Max. Marks: 75

[5+5]



**Time: 3 Hours** 

5.a)

b)

Code No: 133AP R16

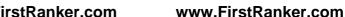
## JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD B.Tech II Year I Semester Examinations, May/June - 2019 ELECTROMAGNETIC FIELDS

(Electrical and Electronics Engineering)

**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] Two infinite plane sheets of equal charge densities 1 C/m<sup>2</sup> are placed at (0,0,0) and b) (0,0,3) respectively. Find the Electric field intensity at (0,0,2). [3] Define conduction and convection current densities. c) [2] Mention the properties of a conductor. [3] d) State Gauss's law for magnetostatic fields. [2] e) Prove Curl (H)=J<sub>c</sub> [3] f) Write the units of magnetic scalar and vector potentials. g) [2] h) What does Lorentz force equation specify? [3] Express relation between (i)electric field intensity and magnetic field intensity for time i) varying field (ii) displacement current density and electric flux density. [2] Define statistically induced emf and dynamically induced emf. [3] <u>j</u>) PART-B **(50 Marks)** Obtain the expression for electric field intensity and potential due to an electric dipole. 2.a) Find the total charge Q with in the sphere of radius r=4 m if its volume charge density is b)  $\rho_v = \frac{10}{r sin\theta} \, C/m^3.$ [5+5]State and derive the expression for Equation of continuity. 3.a) Explain the concept of polarization of dielectrics. b) [5+5]4.a) Derive the expression for electrostatic energy density. A homogeneous dielectric ( $\varepsilon_r$ = 2.5) fills region 1(x<0) while region 2 (x>0) is free space. b) 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]

State the boundary conditions in electrostatic fields and prove any one of them.

Obtain the expression for capacitance of a spherical capacitor.



[5+5]



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

OR

- Define Magnetic flux, Magnetic flux line and Magnetic flux density and state the relation 7.abetween Magnetic flux and Magnetic flux density.
  - Planes z = 0 and z = -10 m carry currents with  $\vec{K} = -100a_x$  A/m and  $\vec{K} = 60a_x$  A/m b) 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.
  - Derive the expression for self-inductance of a toroid. b)

- Derive the expression for energy stored and density in a magnetic field. 9.a)
  - Define and explain Scalar Magnetic potential and its limitations. b) [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]

- In a material for which  $\sigma = 5$  S/m and  $\varepsilon_r = 1.0$ , the electric field intensity, is given by 11.a)  $\vec{E} = 250 \text{ Sin} 10^{10} \text{ t} \text{ V/m}$ . Find the conduction and displacement current densities?
  - State and explain Faraday's laws of electromagnetic induction with its integral and point WANTERS R--- 00000--forms. [5+5]