

R16

Code No: 133AP

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 $\text{Curl } (\mathbf{H}) = \mathbf{J}_c$ [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 within the sphere of radius $r=4 \text{ m}$ if its volume charge density is $\rho_v = \frac{10}{r \sin \theta} \text{ C/m}^3$. [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 ($\epsilon_r = 2.5$) fills region 1 ($x < 0$) while region 2 ($x > 0$) is free space. If $\vec{D}_1 = 12 \mathbf{a}_x - 10 \mathbf{a}_y + 4 \mathbf{a}_z \text{ nC/m}^2$, 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 $\vec{E} = E_m \sin(\omega t - \beta z) \mathbf{a}_y$, find \vec{D} , \vec{B} , \vec{H} . [5+5]

OR

- 11.a) In a material for which $\sigma = 5$ S/m and $\epsilon_r = 1.0$, 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]

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