SS – 324

III Semester B.Sc. Examination, November/December 2018
(Repeaters) (CBCS/NS) (NS – 2012-2013 and Onwards)
(Prior to 2017-18)
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 electric dipole ?
   b) Obtain an expression for electric potential at any point due to a short electric dipole. **(2+6)**

2. State and prove maximum power transfer theorem. **8**

3. a) Assuming the expression for resultant magnetic field, derive an expression for the current through Helmholtz galvanometer.
   b) What are eddy currents ? How are they minimised ? **(4+4)**

4. a) State Faraday's laws of electromagnetic induction.
   b) Derive an expression for magnetic field due to a long straight conductor carrying current. **(2+6)**

5. a) Derive an expression for the energy stored in an inductor.
   b) State and explain coefficient of self induction. **(5+3)**

6. Derive Maxwell's field equations

$$\vec{\nabla}\cdot\vec{B}=0 \text{ and } \vec{\nabla}\times E=-\frac{\partial\vec{B}}{\partial t}$$ **8**

7. a) Derive an expression for current through an A.C. circuit containing capacitor and resistor.
   b) Write a note on wattless current. **(6+2)**

8. a) Define neutral temperature and inversion temperature.
   b) What is Thomson effect ? Describe an experiment to demonstrate Thomson effect. **(2+6)**

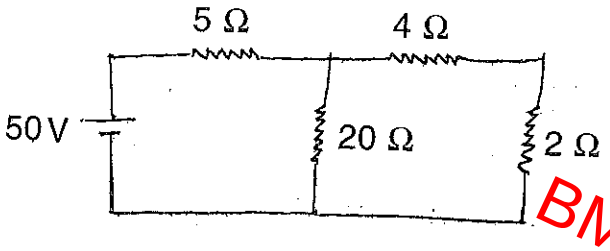
P.T.O.

PART – B

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

9. If two point charges +4 μc and –4 μc are placed at two corners of an equilateral triangle of side 0.3 m, find the magnitude and direction of their resultant at the third corner.

10. Using Thevenin's theorem, find the current through 2Ω for the circuit shown in the figure



11. The magnetic field due to a current carrying circular loop of radius 0.12 m at its centre is 0.5×10^{-4} T. Find the current through the coil. Given $\mu_0 = 4\pi \times 10^{-7}$ Hm^{-1}.

12. A coil with an average diameter of 0.02 m is placed perpendicular to a magnetic field of 6000 T. If the induced emf is 11V when the magnetic field is changed to 1000 T in 4S, what is the number of turns in the coil ?

13. In an L-R circuit, the current attains $\left(\frac{1}{3}\right)$ of its final steady value in one second after the circuit is closed. What is the time constant of the circuit ?

14. Electromagnetic waves travel in a medium at a speed of 2×10^8 ms^{-1}. The relative permeability of the medium is unity. Find the relative permittivity. Given $C = 3 \times 10^8$ ms^{-1}.

15. An ac voltage of 100 V is applied to a circuit consisting of an inductance of 10 mH, a capacitor of 1 μF and a resistance of 10 Ω. Calculate the frequency at which the circuit will be in resonance with the current of the same frequency and find the value of current.

16. Calculate the thermo emf of silver-Iron thermocouple with junctions at 0°C and 80°C given a = 13.31 μv/°C and b = –0.019 μv/°C^2.

PART – C

17. Answer **any five** questions. **Each** question carries **two** marks. **(5×2=10)**

a) Is repulsion a sure test for electrification ? Justify.

b) Does the solenoid contract when a current is passed through it ? Explain.

c) Why two coils are used in Helmholtz galvanometer instead of single coil ?

d) A charge is kept near a magnet will it experience a force ? Explain.

e) Does a current loop behaves as a magnetic dipole ? Explain.

f) Is the phase difference between the applied voltage and current in an LCR series ac circuit at resonance is zero ? Explain.

g) Is the average value of an ac is taken over one complete cycle ? Explain.

h) Is Peltier effect reversible ? Explain.