EE 221 (R-22)

Total No. of Questions : 10] [Total No.of Pages : 02

II/IV B. Tech. DEGREE EXAMINATIONS, AUGUST - 2024

Second Semester

ELECTRICAL AND ELECTRONICS ENGINEERING

ELECTROMAGNETIC FIELD THEORY

Time : **Three Hours** Maximum : **70** Marks

Answer ONE question from each Unit. 5x14=70 M

All Questions carry equal marks.

UNIT - I

1. a) Derive an expression for the electric field intensity due to a finite length line charge along the Z-axis at an arbitrary point Q(x,y,z).

   b) A charge of -0.3mC is located at A(25, -30, 15) cm and a second charge of 0.5mC is located at B(-10, 8, 12) cm. Find the electric field strength, E at (i) The origin (ii) Point P (15, 20, 50) cm.

(OR)

2. a) Define Electric potential and derive the relationship between electric potential and electric field.

   b) A line charge ρ_L = 400pC/m lies along the X-axis. The surface of zero potential passes through the point P(0,5,12)m. Find the potential at point (2,3,-4)m.

UNIT - II

3. a) Determine the capacitance of a Two wire line.

   b) Explain the properties of dielectric materials.

(OR)

4. a) Explain the current and current density with relevant equations.

   b) Define conductor. Explain the properties and boundary conditions of a conductor.

P.T.O.

UNIT - III

5. a) State Ampere's circuital law. Specify the conditions to be met for determining magnetic field strength H based on Ampere's circuital law.

   b) A thin ring of radius 5 cm is placed on plane Z=1cm, so that its center is at (0,0,1) cm. If the ring carries 50mA along $a\Phi$. Find H at (i) (0,0,-1) cm (ii) (0,0,10) cm.

(OR)

6. a) Obtain an expression for Energy stored in a magnetic field.

   b) Classify various magnetic materials and explain them in detail.

UNIT - IV

7. a) Define E.M.F. Explain the concept of motional E.M.F.

   b) Derive an expression for EMF generated for moving loop in static magnetic field.

(OR)

8. a) Explain about the concept of Displacement current.

   b) Derive the expressions for Maxwell's equations in differential forms.

UNIT - V

9. a) Explain about the wave propagation in lossy dielectrics.

   b) Obtain the expressions for EM plane wave propagating in free space.

(OR)

10. a) Explain oblique incidence wave propagation with perpendicular polarization.

    b) A uniform plane wave propagation in a medium has $E = 2e^{-\alpha z} \sin(10^8 t - \beta z)\, a_y$ V/m. If the medium is characterized by $\varepsilon_r = 1$, $\mu_r = 20$ and $\sigma = 3$ S/m, find α, β, and H.