



Date: 16-06-2022

Dept. No.

Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

**PART – A**

**Q. No. Answer ALL the Questions**

**(10 x 2 = 20 Marks)**

- 1 What is electric field? Give its unit.
- 2 State Coulomb's law.
- 3 Show that  $U = \frac{1}{2} \epsilon_0 E^2$ .
- 4 Write the relation between dielectric constant and susceptibility.
- 5 How does a rectangular loop carrying current kept in a magnetic field respond?
- 6 What is Lorentz force?
- 7 Calculate the induced emf in a coil of 10 H inductance in which the current changes from 8 to 3 A in 0.2 s.
- 8 An electron moving with velocity  $5 \times 10^7$  m/s enters a magnetic field of 1 T at an angle of  $90^\circ$  to the magnetic field. Estimate the magnetic force acting on the electron.
- 9 Write any four characteristics of EM wave.
- 10 Show that EM waves travel at the speed of light.

**PART – B**

**Answer any FOUR Questions**

**(4 x 7.5 = 30 Marks)**

- 11 Find the electric field a distance  $z$  from the center of infinite straight wire, which carries a uniform linear charge density.
- 12 Three capacitors each of capacitance 9 pF are connected in series (i) What is the capacitance of the combination? (ii) What is the potential difference across each capacitor, if the combination is connected to 120 V supply?
- 13 Apply Ampere's circuital law to magnetic field inside a straight solenoid.
- 14 Obtain an expression for the force acting on a charge  $q$  moving with a velocity  $v$  in a magnetic field of uniform intensity
- 15 What is meant by mutual induction? Derive an expression for the mutual inductance of two long coaxial solenoids.
- 16 Write down all four Maxwell's equations in differential form. Solve them to get the wave equation in vacuum.

**PART – C**

**Answer any FOUR Questions**

**(4 x 12.5 = 50 Marks)**

- 17 Define electric potential at a point. Derive an expression for electric potential and field due to an electric dipole.
- 18 (i) What is electronic polarization? Derive an expression for electronic polarizability of an atom. (7)  
(ii) Derive the relation between D, E and P. (5.5)
- 19 Use Biot-Savart's law to derive the expression for the magnetic field due to a circular coil carrying current at a point along the axis.
- 20 Explain the construction and theory of Helmholtz galvanometer. Mention its merits.  
(i) Derive an expression for potential energy of a dipole in uniform magnetic field. (7)  
(ii) Derive an expression for force on current in a magnetic field. (5.5)
- 22 State and prove Poynting theorem for the flow of energy in an electromagnetic field.

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