

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C. Sem- III Examination December 2010

Subject code: X31102

Subject Name: Engineering Electromagnetics

Date: 13 /12 /2010

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 the help of neat sketches, explain cylindrical co-ordinate system. Show how to convert a vector from rectangular system to Spherical co-ordinate system. **07**

(b) Given points P(2,5,-1), Q(-1,-4,1), and T(5,0,2), find (i) vector \vec{R}_{PQ} (ii) a unit vector of \vec{R}_{PQ} (iii) length of perimeter of triangle PQT (iv) the interior angle at Q. **07**

Q.2 (a) Using coulomb's law define and explain Electric field intensity & find the field of line charge in free space. **07**

(b) Four infinite uniform sheets of charge are located as follows: 20pC/m^2 at $y=7$, -8pC/m^2 at $y=3$, 6pC/m^2 at $y=-1$, and -18pC/m^2 at $y=-4$ Find electric field intensity at a point (a) $P_A(2,6,-4)$; (b) $P_B(0,0,0)$; $P_C(-1,-1,1.5)$. **07**

OR

(b) Volume charge density is given by $\rho_v = 10e^{-1000\rho} e^{-100z} \text{ C/m}^3$. (a) Find the maximum value of ρ_v in the region $0 \leq \rho \leq 0.01\text{m}$, $0 \leq \Phi \leq 2\pi$, $0 \leq z \leq 0.01\text{m}$. **07**
 (b) Find the total charge contained in the first octant, where x,y, and z are positive. (c) Find b if total charge found in the volume $0 \leq \rho \leq b$, $0 \leq \Phi \leq \pi/2$, $z \geq 0$, is half the value found in part (b) above.

Q.3 (a) Write a short note on Gauss's law & Divergence theorem. **07**

(b) Explain Energy density in the electrostatic field. **07**

OR

Q.3 (a) Explain Boundary conditions at a conductor free space boundary. **07**

(b) Find the capacitance between a circular conducting cylinder in air, 2 mm in radius, and (a) a conducting plane, 1 cm distant from the cylinder axis, by the equation $C = 2\pi\epsilon / \cosh^{-1}(h/b)$ (b) a conducting plane, 1 cm distant from the cylinder axis, by the equation $C = 2\pi\epsilon L / \ln(2h/b)$. (c) similar cylinder, axis separated by 1 cm. **07**

Q.4 (a) Write a short note on Ampere's circuital law & find \vec{H} due to infinitely long straight conductor. **07**

(b) Two concentric conducting spheres have radii of 3 and 5 cm. The region between them is filled with a homogeneous dielectric for which $\epsilon_r = 5$. If the potential of the inner sphere is 100V while that of the outer is -100 V. Find (a) $V(r)$ (b) $E_r(r)$ (c) The potential midway between conducting spheres (d) the value of r at which $V=0$. **07**

OR

- Q.4** (a) Explain the boundary condition for tangential component in magnetic correlation. **07**
- (b) Obtain the expression for \overline{H} in all regions if a cylindrical conductor carries a direct current I and its radius is R meter. **07**
- Q.5** (a) State and Explain Biot savart law & derive an expression for magnetic field intensity around a thin conductor carrying current I ampere placed at Z -axis. **07**
- (b) Write a short note on stoke's theorem. **07**
- OR**
- Q.5** (a) Explain Lorentz law in detail. **07**
- (b) Describe Pointing vector in brief. **07**
