

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER-III • EXAMINATION – SUMMER 2013

Subject Code: X31102**Date: 13-05-2013****Subject Name: Engg. Electromagnetics****Time: 02.30 pm - 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 neat & clean sketches explain Cylindrical Coordinate system. Give the table for the dot product of unit vectors in Cylindrical & Rectangular Coordinate systems with due justification. **07**
- (b) Express $\mathbf{a}_\rho$ in spherical coordinate system. **07**
- Q.2** (a) Define electric field intensity & derive the electric field intensity for a line charge located on z axis in free space. **07**
- (b) An infinitely long, uniform line charge is located at $y=3, z=5$. If $\rho_L=30 \text{ nC/m}$, find electric field intensity $\mathbf{E}$ at point $P(5,6,1)$. **07**
- OR**
- (b) Find the equation of that streamline that passes through the point $P(-2,7,10)$ in the field $\mathbf{E}=2(y-1)\mathbf{a}_x + 2x\mathbf{a}_y$. **07**
- Q.3** (a) Explain energy density in the electrostatic field. **07**
- (b) If potential $V = (60 \sin \theta)/r^2$ in free space, obtain the volume charge density ρ_v at point $P(r=3 \text{ m}, \theta=60^\circ, \phi=25^\circ)$. **07**
- OR**
- Q.3** (a) Write a detail note on potential gradient. **07**
- (b) Semi infinite conducting planes at $\phi=0$ & $\phi=\pi/6$ are separated by an insulating gap. If $V=0$ at $\phi=0$ & $V=100$ at $\phi=\pi/6$, calculate V & $\mathbf{E}$ in the region between the planes. **07**
- 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) For given potential field: $V=2x^2y-5z$, Determine volume charge density ρ_v at point $P(-4,3,6)$. **07**
- OR**
- Q.4** (a) Explain Uniqueness theorem in brief. **07**
- (b) For given $\mathbf{G}=\sin \theta(\mathbf{a}_r + \mathbf{a}_\theta + \mathbf{a}_\phi)$, determine curl of $\mathbf{G}$ at point $P(4,30^\circ,45^\circ)$. **07**
- Q.5** (a) Describe Lorentz force equation & derive the expression for force exerted between differential current elements. **07**
- (b) Describe the Faraday's law for time varying magnetic field, and explain retarded potentials. **07**
- OR**
- Q.5** (a) State Maxwell's equations in point form & integral form, also explain its physical significance. **07**
- (b) Write a detail note on Poynting's theorem. **07**
