

Second Semester B.Sc. Degree Examination, September 2020

(CBCS Scheme – 2016-18 – Repeaters)

Physics**Paper II (201) – ELECTROSTATICS AND MAGNETISM**

Time : 3 Hours]

[Max. Marks : 90

*Instructions to Candidates : Answers should be written completely in English.***PART – A**Answer any **FIVE** of the following questions. Each question carries **8** marks :**(5 × 8 = 40)**

1. (a) State and explain Gauss divergence theorem.
(b) Explain surface integrals, line integrals and volume integrals. **(2 + 6)**
2. (a) Derive an expression for capacitance of cylindrical capacitor.
(b) Mention three types of electric vectors. Write the relation between them. **(6 + 2)**
3. (a) State and explain Biot-Savart's Law.
(b) Obtain an expression for magnetic field at a point on the axis of circular coil carrying current. **(2 + 6)**
4. Give the theory of Ballistic galvanometer. **(8)**
5. Derive an expression for paramagnetic susceptibility. **(8)**
6. (a) What is Continuity equation of current? Write its equation.
(b) Show that the Electromagnetic waves are transverse in nature. **(2 + 6)**
7. (a) Obtain an expression for growth of current in a circuit consisting of an inductor and a resistor with a steady emf applied to it.
(b) What is the time constant of this circuit?
(c) Represent the growth graphically. **(6 + 1 + 1)**
8. State and prove Thevenin's theorem. **(8)**

PART – B

Answer any **SIX** of the following questions. Each question carries **5** marks :

(6 × 5 = 30)

9. A long copper wire with a radius of 1 mm carries a uniform surface charge density of 5 micro c/m².
- (a) Find the total charge in a 1 m long section of the wire.
- (b) Find the magnitude of the electric field at a distance of 0.15 m from the wire.

10. Find the potential at the centre of a square of side 1 m having charges q , $-3q$, $4q$ and $2q$ at its corners.

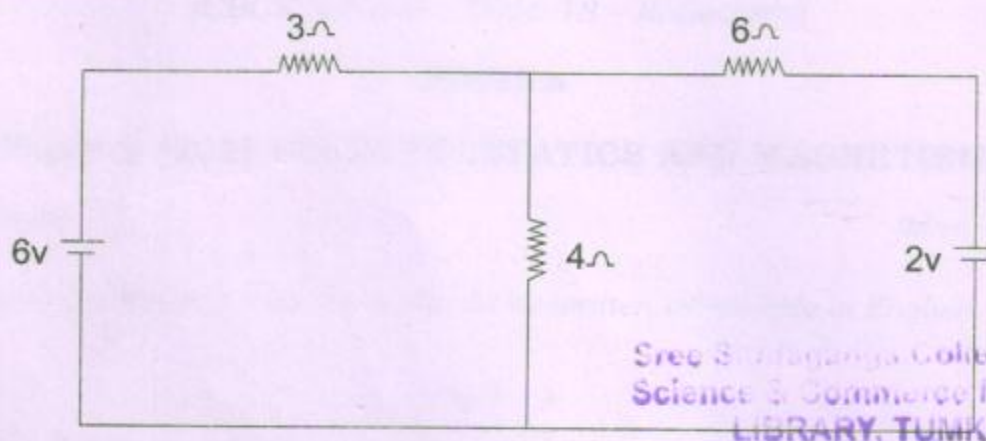
Given : $q = 1 \times 10^{-8}$ C, $\epsilon_0 = 8.854 \times 10^{-12}$ F/m.

11. An induction coil of self-inductance 10 mH has a resistance of 10Ω . If a battery of emf 20 V is connected across the coil, calculate the energy stored in the coil.
12. The magnetic flux in a closed circuit of resistance 10Ω varies with time according to the equation $\phi = 6t^2 - 5t + 1$. What is the magnitude of the emf and current at $t = 0.25$ sec?
13. The flux produced by a magnetic field of 2T is 4.5×10^{-8} Wb, in a bar of iron with a cross-sectional area of 0.3×10^{-4} m². What is the permeability and susceptibility of the bar?
14. If the earth receives 1400 Wm^{-2} of solar energy, calculate the maximum amplitudes of electric and magnetic fields of the electromagnetic radiation.

Given $C = 3 \times 10^8$ m/s, $\mu_0 = 4\pi \times 10^{-7}$ H/m.

15. A series circuit having a resistance of 10Ω and a inductance of 0.025 H and variable capacitance connected to a 100 V, 50 Hz single phase supply. Calculate the capacitive reactance when the value of current is 8A and also calculate the circuit impedance.

16. Using Superposition theorem, find the current through $4\ \Omega$ resistance in the given circuit :



PART – C

Answer any **TEN** of the following questions. Each question carries **2** marks :
(10 × 2 = 20)

17. (a) What happens when a dielectric slab is introduced between parallel plate capacitor? Explain.
- (b) When does the electric flux become maximum?
- (c) Does a stationary charge in a magnetic field experience a force? Explain.
- (d) Compare sound waves with electromagnetic waves.
- (e) Is the induced emf is greater during break of the circuit than the make of the circuit?
- (f) $\nabla \cdot \vec{B} = 0$. What is the physical significance of this equation?
- (g) Why does hammering demagnetise a magnet?
- (h) Which electromagnetic waves are used in a RADAR system? Give the frequency range.
- (i) Explain why inductors are made of copper.
- (j) What is the current through a capacitor, which is fully charged connected to a battery? Explain.
- (k) Does time constant of an CR circuit depend on the applied emf? Explain.
- (l) When is the power transferred to the load maximum?