

III Semester B.Sc. Examination, November/December 2017
(CBCS) (2017 – 18 and Onwards) (Fresh)

PHYSICS – III
Electricity and Magnetism



Time : 3 Hours

Max. Marks : 70

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

PART – A

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

1. a) Define an ideal voltage source and current source.
b) State and prove maximum power transfer theorem. (2+6)
2. Obtain an expression for decay of charge in series LCR circuit and mention its special cases. 8
3. a) State and explain Biot – Savart's law.
b) Obtain an expression for the field on the axis of a Solenoid carrying current. (3+5)
4. a) Obtain with necessary theory an expression for the current through the Helmholtz galvanometer.
b) Using Ampere's circuital law obtain an expression for the magnetic field due to a straight conductor carrying conductor. (5+3)
5. a) State and explain Divergence theorem.
b) Derive Maxwell's Equation $\nabla \cdot \mathbf{D} = \rho$ and discuss its physical significance. (2+6)
6. a) Obtain an expression for velocity of electromagnetic waves in free space.
b) State Poynting theorem. (6+2)

P.T.O.



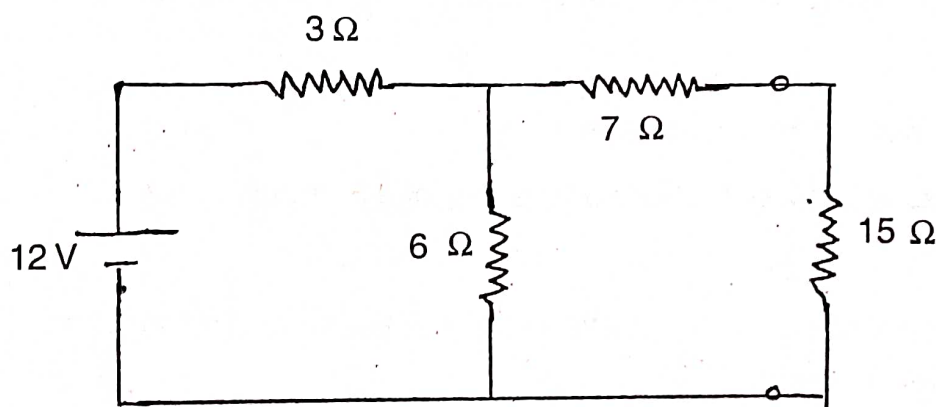
7. a) Derive with a diagram an expression for self inductance of a coil using Maxwell's Bridge. (5+3)
- b) What is Q-factor ? Explain its significance.
8. a) Distinguish between Seebeck effect and Peltier effect.
- b) What is meant by Thermo electric diagrams ? Discuss in detail any two of its applications. (2+6)

PART – B

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

$$\left[\begin{array}{l} \text{Permeability of free space } \mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1} \\ \text{Permittivity of free space } \epsilon_0 = 8.8 \times 10^{-12} \text{ Fm}^{-1} \end{array} \right]$$

9. Using Thevenin's theorem calculate the power delivered across 15Ω .



10. A 0.5 m long solenoid having 500 turns and radius 0.02 m is wound on an iron core of relative permeability 800. What will be the average emf induced in the solenoid if the current in it changes from 0 to 2 amp. in 0.05 sec.

Given $\mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1}$.

11. A uniform magnetic field of magnitude 1.5 Tesla points horizontally from south to north. A proton of energy 5 MeV moves vertically downward through this field. Calculate the force on it.

Given mass of proton = $1.7 \times 10^{-27} \text{ kg}$

Charge = $1.6 \times 10^{-19} \text{ C}$.



12. A condenser of 1000 PF is charged to a potential difference of 1 volt and then discharged through a BG. The first throw on a scale placed away is 0.62 m. If the time period is 10 sec and logarithmic decrement is 0.02, calculate the ballistic constant of the galvanometer.
13. An ac voltage is applied directly across a $10 \mu\text{F}$ capacitor. The frequency of the source is 3 kHz and the voltage amplitude is 30 V. Find the displacement current between the plates of the capacitor.
14. Calculate the skin depth in copper of conductivity $5.8 \times 10^7 \text{ S m}^{-1}$ for the electromagnetic waves of frequency 1 m Hz.

Given $\mu = \mu_0 = 4\pi \times 10^{-7} \text{ H m}^{-1}$
15. A circuit consists of a non inductive resistance of 50Ω , an inductance of 0.3 H and resistance of 2Ω , a capacitor of $40 \mu\text{F}$ in series and is supplied with 200 V at 50 Hz. Find the impedance, I_{rms} and I_{max} in the circuit.
16. Calculate the neutral temperature, temperature of inversion and the total emf of a thermo couple between 0°C and 100°C for which the Seebeck coefficients are $a = 10 \mu\text{V}/^\circ\text{C}$ and $b = -0.025 \mu\text{V}/^\circ\text{C}^2$.

PART – C

17. Answer **any five** questions. **Each** question carries **two** marks. (5×2=10)
- a) Can super position theorem be applied to non linear networks ? Explain.
 - b) Is there any loss of energy due to the production of back emf in an LR circuit ? Explain.
 - c) Does a current loop behave as a magnetic dipole ? Explain.
 - d) Is the field produced in a toroid uniform ? Explain.
 - e) Do magnetic monopoles exist ? Explain.
 - f) Is it possible to have only electric wave or magnetic wave alone propagating through space ? Explain.
 - g) What is the phase difference between the applied voltage and current in an LCR series ac circuit at resonance ? Explain.
 - h) Does thermoelectric effect obey the law of conservation of energy ? Explain.
-