

GUJARAT TECHNOLOGICAL UNIVERSITY**PDDC - SEMESTER-III • EXAMINATION – WINTER 2013****Subject Code: X31102****Date: 20-12-2013****Subject Name: Engineering 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) With neat sketches briefly explain Cylindrical Coordinate system. Also give the dot table relating the unit vectors in Cartesian coordinate & Cylindrical coordinate system with due justification. **07**
- (b) Answer the followings. **07**
- i) Define the term cross product of vector quantity; enlist the applications of the same.
 - ii) Express the given vector $\mathbf{A} = \mathbf{a}_\rho$ in to spherical coordinates.
- Q.2** (a) Define the electric field intensity. Also derive the expression for the electric field intensity due to a line charge of uniform density of ρ_l C/m lying on the z axis at an arbitrary point. **07**
- (b) Define the term volume charge density. Three infinite uniform sheets of charge are located in free space as follows: 3 nC/m^2 at $z = -4$, 6 nC/m^2 at $z = 1$ & -8 nC/m^2 at $z = 4$. Find \mathbf{E} at the point P (2,5,-5) & Q(-1,-5,2). **07**
- OR**
- (b) Define the term potential gradient. Determine the gradient of the following scalar fields **07**
- 1) $V = \rho^2 z \cos 2\theta$
 - 2) $U = 10 r \sin^2 \theta \cos \phi$
- Q.3** (a) Discuss the Farady's experimental setup for the electrostatic field. Also state & prove Gauss's Law. **07**
- (b) Define the term divergence for any vector flux quantity. For given electric flux density $\mathbf{D} = 0.3 r^2 \mathbf{a}_r \text{ nC/m}^2$ in free space. Determine the \mathbf{E} at point P($r=2$, $\theta=25^\circ$, $\phi=90^\circ$) and the total electric charge within the sphere $r=3$. **07**
- OR**
- Q.3** (a) Define the term dipole also derive the expression for the field intensity due to a dipole at a distant point in free space. **07**
- (b) Define the terms Curl & Current density. Calculate the value of the vector current density for Magnetic Field $\mathbf{H} = x^2 z \mathbf{a}_y - y^2 x \mathbf{a}_z$ at point P (2,3,4). **07**
- Q.4** (a) Write a brief note on energy density in the electrostatic field. **07**
- (b) Deduce the boundary conditions with necessary derivations at the interface between two dielectric materials with permittivity ϵ_1 & ϵ_2 . **07**
- OR**
- Q.4** (a) State Bio-Savart law & derive the expression for the magnetic field intensity if infinitely long wire carrying current I located on the z axis. **07**
- (b) Write a brief note on retarded potential. **07**
- Q.5** (a) Write a brief note on wave propagation in good conductor. **07**

- (b) Define magnetization & permeability. For given ferrite material which operates in linear mode with $B = 0.05$ T and $\mu_r = 50$. Calculate values for χ_m , M & H . **07**

OR

- Q.5** (a) Derive the expression for the torque on a square loop carrying a current I in the presence of a uniform magnetic field. **07**
- (b) Explain magnetic boundary conditions in brief. **07**
