

FYUGP/3rd Sem/25(NEP)New

2025

Four Year Under Graduate Programme (FYUGP)

3rd Semester Examination (Under NEP)

(New Session 2024-25)

PHYSICS (Major)

Paper Code : PHSMJ DC-302

(Electricity and Magnetism)

Full Marks : 30

Time : Two Hours

The figures in the margin indicate full marks.

*Candidates are required to give their answers
in their own words as far as practicable.*

1. Answer any six questions : $1 \times 6 = 6$

(a) State Coulomb's law for electrostatic force between two point charges.

(b) The electric potential at the surface of a uniformly charged solid sphere of insulator is 20 V. What is the electric potential at its centre?

(c) What is the Lorentz force?

(d) State Ohm's law.

(e) Define electric susceptibility and dielectric constant.

P.T.O.

(f) What is meant by magnetic flux?

(g) State Norton's theorem.

(h) What is the SI unit of magnetic field (B)?

2. Answer any *three* questions : $3 \times 3 = 9$

(a) Obtain the differential form of the Gauss's law from its integral form.

(b) Two parallel beams of electrons moving in the same direction repel each other. But two wires carrying current in the same direction attract each other. Explain.

(c) State three differences between dia-, para- and ferromagnetic materials.

(d) Show that the electrostatic field is conservative.

(e) State and explain Biot-Savart's law.

3. Answer any *three* questions : $5 \times 3 = 15$

(a) (i) Determine the self-inductance of toroid with N number of uniform turns. The inner and outer radii of the toroid are r_1 and r_2 respectively and its width is h .

(ii) Show that the magnetic energy stored in a circuit having self-inductance L and

carrying current I , is given by $U = \frac{1}{2} LI^2$.

2+3

(3)

- (b) State and explain Lenz's law in the context of self-induction. Show how it supports the law of conservation of energy. 3+2
- (c) Show that the electrostatic field is conservative. What is polarization of a dielectric? 3+2
- (d) Derive Curie's law for paramagnetic materials and explain the physical significance of Curie constant. 3+2
- (e) Using Thevenin's theorem, find the value of the current through the 6Ω resistor in the circuit shown in the figure below — 5

