

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER V • EXAMINATION – WINTER - 2012****Subject code: 151002****Date: 17-01-2013****Subject Name: Engineering Electromagnetic****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) 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 systems & justify. **07**

(b) Solve the followings. **07**

- 1) The vector from the origin to point A is given as (6, -2, -4) and the unit vector directed from the origin toward point B is (2, -2, 1)/3. If point A and B are ten units apart, find the coordinates of point B.
- 2) Transform the given vector $\mathbf{A}=10 \mathbf{a}_z$ into spherical coordinates at Point P ($r=4, \theta=110^\circ, \phi=120^\circ$).

Q.2 (a) Describe the experimental law of Coulomb. Also define Electric Field Intensity & Derive the expression for electric field intensity \mathbf{E} due to infinite & uniform line charge ρ_L located on the z axis. **07**

(b) Three infinite uniform sheets of charges are located in the free space as Follows: 3 nC/m^2 at $z = -4$, 6 nC/m^2 at $z = 1$, and -8 nC/m^2 at $z = 4$. Determine the \mathbf{E} at the point P (4, 2, -3) & Q (-1, -5, 2). **07**

OR

(b) An electric field is expressed in rectangular coordinates by $\mathbf{E} = 6x^2 \mathbf{a}_x + 6y \mathbf{a}_y + 4 \mathbf{a}_z$ V/m for points M (2, 6, -1) & N (-3, -3, 2). Determine potential **07**

a) V_{MN}

b) V_N if $V = 2$ at P(1, 2, -4)

Q.3 (a) Define displacement flux. Also state & prove Gauss's law. **07**

(b) Define volume charge density & divergence. And obtain volume charge density ρ_v at the point specified by P($\rho = 2, \phi = 110^\circ, z = -1$) for $\mathbf{D} = (2 \rho z^2 \sin^2 \phi) \mathbf{a}_\rho + (\rho z^2 \sin 2\phi) \mathbf{a}_\phi + (2 \rho^2 z \sin^2 \phi) \mathbf{a}_z$ **07**

OR

Q.3 (a) Explain term current density. Also explain the boundary conditions for perfect dielectric materials. **07**

(b) What is an electric dipole? Derive the expression for electric field intensity \mathbf{E} at distant point due to a +Q & -Q charge located d unit apart from origin. **07**

Q.4 (a) Derive equation to find the energy stored in the field of a system of charges. **07**

(b) Explain uniqueness theorem in brief. Also derive the expression of \mathbf{E} if boundary conditions for two radial planes are given by $V = 0$ at $\phi = 0$ and V **07**

$$= V_0 \text{ at } \phi = \alpha.$$

OR

Q.4 (a) Define magnetic flux & magnetic field intensity. Also explain Magnetic boundary conditions in brief. **07**

(b) State Stoke's theorem. Evaluate both side of stokes theorem for the field $\mathbf{H} = (6 r \sin\theta) \mathbf{a}_r + (18 r \sin\theta \cos\theta) \mathbf{a}_\theta$, surface specified by $r=4$, $0 \leq \theta \leq 0.1 \pi$, $0 \leq \phi \leq 0.3 \pi$. **07**

Q.5 (a) State ampere's circuital law & derive the expression for curl of magnetic field intensity. **07**

(b) State & prove Poynting theorem relating to the flow of energy at a point in space in an electromagnetic field. **07**

OR

Q.5 (a) State Maxwell's equations in point form & explain physical significance of the equations. **07**

(b) Write Short note on the followings. **07**
 1) Skin effect
 2) The retarded potentials
