

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI • EXAMINATION – SUMMER 2013****Subject Code: 160906****Date: 04-06-2013****Subject Name: Theory of Electromagnetics****Time: 10.30 am - 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 coordinate system, differential elements and transformation method from cylindrical to cartesian coordinate system. **07**
- (b) Transform the vector $4\mathbf{a}_x - 2\mathbf{a}_y - 4\mathbf{a}_z$ into spherical coordinates at a point P ($x=-2, y=-3, z=4$). **07**

- Q.2** (a) Derive the expression for total electric field intensity due to infinite surface charge distribution in free space. **07**
- (b) Let $\mathbf{D} = 2y^2z^2\mathbf{a}_x + 3xy^2z^2\mathbf{a}_y + 2xyz\mathbf{a}_z$ pC/m² in free space. Find (a) the total electrical flux passing through the surface $x=2, 0 \leq y \leq 2$, and $0 \leq z \leq 2$ in a direction away from the origin, (b) the total charge contained in an incremental sphere of a radius 1 μm centered at $P(2,2,2)$. **07**

OR

- (b) Define divergence and its physical significance. **07**
- Q.3** (a) Explain potential and potential gradient. Derive relationship between potential and electric field intensity. **07**
- (b) A non uniform field $\mathbf{E} = y\mathbf{a}_x + x\mathbf{a}_y + 2\mathbf{a}_z$. Determine the work expended in carrying 2C from B(1,0,1) to A(0.8,0.6,1) along the shorter arc of the circle $x^2 + y^2 = 1, z=1$. **07**
- Find the work required to carry same charge from B to A through straight line joining B to A in the same field.

OR

- Q.3** (a) Explain the Gauss's law applied to infinite line charge and derive the expression for $\mathbf{D}$ due to infinite line charge. **07**
- (b) Derive Poisson's and Laplace's equations from fundamental. **07**

- Q.4** (a) Write a short note on Displacement Current. **07**
- (b) Write and explain differential and integral forms of Maxwell's equations. **07**

OR

- Q.4** (a) Derive the relation between I and J and explain the continuity equation of steady electric current in integral form and point form. **07**
- Q.4** (b) Explain and derive the boundary conditions for a dielectric- dielectric interface. **07**

- Q.5** (a) State and explain Ampere's circuital law. **07**
- (b) What is inductance? Explain self inductance and mutual inductance. **07**

OR

- Q.5** (a) State and prove uniqueness theorem. **07**
- (b) Explain force on a differential current element. **07**