Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC- SEMESTER–III - EXAMINATION – SUMMER 2017

Subject Code: X31102 **Date:29/05/2017**

Subject Name: Engineering Electromagnetics

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)** Define the terms: scalar, vector & unit vector. Also explain spherical coordinate system with neat & clean diagram in brief. **07**

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

1) Show that the vector fields $\mathbf{A} = \rho\cos(Ø)\mathbf{a}_\rho + \rho\sin(Ø)\mathbf{a}_Ø + \rho\mathbf{a}_z$ and $\mathbf{B} = \rho\cos(Ø)\mathbf{a}_\rho + \rho\sin(Ø)\mathbf{a}_Ø - \rho\mathbf{a}_z$ are everywhere perpendicular to each other.
2) Transform the given vector $G = (xz/y)\ \mathbf{a}_x$ into cylindrical coordinate components & variables.

Q.2 **(a)** Derive the expression for the electric field intensity due to an infinite sheet charge ρ_s C/m^2 in yz plane at any point on the x axis. **07**

(b) Define electric field intensity. For given infinite uniform line charges of 5 nC/m lie along the positive and negative x and y axis in free space. Find **E** point P(0,3,4). **07**

OR

(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 **E** at the point P (2,5,-5) & Q(-1,-5,2). **07**

Q.3 **(a)** Explain the concept of potential gradient and derive the relationship between **E** and V. **07**

(b) Define current density. Evaluate point form of the continuity equation. **07**

OR

Q.3 **(a)** Define the divergence of a vector field. And prove the divergence theorem. **07**

(b) Define dipole and dipole moment. Determine the V and **E** for a dipole of moment p=6 $\mathbf{a}_z$ nC.m located at the origin in free space at point P(r=4,Θ=20º,Ø =0º). **07**

Q.4 **(a)** Derive the Poisson's equations & Laplace's equations. Also explain uniqueness theorem. **07**

(b) Semi infinite planes at Ø = 0 & Ø = π/6 are separated by an infinitesimal insulating gap.If V = 0 at Ø = 0 & V = 100 at Ø = π/6, calculate potential V & electric field intensity **E**. **07**

OR

Q.4 **(a)** Determine the Electric field intensity at point P(3,1,2) for the field of two coaxial cylinders, V= 50 V at ρ = 2 m and V= 20 V at ρ = 3 m. **07**

(b) Derive the boundary conditions for the perfect dielectric materials. **07**

Q.5 **(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) State & prove poynting theorem relating to the flow of energy at a point in space in and electromagnetic field. **07**

OR

Q.5 **(a)** Write a brief note on retarded potential. **07**

(b) State Maxwell's equations in point form and explain physical significance. **07**

(b) Write a brief note on wave propagation in good conductor. **07**

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