Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC-Semester –III (May-2012) Examination

Subject code: X31102

Subject Name: Engineering Electromagnetics

Date: 15/05/2012

Time: 02.30 pm – 05.00 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)** With the help of neat sketches, briefly explain the cylindrical coordinate system. Also give the dot table relating to the vectors in cylindrical coordinate & rectangular coordinate system with justification. **07**

(b) Transform vector $\mathbf{A} = 4\,\mathbf{a_x} - 2\,\mathbf{a_y} - 4\,\mathbf{a_z}$ to spherical coordinate system at point P (-2,-3,4). **07**

Q.2 **(a)** Explain the experimental law of coulomb & derive the expression for electric field intensity due to line charge located on z axis. **07**

(b) Find the total charge inside the volume indicated **07**

a) $\rho_v = 10\ z^2 e^{-0.1x} \sin(\pi y)$, $-1 \le x \le 2$, $0 \le y \le 1$, $1.3 \le z \le 3.6$.

b) $\rho_v = 4xyz^2$, $0 \le \rho \le 2$, $0 \le Ø \le 90^\circ$, $0 \le z \le 3$.

OR

(b) Infinite uniform line charge is located at y = 3, z = 5 , Find the **E** at the a) P(0,0,0) b) Q(5,6,1) for line charge $\rho_L = 30$ nC/m. **07**

Q.3 **(a)** Explain the concept of electric flux. Sate & prove the divergence theorem. **07**

(b) Find the value of integral of $\mathbf{D \cdot dS}$ over a closed surface of sphere r=1. **07**

OR

Q.3 **(a)** Explain the energy density in the electrostatic field. **07**

(b) Find the work done in moving a 5 μC charge from the origin to P(2,-1,4) through the field $\mathbf{E} = 2\,xyz\ \mathbf{a_x} - x^2 z\ \mathbf{a_y} + x^2 y\ \mathbf{a_z}$ V/m via path straight line segment(0, 0 ,0) to (2,0,0) to (2,-1,0) to (2,-1,4). **07**

Q.4 **(a)** Define the term dipole & derive the expression for the electric field intensity **E** at arbitrary point P. **07**

(b) For magnetic potential $V_m = 2x^2 + 4x - 2y^2$ A in a certain region of free space. Find the vector force exerted on a straight wire segment in the region if it extends from the origin to P (0.6, 0.8, 0) and carries 5 A current away from the origin. **07**

OR

Q.4 **(a)** Explain uniqueness theorem. **07**

(b) Derive the point form of ampere's circuital law. **07**

Q.5 **(a)** State the lorentz equation & express the torque on a differential current loop in a field **B.** **07**

(b) Explain the Faraday's law for time varying field. Also Describe the retarded potentials. **07**

OR

Q.5 **(a)** State & explain Bio Savart law & derive the expression for magnetic field intensity for infinitely long straight filament carrying a direct current I at distant point. **07**

(b) Explain Poynting's theorem & Discuss the skin effect. **07**

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