

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-III • EXAMINATION – WINTER • 2014

Subject Code: X31102**Date: 29-12-2014****Subject Name: Engineering Electromagnetics****Time: 10:30 am - 01:30 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 neat & clean sketches explain Cylindrical Coordinate system. Give the dot table for the dot product of unit vectors in Cylindrical & Cartesian Coordinate systems with due justification. **07**
- (b) Answer the followings.
- i) Define the term dot product; enlist the applications of the same. **03**
- ii) Express the given vector $\mathbf{A} = r \mathbf{a}_r$ in Cartesian coordinates at point $P(5, 90^\circ, 0^\circ)$ **04**
- Q.2** (a) Define the term line charge. Also derive the expression for the electric field intensity due to a line charge ρ_L C/m located on the z axis at point $P(0, y, 0)$. **07**
- (b) Four identical 3 nC point charges located at $P(1, 1, 0)$, $Q(-1, 1, 0)$, $R(-1, -1, 0)$ and $S(1, -1, 0)$, determine the electric field intensity at point $D(1, 1, 1)$ due to these identical point charges. **07**
- OR**
- (b) Infinite uniform line charges of 5 nC /m lie along the (positive and negative) x and y axes in free space. Find the electric field intensity at point $P(0, 3, 4)$. **07**
- Q.3** (a) State Faraday's law. Also prove the point form of Gauss's law. **07**
- (b) Determine the expression of volume charge density associated for the given $\mathbf{D} = z \sin \theta \mathbf{a}_\rho + z \cos \theta \mathbf{a}_\theta + \rho \sin \theta \mathbf{a}_z$. **07**
- OR**
- Q.3** (a) State and explain the divergence theorem. **07**
- (b) Evaluate both side of the divergence theorem for the field $\mathbf{D} = 2xy \mathbf{a}_x + x^2 \mathbf{a}_y$ C/m² and the rectangular parallelepiped formed by the planes $x = 0$ and 1, $y = 0$ and 2, and $z = 0$ and 3. **07**
- Q.4** (a) Write a brief note on potential gradient. **07**
- (b) The point charges -1 nC, 4 nC and 3 nC are located at $A(0, 0, 0)$, $B(0, 0, 1)$ and $C(1, 0, 0)$ respectively, find the energy in the system. **07**
- OR**
- Q.4** (a) Derive the expression for the electric field intensity at a distant point in free space for the dipole & define the term dipole moment. **07**
- (b) Calculate numeric values for V and ρ_v at point $P(0.5, 45^\circ, 60^\circ)$ for $V = 2 r^{-2} \cos \theta$. **07**
- Q.5** (a) Write a detail note on magnetic boundary condition. **07**
- (b) Define the curl of a vector quantity. Evaluate the Curl of given vector field $\mathbf{A} = r^{-2} \cos \theta \mathbf{a}_r + r \sin \theta \cos \theta \mathbf{a}_\theta + \cos \theta \mathbf{a}_\phi$. **07**
- OR**
- Q.5** (a) Explain in brief wave propagation in free space. **07**
- (b) State and prove Poynting's theorem relating to the flow of energy at a point in space in an electromagnetic field. **07**
