QP – 158

III Semester B.Sc. Examination, March/April 2022
(F+R) (CBCS) (2017 – 18 and Onwards)
PHYSICS – III
Electricity and Magnetism

Time : 3 Hours Max. Marks : 70

Instructions : *i) Answer **any five** questions from **each** Part.*
*ii) **Use** of Non-programmable scientific calculators are **permitted**.*

PART – A

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

1. a) What is an ideal voltage source ?
   b) State and explain Norton's theorem. **(2+6)**

2. a) Define Self-Inductance of a coil.
   b) Obtain an expression for the growth of charge in a C-R circuit and represent it graphically. **(1+7)**

3. a) State and explain Ampere's circuital law.
   b) Obtain an expression for Magnetic field at a point inside a long solenoid carrying current. **(2+6)**

4. a) Give the conditions for moving coil Galvanometer to be Dead beat.
   b) Describe the experimental determination of high resistance by leakage using Ballistic Galvanometer (BG). **(2+6)**

5. a) State Gauss Divergence theorem.
   b) Show that Electro Magnetic waves are transverse in nature. **(2+6)**

6. Derive Maxwell's equation

   $\nabla.D = \rho$

   $\nabla.B = 0$ **(4+4)**

P.T.O.

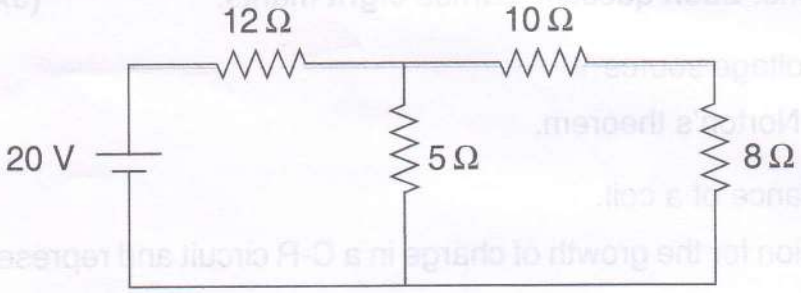
7. a) Define RMS value of AC.
   b) Obtain an expression for current and impedance of a series L-R circuit using J-operator method. **(2+6)**

8. Applying the Laws of Thermodynamics to a thermo couple, derive expressions for Peltier co-efficient and Thomson co-efficient.

PART – B

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

9. Using Thevenin's theorem, calculate current through 8Ω resistor in the following circuit.



10. A rectangular coil of length 10 cm and breadth 5 cm having 1000 turns is suddenly removed from a magnetic field 120×10^{-2}T acting perpendicular to the plane of the coil in 1 ms. Find the induced emf in the coil.

11. Two parallel conductors each of length 5 m separated by a distance of 30 cm carry currents of 10 A and 20 A respectively in the opposite direction. Calculate the force acting [$\mu_0 = 4\pi \times 10^{-7}$H/m] between them.

12. The radius of circular coil is 0.1 m. Find the ratio of magnetic fields at two points 0.1 m and 0.2 m from the centre.

13. If $\phi = 2x^2 - y^3 + z^2$. Find div (grad ϕ).

14. Calculate the skin depth for an Electro magnetic wave of frequency 2×10^6 Hz incident on copper.
    Given $\sigma = 5.8 \times 10^7$ ohm^{-1} m^{-1}
    $\mu_r \doteq 1$.

15. A coil of 40 mH and negligible resistance is connected across AC source of frequency 1000 Hz. The effective current through the coil is 2.5 mA. Calculate the voltage across the coil.

16. The thermo emf of a thermocouple is given by $e = 100\,\theta - \frac{1}{30}\theta^2 \mu V$. Determine the neutral temperature and temperature of the couple inversion.

PART – C

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

a) Can we apply superposition theorem to circuits containing active devices ? Explain.

b) What is the effect of superposing two magnetic fields having the same period and strength but a phase difference of $\pi/2$?

c) Is it possible for a charge to pass through magnetic field without getting deflected ? Explain.

d) Which Galvanometer has greater sensitivity a TG or HTG ? When the number of turns and radii are same ?

e) Do magnetic mono poles exist ? Explain.

f) Can we have displacement current even in vacuum ? Explain.

g) Why parallel resonance circuit is called rejector circuit ? Explain.

h) Is Seebeck effect reversible ? Explain.