

22140

II SEMESTER B.Sc. EXAMINATION, JULY/AUGUST 2023

SCHEME: SEMESTER (NEP)

013

PHYSICS, PAPER-II

ELECTRICITY AND MAGNETISM

Time: 2 ½ Hours

Max Marks: 60

**Instruction:** Answer all questions from Part A, any three from Part B and any four from Part C.

PART - A

I. Answer following questions.

4x10=40

1. a) State and explain Gauss law. Derive an expression for electric field due to a uniformly charged infinite plane sheet.

CO1 LL2 7

b) Obtain the relation between electric field and electric potential.

CO1 LL2 3

OR

a) Explain gradient of a scalar function.

CO1 LL2 3

b) Derive an expression for electric potential due to an electric dipole.

CO1 LL2 7

2. a) What capacitance of a capacitor ? and hence define Farad.

CO2 LL1 4

b) Obtain the expression for capacitance of a parallel plate capacitor without dielectric medium.

CO2 LL2 6

OR

a) State and explain Ohm's law.

CO2 LL1 4

b) Obtain an expression for decay of charge in RC circuit fed with dc source.

CO2 LL2 6

3. a) Obtain an expression for Hall voltage.

CO3 LL2 6

b) Derive an expression for quality factor using LCR series circuit.

CO3 LL2 4

OR

a) State and explain Ampere's circuital law. Express it in differential form.

CO3 LL1 4

b) Derive an expression for magnetic field due to a current carrying conductor.

CO3 LL2 6

4. What are plane electromagnetic waves? Set up Maxwells equations

$$(i) \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

$$(ii) \nabla \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$$

CO4 LL2 10

OR

a) Obtain an expression for energy transported by EM waves.

CO4 LL2 6

b) What are diamagnetic and paramagnetic materials? Give examples.

CO4 LL1 4

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PART – B

II. Answer any three of the following questions.

3x4=12

5. The electrostatic force between two like ions that are separated by  $5 \text{ \AA}$  is  $3.7 \times 10^{-9} \text{ N}$ . What is the charge on each ion? Given  $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$ . CO1 LL3 4
6. A capacitor of capacitance  $10 \mu\text{F}$  is charged to  $10 \text{ V}$ . What is the energy stored in it? CO2 LL3 4
7. A series LCR circuit has  $L = 500 \mu\text{H}$ ,  $C = 200 \mu\text{F}$  and  $R = 32 \Omega$ . The supply voltage is  $5 \text{ V}$ . Calculate the resonant frequency and current at resonance. CO3 LL3 4
8. A parallel plate capacitor of area  $6 \text{ cm}^2$  having separation between the parallel plates of  $2 \text{ mm}$  has a voltage  $\frac{dV}{dt} = 50 \text{ KV}$  applied to its plates. Calculate the displacement current (Given  $k=2$ ,  $\epsilon_0 = 8.85 \times 10^{-12} \text{ F/m}$ ). CO4 LL3 4

PART – C

III. Answer any four of the following questions.

4x2=8

9. a) State and explain Coulomb's law. CO1 LL1 2
- b) What are equipotential surfaces? CO2 LL1 2
- c) What is a dielectric material? Give example. CO2 LL1 2
- d) Explain current density. CO3 LL1 2
- e) What is Hall effect? CO4 LL1 2
- f) Write the relation for power factor in RL and RC circuit. CO4 LL1 2

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