EC 221 (R-22)

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

Second Semester

ELECTRONICS AND COMMUNICATIONS ENGINEERING

ELECTROMAGNETIC FIELD THEORY

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

Answer ONE question from each Unit.

All Questions carry equal marks. 5x14=70 M

UNIT - I

1. a) Derive an expression for the electric field intensity due to a infinite sheet of charge distribution.

   b) Points charges 1 mC and -2mC are located at (3,2-1) and (-1,-1,4), respectively. Calculate the electric force on a 10nC charge located at (0,3,1) and the electric field intensity at that point.

(OR)

2. a) Using Gauss's law, derive the expressions for electric field intensity and electric flux density due to an infinite sheet of conductor of charge density ρ C/cm.

   b) Define electric potential and obtain an expression for it.

UNIT - II

3. a) Define Capacitance and deduce an expression for capacitance of coaxial cable.

   b) Prove that the energy stored in capacitor $W = 1/2\ CV^2$ Joules.

(OR)

4. a) Derive an expression for continuity of current equation.

   b) Derive an expression for Energy density in an electrostatic field.

UNIT - III

5. a) What is the inconsistency in Ampere's law ? How is it rectified by Maxwell ?

   b) Find an expression for the magnetic field produced by a straight current carrying conductor at a distance X from it.

P.T.O.

(OR)

6. a) Derive an expression for energy stored in a magnetic field.

   b) Explain about the force acting on differential current element with relevant expression.

UNIT - IV

7. a) Define Faraday's law and derive EMF for stationary loop in a Time varying magnetic field.

   b) Deduce the expressions for displacement current and displacement current density.

(OR)

8. List out the Maxwell's equations in static form and derive the expressions for those Maxwell's equations in differential forms.

UNIT - V

9. a) For good dielectrics derive the expressions for α, β, ν and η.

   b) Derive the expression for attenuation and phase constants of uniform plane wave.

(OR)

10. a) Define and distinguish between the terms perpendicular polarization, parallel polarization for the case of reflection by a perfect conductor under oblique incidence.

    b) A circular loop of 10 cm radius is located in the x-y plane in a field given by $\vec{B} = 0.5\cos 377t(3a\hat{y} + 4a\hat{z})$ tesla. Find the emf induced in the loop.