Seat No.: \_\_\_\_

Enrolment No.

## GUJARAT TECHNOLOGICAL UNIVERSITY PDDC - SEMESTER-III • EXAMINATION - SUMMER • 2014

Subject Code: X31102

Date: 20-06-2014

**Subject Name: Engineering Electromagnetics** Time: 02:30 pm – 05:00 pm

**Total Marks: 70** 

**Instructions:** 

- 1. Attempt all questions.
- Make suitable assumptions wherever necessary. 2.
- Figures to the right indicate full marks. 3
- Q.1 Define the terms: scalar, vector & unit vector. Also explain spherical 07 (a) coordinate system with neat & clean diagram in brief.
  - Given  $\mathbf{A} = 6\mathbf{a}_{x} + 2\mathbf{a}_{y} + 5\mathbf{a}_{z}$  &  $\mathbf{B} = 2\mathbf{a}_{x} + 4\mathbf{a}_{y} + 7\mathbf{a}_{z}$  Find The angle between A & 07 **(b) B**. The distance between their tips, Unit vector normal to the plane containing A & B and the area of the parallelogram of which A & B are adjacent sides.
- Define the electric field intensity. Also derive the expression for the electric 07 **Q.2** (a) field intensity due to a line charge of uniform density of  $\rho_1$  C/m lying on the z axis.
  - 07 **(b)** Convert the given vector  $\mathbf{A} = 3\mathbf{a}_x + 4\mathbf{a}_y + 5\mathbf{a}_z$  to spherical coordinate system.
  - For given surface charge density  $\rho_s = x^2 + xy$ , calculate  $\int \rho_s dS$  over the region 07 **(b)** specified by  $y < x^2 \& 0 < x < 1$ .
- Discuss the Farady's experimental setup for the electrostatic field. Also state & 0.3 07 (a) prove Gauss's law.
  - Define the term volume charge density. Obtain the expression for the volume 07 **(b)** charge density for given  $\mathbf{D} = (4xy/z)\mathbf{a}_{\mathbf{x}} + (2x^2y/z^2)\mathbf{a}_{\mathbf{y}} - (2x^2y/z^2)\mathbf{a}_{\mathbf{z}}$

## OR

- 07 **Q.3** State & explain the divergence theorem. **(a)** Evaluate both side of the divergence theorem for the field  $\mathbf{D} = 2 \operatorname{xy} \mathbf{a}_{x} + \operatorname{x}^{2} \mathbf{a}_{y}$ **(b)** 07  $C/m^2$  and the rectangular parallelepiped formed by the plane 0 < x < 1, 0 < y < 2, 0 < z < 3.
- Derive the expression for the electric field intensity E due to a dipole at distant **Q.4** 07 (a) point.
  - For given potential field  $V = 2x^2y 5z$ , and a point P(-4,3,6), find the electric 07 **(b)** field density **D** and volume charge density  $\rho_{v}$ .

## OR

- **Q.4** State Bio Savart law & derive the expression for the magnetic field intensity if 07 **(a)** infinitely long wire carrying current I located on the z axis. 07
  - Explain in brief Uniqueness theorem. **(b)**
- Q.5 State & prove Poynting's theorem relating to the flow of energy at a point in 07 **(a)** space in and electromagnetic field.
  - Write a brief note on wave propagation in a good conductor. 07 **(b)**

OR

- State Maxwell's equations in point form and explain physical significance of the Q.5 07 **(a)** equations.
  - Write a short note on Stoke's theorem. **(b)**

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