

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (Old) EXAMINATION - WINTER 2019

Subject Code: 151002

Date: 04/12/2019

Subject Name: Engineering Electromagnetics

Time: 10:30 AM TO 01:00 PM

Total Marks: 70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Explain Cylindrical co-ordinate system with a neat sketch giving details of their unit vectors and point form and vector form representations. **07**
- (b) Define curl and give its physical interpretation. Also give relation of curl in all three co-ordinate system. **07**
- Q.2** (a) State Coulomb's law and give its mathematical expression. From that deduce expression of electric field intensity  $\mathbf{E}$  for point charges. **07**
- (b) Find Electric Field Intensity  $\mathbf{E}$  at a point on Z-axis, due to circular ring charge with charge density  $\rho_L$  C/m present in XY plane. **07**
- OR**
- (b) State and prove divergence theorem. Relate Gauss's law with divergence theorem. **07**
- Q.3** (a) State & explain the Biot-Savart's Law and derive the necessary equations of Magnetic field Intensity  $\mathbf{H}$ . **07**
- (b) A circular loop located on  $X^2 + Y^2 = 9$ ,  $Z=0$  carries a current of 10 A along  $\hat{\mathbf{a}}_\phi$ . Determine  $\mathbf{H}$  at (0,0,4) and (0,0,-4). **07**
- OR**
- Q.3** (a) A circular current carrying loop is lying on x-y plane. Derive the equation of Magnetic field intensity  $\mathbf{H}$  on the axis of a circular loop. Also find  $\mathbf{H}$  at the center of the loop. **07**
- (b) Evaluate Stoke's theorem for the field  $\mathbf{H} = 6xy \hat{\mathbf{a}}_x - 3y^2 \hat{\mathbf{a}}_y$  amp/meter if rectangular path around the region is  $2 \leq x \leq 5$ ,  $-1 \leq y \leq 1$  and  $z=0$ . Also find out current I. **07**
- Q.4** (a) Derive electrostatic Boundary conditions for Dielectric to Dielectric interface. **07**
- (b) Find the potential and volume charge density at P (0.5, 1.5, 1) in free space if potential field is given as  $V = 6 \rho \phi z$ . **07**
- OR**
- Q.4** (a) A boundary exist at  $z=0$  between two dielectric.  $\epsilon_{r1} = 2.5$  in region  $z < 0$ .  $\epsilon_{r2} = 4$  in region  $z > 0$ . The electric field in the region of  $\epsilon_{r1}$  is  $\mathbf{E}_1 = -30 \hat{\mathbf{a}}_x + 50 \hat{\mathbf{a}}_y + 70 \hat{\mathbf{a}}_z$  V/m. then find out **07**
- i. Normal component of  $\mathbf{E}_1$
  - ii. Tangential component of  $\mathbf{E}_1$
  - iii. Angle  $\Theta_1$  between  $\mathbf{E}_1$  and normal to the surface
  - iv. Normal component of  $\mathbf{D}_2$
  - v. Tangential component of  $\mathbf{D}_2$
  - vi. Angle  $\Theta_2$  between  $\mathbf{E}_2$  and normal to the surface
- (b) Define Torque. Derive the equation of Torque on a close current carrying loop which is placed in steady magnetic field. **07**
- Q.5** (a) Derive Maxwell's equations in point and Integral form for time varying fields. **07**
- (b) Derive the equation of Capacitance (C) and Energy stored (W) for parallel plate capacitor. **07**
- OR**
- Q.5** (a) Explain wave propagation in free space with necessary equations. **07**
- (b) Derive point form of Ampere's Circuital Law. **07**

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