at a point distant 2m from the center of a circular coil of radius 1 mm carrying a current of 0.5 Amp along its axis.
- Show that the energy density in a magnetic field is equal to $(1/2\mu_0)B^2$
- Give three differences between dia, para and ferromagnetic materials.
- Define magnetic susceptibility and magnetic permeability and derive a relation between them.
- State Norton and Superposition network theorem. [5x3]

Q2

- State Gauss law of electrostatics. Use this law to determine the electric field due to a uniformly charged sphere at points lying outside and inside the sphere.
- Show that $\mathbf{E}$ is a conservative field. [10,5]

Q3

- State Ampere's circuital law. Write its integral form and hence show that $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$ where symbols have their usual meanings. How is it modified in the presence of a core material?
- Derive an expression for the torque acting on a magnetic dipole placed in a uniform magnetic field. [9,6]

Q4

- a) What is Biot-Savart's law? Use it to prove $\nabla \cdot \mathbf{B} = 0$. Write its significance.
- b) Two long parallel wires each carrying a current of 10 Amp in the same direction are separated by 10 cm. Calculate the force between the wires per unit length. [8,7]

Q5

- a) Define Self Inductance (L) and Mutual Inductance (M).
- b) State Lenz's law and show that it does not violate the law of conservation of energy
- c) Write differential and integral forms of Maxwell's electromagnetic field equations using μ_0 , ϵ_0 , ρ , and $\mathbf{j}$. Discuss significance of each of these equations. [3,4,8]