Code No: 133AP **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, May/June - 2019
ELECTROMAGNETIC FIELDS
(Electrical and Electronics Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) State Coulumb's Law and mention its limitations. [2]
b) Two infinite plane sheets of equal charge densities 1 C/m^2 are placed at (0,0,0) and (0,0,3) respectively. Find the Electric field intensity at (0,0,2). [3]
c) Define conduction and convection current densities. [2]
d) Mention the properties of a conductor. [3]
e) State Gauss's law for magnetostatic fields. [2]
f) Prove Curl (H)=J_c [3]
g) Write the units of magnetic scalar and vector potentials. [2]
h) What does Lorentz force equation specify? [3]
i) Express relation between (i)electric field intensity and magnetic field intensity for time varying field (ii) displacement current density and electric flux density. [2]
j) Define statistically induced emf and dynamically induced emf. [3]

PART-B

(50 Marks)

2.a) Obtain the expression for electric field intensity and potential due to an electric dipole.
b) Find the total charge Q with in the sphere of radius r=4 m if its volume charge density is $\rho_v = \frac{10}{rsin\theta}$ C/m^3. [5+5]

OR

3.a) State and derive the expression for Equation of continuity.
b) Explain the concept of polarization of dielectrics. [5+5]

4.a) Derive the expression for electrostatic energy density.
b) A homogeneous dielectric (ε_r= 2.5) fills region 1(x<0) while region 2 (x>0) is free space. If $\vec{D}_1$ =12 $\mathbf{a_x}$-10 $\mathbf{a_y}$+4 $\mathbf{a_z}$ nC/m^2, find $\vec{D}_2$. [5+5]

OR

5.a) Obtain the expression for capacitance of a spherical capacitor.
b) State the boundary conditions in electrostatic fields and prove any one of them. [5+5]

6.a) Apply Biot-Savart's law to derive the expression for Magnetic Field Intensity due to circular loop placed on xy plane with radius 'r'.

b) If magnetic vector potential is $\vec{A}$= 2.5 $r^{2.5}\mathbf{a_z}$ Wb/m in free space, find Magnetic field intensity $\vec{H}$. [5+5]

OR

7.a) Define Magnetic flux, Magnetic flux line and Magnetic flux density and state the relation between Magnetic flux and Magnetic flux density.

b) Planes z = 0 and z = -10 m carry currents with $\vec{K}$ = -100$\mathbf{a_x}$ A/m and $\vec{K}$ = 60$\mathbf{a_x}$ A/m respectively. Determine $\vec{H}$ at the point (-2, -3, -1)m. [5+5]

8.a) Derive the expression for the force between two finite current carrying loops.

b) Derive the expression for self-inductance of a toroid. [5+5]

OR

9.a) Derive the expression for energy stored and density in a magnetic field.

b) Define and explain Scalar Magnetic potential and its limitations. [5+5]

10.a) Write Maxwell's equations for time varying fields and make their word statements.

b) Given in free space $\vec{E} = E_m \sin(\omega t - \beta z) a_y$, find $\vec{D}, \vec{B}, \vec{H}$. [5+5]

OR

11.a) In a material for which σ = 5 S/m and ε_r = 1.0, the electric field intensity, is given by $\vec{E}$ = 250 $\sin 10^{10}$ t V/m. Find the conduction and displacement current densities?

b) State and explain Faraday's laws of electromagnetic induction with its integral and point forms. [5+5]

---oo0oo---