Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER– IV • EXAMINATION – SUMMER 2015

Subject Code: X40904 **Date:04/06/2015**

Subject Name: Theory of Electromagnetics

Time: 10.30am-01.00pm **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 dot product and cross product of vectors. Consider two vectors A and B in x=0 plane. Explain how scalar and vector components of A in the direction of B can be obtained. (7)

(b) Given point P(-2,6,3) and vector $A = ya_x + (x+z)a_y$. Evaluate A at P in cartesian and cylindrical co-ordinate systems (7)

Q.2

(a) Define electric field intensity. State the formula for electric field intensity due to point charge and hence derive the formula for electric field intensity due to line charge (7)

(b) Find magnitude and direction of electric field intensity at (6,8,-3) if uniform line charge of 5×10^{-9} lies along the (a) y-axis (b) the line x=9, y=4 (7)

OR

(b) Explain how a vector in cartesian system can be converted into cylindrical or spherical co-ordinate system. (7)

Q.3

(a) What is electric flux and electric flux density? State the relationship between electric flux density and electric field intensity for free space? (4)

(b) State the application of Gauss' law to differential volume element and hence explain the divergence theorem. (10)

OR

Q.3

(a) Three co-axial cylindrical sheets of charge are present in free space; $\rho_s = 5\ C/m^2$, at r =2m $\rho_s = -2\ C/m^2$, at r = 4m and $\rho_s = -3\ C/m^2$ at r=5m. Find the electric flux density D at (i) r = 1m (ii) r = 3m (iii) r = 4.5m and (iv) r = 6m (7)

(b) State and explain the expression for energy expended in moving a point charge in an electric field. Also define potential difference and absolute potential. (7)

Q.4

(a) What is voltage gradient? Prove that electric field intensity is given by negative of voltage gradient. (7)

(b) Explain electric dipole (7)

OR

Q.4

(a) What is current and current density? Also derive the point form of continuity equation (7)

(b) Write a short notes on boundary conditions for perfect dielectric materials (7)

Q.5

(a) Explain Poisson's and Lapalce's equation (7)

(b) What is curl? Prove that curl H = J (7)

OR

Q.5

(a) State and explain Lorentz force equation. Also prove that force on a current element depends upon the angle between the vectors representing the direction of current flow and the direction of magnetic flux density (7)

(b) Discuss Maxwell's equations in integral form and point form (7)