

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VI • EXAMINATION – WINTER 2013

Subject Code: 160906**Date: 09-12-2013****Subject Name: Theory of Electromagnetics****Time: 02:30 pm to 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) Transform the following vectors to spherical coordinates at the points given: **07**
 (a) $10\mathbf{a}_x$ at P ($x = -3, y = 2, z = 4$); (b) $10\mathbf{a}_y$ at Q ($\rho = 5, \theta = 30^\circ, z = 4$); (c) $10\mathbf{a}_z$ at R($r = 4, \theta = 110^\circ, \phi = 120^\circ$).
- (b) Define Electric field intensity. Derive the necessary equation for electric field intensity due to line charge. **07**
- Q.2** (a) State Gauss's Law. Find divergence D at the origin if **07**
 $D = e^{-x} \sin yx - e^{-x} \cos yx + 2za_z$
- (b) Derive necessary equation for potential gradient from the electric field intensity by means of a line integral. **07**
- OR**
- (b) Explain boundary conditions for perfect dielectric materials. **07**
- Q.3** (a) A 15-nC point charge is at the origin in free space. Calculate V_1 if point P_1 is located at $P_1(-2, 3, -1)$ and (a) $V=0$ at $(6, 5, 4)$; (b) $V=0$ at infinity; (c) $V = 5V$ at $(2, 0, 4)$. **07**
- (b) Derive Poisson's and Laplace's equation. **07**
- OR**
- Q.3** (a) Explain Ampere's circuital law. **07**
 (b) Write a short note on "Magnetic Resonance Imaging." **07**
- Q.4** (a) Explain Biot-Savart's law. **07**
 (b) State Lorentz force equation. Give the classification of magnetic materials. **07**
- OR**
- Q.4** (a) Explain the construction and working principle of Magneto Hydrodynamic (MHD) Generator. **07**
 (b) Explain and derive Maxwell's equations in Point and Integral form. **07**
- Q.5** (a) Explain advantages and applications of numerical techniques. **07**
 (b) An electric dipole located at the origin in free space has a moment $p = 3a_x - 2a_y + a_z$ nC.m (a) find V at $P_A(2, 3, 4)$. **07**
- OR**
- Q.5** (a) Write a short note on "Finite element Method" **07**
 (b) A charge of $-0.3 \mu C$ is located at A(25, -30, 15) (in cm), and a second charge of $0.5 \mu C$ is at B(-10, 8, 12) cm. Find Electric field intensity E at (a) the origin; (b) P(15, 20, 50) cm. **07**
