



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. (3+5)
- b) State and explain Norton's theorem. (3+5)
2. a) Derive an expression for the self inductance of a solenoid. (3+5)
- 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. (3+5)
- 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. (4+4)
- 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 ? (2+6)
- b) Write the four Maxwell's field equations. Derive  $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ . (2+6)
6. a) Derive  $\nabla^2 E = \mu_0 \epsilon_0 \frac{\partial^2 E}{\partial t^2}$ . (6+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.

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8. a) State and explain the laws of thermo-electricity.

b) Explain with a neat diagram Thermopile.

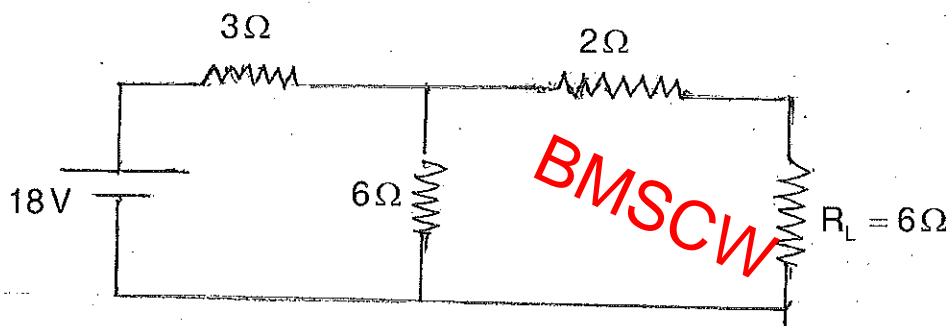
(4+4)

## 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 200  $\Omega$ , 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  $\theta$  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. **(5x2=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.

BMOCW

$E_{ind} = V_{L.D}$

$I = 18$      $P = 10$

$V = 220$      $200 \times 10$

$300 \times 9$      $200 \times 10$      $11.0$

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$I_1 = \frac{E_{ind}}{R_{total}}$      $\frac{10}{200}$      $\frac{10}{200}$

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