Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC– SEMESTER IV– • EXAMINATION – SUMMER - 2016**

**Subject Code:X40904** **Date:22/11/2016**

**Subject Name: Theory of Electromagnetics**

**Time:02:30 PM to 5:00 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)** | Let each of the vector $A = 5\bar{a}_x - \bar{a}_y + 3\bar{a}_z$ , $B = -2\,\bar{a}_x + 2\,\bar{a}_y + \bar{a}_z$, $C = 3\,\bar{a}_y - 4\,\bar{a}_z$ extend outward from the origin of Cartesian coordinates system to points A, B and C respectively. Find a unit vector directed from point A toward: (a) to the origin; (b) point B; (c) Unit vector from A to mid point of BC. | 07 |
| | **(b)** | Transform the following vector to spherical coordinates at the points given : $10\,\bar{a}_z \; at \; P(x = -3, y = 2, z = 4)$ | 07 |
| **Q.2** | **(a)** | Define electric field intensity. Derive an equation for the electric field intensity due to line charge with usual notations. | 07 |
| | **(b)** | A charge of - 0.3 μC is located at A ( 25, -30, 15 ) (in cm) and a second charge of 0.5 μC is at B ( -10, 8, 12 ) cm . Find electric field intensity E at the origin. | 07 |
| | | **OR** | |
| | **(b)** | Explain vector form of coulomb's law with statement. | 07 |
| **Q.3** | **(a)** | State and explain Gauss's law to differential volume element. | 07 |
| | **(b)** | State divergence theorem. Find divergence D at the origin if $D = e^{-x}\sin y\,\bar{a}_x - e^{-x}\cos y\,\bar{a}_y + 2z\,\bar{a}_z$ | 07 |
| | | **OR** | |
| **Q.3** | **(a)** | State and explain the Gauss's law. | 07 |
| | **(b)** | Derive Maxwell's first equation as applied to the electrostatics, using Gauss's law. Also state the Divergence theorem. | 07 |
| **Q.4** | **(a)** | Define electric potential & potential difference. Also prove $\bar{E} = -\nabla V$ . | 07 |
| | **(b)** | Given the potential field, $V = 2x^2 y - 5z$ and a point P (-4, 3, 6), find following at point P : (1) the potential V, (2) the electric field intensity E (3) the direction of E (4) the electric flux density D | 07 |
| | | **OR** | |
| **Q.4** | **(a)** | Explain and derive the boundary condition for a dielectric-dielectric interface. | 07 |
| | **(b)** | Derive Poisson's and Laplace's equation. | 07 |
| **Q.5** | **(a)** | State and explain Ampere circuital law. | 07 |
| | **(b)** | State and explain Biot-Savart's law. | 07 |
| | | **OR** | |
| **Q.5** | **(a)** | State and explain Lorentz force equation. | 07 |
| | **(b)** | Give classification of magnetic materials. | 07 |