



III Semester B.Sc. Examination, Nov./Dec. 2018
(CBCS) (2017-18 and Onwards)

(Fresh + Repeaters)

PHYSICS – III
Electricity and Magnetism

Time : 3 Hours

Max. Marks : 70

Instruction : Answer **any five** questions from **each Part**.

PART – A

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

1. a) What is an ideal voltage source ? Represent V-I characteristics of ideal and practical voltage sources.

b) State and explain Norton's theorem. (3+5)

2. a) Derive an expression for the self inductance of a solenoid.

b) Derive an expression for the growth of current in LR circuit connected to a d.c. source. (3+5)

3. a) Mention the conditions for a moving coil galvanometer to be dead beat.

b) Explain with a neat diagram the experimental determination of high resistance by leakage using ballistic galvanometer. (3+5)

4. a) State and prove Ampere's circuital law.

b) Using Ampere's circuital law obtain an expression for magnetic field at a point inside a long solenoid carrying current. (4+4)

5. a) Write the equation of continuity. What is its physical significance ?

b) Write the four Maxwell's field equations. Derive $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$. (2+6)

6. a) Derive $\nabla^2 E = \mu_0 \epsilon_0 \frac{\partial^2 E}{\partial t^2}$.

b) State Poynting theorem.

(6+2)

P.T.O.





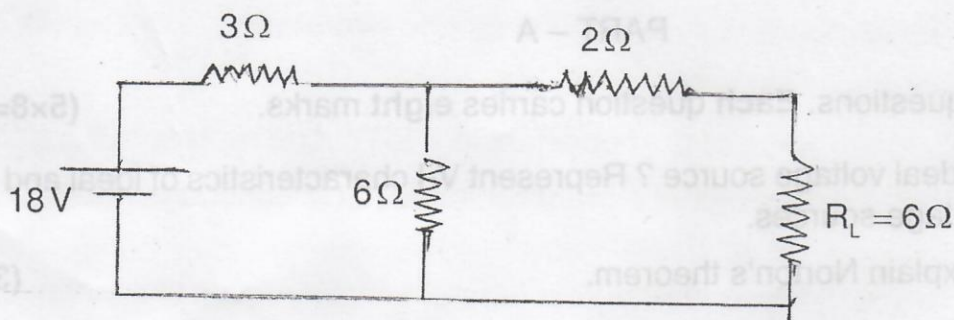
7. Derive expressions with diagram for impedance, current and phase angle of a series CR ac circuit by j operator method. 8
8. a) State and explain the laws of thermo-electricity.
b) Explain with a neat diagram Thermopile. (4+4)



PART - B

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

9. In the given circuit find the current through R_L using Thevenin's theorem.



10. How many time constants will be taken by a condenser to gain 99% of its steady state charges in a CR circuit ?
11. Two parallel wires each of length 3 m kept 20 cm apart carry currents of 20 A and 30 A respectively in the same direction. Calculate the force acting. What is the nature of this force ? Given $\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$.
12. An electric current I is flowing in a circular wire of radius $\sqrt{3}$ m. At what distance from the centre on the axis of circular wire will the magnetic field be $1/8^{\text{th}}$ of its value at the centre ?
13. Yellow light of frequency $5.09 \times 10^{14} \text{ Hz}$ enters diamond. Calculate the wavelength and speed of wave propagation in diamond. At this frequency diamond has $\epsilon_r = 5.84$ and $\mu_r = 1$. Given $C = 3 \times 10^8 \text{ ms}^{-1}$.
14. An electromagnetic wave of frequency 2 MHz is propagating in a conducting medium. The medium is silver for which conductivity is $6.8 \times 10^7 \text{ Sm}^{-1}$ and $\mu_r = 1$. Calculate the skin depth. Given $\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$.





15. An alternating voltage of 110 V, 50 Hz is applied to a circuit containing a resistance of 200Ω , an inductance of 5 H and a capacitance of $2 \mu\text{F}$ connected in series. Calculate the impedance and the current in the circuit.
16. The emf of a certain thermocouple varies with temperature θ of the hot junction when the cold junction is kept at 0°C as $e = 40 \theta - \frac{\theta^2}{20}$. Find the neutral temperature and the temperature of inversion.

PART – C

17. Answer **any five** questions. **Each** question carries **two** marks. **(5×2=10)**
- a) Self inductance is called electrical inertia. Justify.
 - b) What does a small value of time constant in a LR circuit represent ? Explain.
 - c) Is the direction of displacement current same as that of conduction current ? Explain.
 - d) Does a current carrying conductor kept parallel to the direction of a magnetic field get deflected ? Explain.
 - e) Do magnetic monopoles exist ? Explain.
 - f) Does the skin depth for a good conductor increase with increasing wave frequency ? Explain.
 - g) What is a rejector circuit ? Why is it so called ?
 - h) Is Peltier effect reversible ? Explain.

