

61321

**Third Semester B.Sc. Degree Examination,
August/September 2021**

(CBCS - Freshers and Repeaters)

Physics

Paper III – ELECTRICITY AND MAGNETISM

Time : 3 Hours]

[Max. Marks : 70

Instructions to Candidates : Answer any **FIVE** questions from each Part.

PART – A

Answer any **FIVE** questions. Each question carries **8** marks : **(5 × 8 = 40)**

1. State and prove superposition theorem. **(8)**
2. (a) Derive an expression for the growth of current in a series LR circuit.
(b) Define time constant and its significance in LR circuit. **(6 + 2)**
3. (a) State and explain Biot-Savart's law.
(b) Derive an expression for the magnetic field at a point near a straight conductor carrying current using Biot-Savart's law. **(3 + 5)**
4. Give the principle, construction and theory of moving Coil Ballistic galvanometer and obtain an expression for the charge flowing through it. **(8)**
5. (a) Derive the Maxwell's equation $\vec{\nabla} \cdot \vec{D} = \rho$
(b) Give any four properties of electromagnetic waves. **(4 + 4)**
6. (a) Obtain an expression for the velocity of electromagnetic wave in free space.
(b) Mention any two factors on which refractive index of a material medium depends. **(6 + 2)**

7. (a) What is an acceptor circuit? Mention its significance.
 (b) Derive an expression for the impedance of series LCR circuit using vector method. **(2 + 6)**
8. (a) State the laws of thermo electricity.
 (b) Discuss the variation thermoemf with the temperature of hot junction assuming the cold junction temperature to be zero. **(4 + 4)**

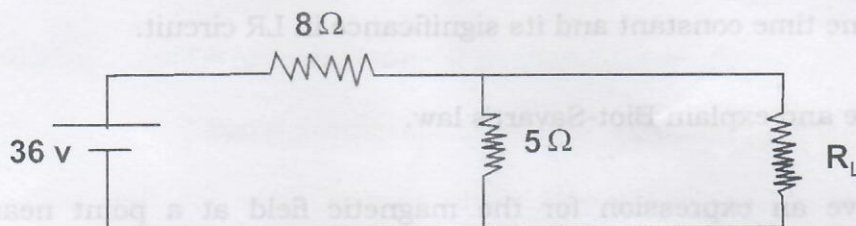
PART - B

Solve any **FIVE** problems. Each problem carries **4** marks : **(5 × 4 = 20)**

(permeability of free space = $\mu_0 = 4\pi \times 10^{-7} \text{Hm}^{-1}$)

(permittivity of free space = $\epsilon_0 = 8.854 \times 10^{-12} \text{Fm}^{-1}$)

9. Find the value of R_L and maximum power for the circuit.



10. The time constant of a certain inductive coil was found to be 2.5 ms. With a resistance of 80Ω added in series, a new time constant of 0.5 ms was obtained. Find the inductance and resistance of the coil.
11. A straight solenoid of length 4 m is wound uniformly on a glass of diameter 0.02 m. If there are 1000 turns, calculate the strength of the magnetic field at the centre of the solenoid when a current of 1 A flows through it.
12. A Helmholtz tangent galvanometer has coils of radius $11 \times 10^{-2} \text{m}$ and number of turns $70\sqrt{5}$. Calculate the current through the coils which produces a deflection of 45° . What will be the deflection if the current is doubled? ($B_H = 0.32 \times 10^{-4} \text{T}$).

13. The Voltage between the plates of a parallel plate capacitor of capacitance $1\mu F$ is changing at the rate of 5 V/s . What is the displacement current in the capacitor?
14. Assuming $\mu = \mu_0$, calculate the skin depth in Aluminium of conductivity $3.75 \times 10^7\text{ mho m}^{-1}$ for the electromagnetic waves of frequency of 10^7 Hz .
15. An electric lamp takes a current of 10 A when connected to a 100 V DC supply. If it is to be run by 200 V , 50 Hz AC supply, what is the value of the inductance required?
16. Calculate the thermo emf, neutral temperature and temperature of inversion of a thermo couple between 0°C and 80°C for which seebeck coefficients are $a = 12\ \mu\text{V}/^\circ\text{C}$ and $b = -0.026\ \mu\text{V}/^\circ\text{C}^2$.

PART - C

17. Answer any **FIVE** questions. Each question carries **2** marks : **(5 × 2 = 10)**
- (a) When is the power transferred from a source to a load maximum? Explain.
- (b) Is the field produced in a Toroid Uniform? Why?
- (c) Why do we prefer phosphour-Bronze alloy for the suspension wire of moving coil ballistic galvanometer?
- (d) Does the current carrying solenoid contract? Explain.
- (e) Is Lenz's law in accordance with the law of conservation of Energy? Explain.
- (f) Is the average value of an AC over one complete cycle zero? Why?
- (g) Why LCR parallel circuit is called rejector circuit? Explain.
- (h) Why is lead used as a reference metal in thermoelectricity?