

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C Sem-III Examination May 2011

Subject code: X31102

Subject Name: Engineering Electromagnetics

Date: 20/05/2011

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 cartesian co-ordinate system. Show how to convert given vector from cartesian system to cylindrical co-ordinate system. **07**

- (b)** Given three points in Cartesian co-ordinate system as $A(3,-2,1)$, $B(-3,-3,5)$, $C(2,6,-4)$. Find: **07**
- (i) The vector from A to C
 - (ii) The unit vector from B to A
 - (iii) The distance from B to C
 - (iv) The vector from A to the midpoint of the straight line joining B to C

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

- (b)** A charge $Q_1 = -20 \mu\text{C}$ is located at $P(-6,4,6)$ and charge $Q_2 = 50 \mu\text{C}$ is located at $R(5,8,-2)$ in a free space. Find the force exerted on Q_2 by Q_1 in vector form. The distances given are in meters. **07**

OR

- (b)** Volume charge density is given by $\rho_v = 10e^{-1000\rho} e^{-100z} \text{ C/m}^3$. **07**
- (a) Find the maximum value of ρ_v in the region $0 \leq \rho \leq 0.01 \text{ m}$, $0 \leq \Phi \leq 2\pi$, $0 \leq z \leq 0.01 \text{ m}$.
 - (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) Explain Boundary conditions at a conductor free space boundary. **07**

- (b)** Explain Electric flux density for line charge, surface charge, Volume charge Distributions. **07**

OR

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

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

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

- (b)** A point charge of 6 nC is located at origin in free space, find potential of point P if P is located at $(0.2, -0.4, 0.4)$ and **07**
- a) $V=0$ at infinity
 - b) $V=0$ at $(1, 0, 0)$
 - c) $V=20 \text{ V}$ at $(-0.5, 1, -1)$

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) Explain Uniqueness theorem. **07**
- (b) Explain Pointing vector in brief. **07**
- OR**
- Q.5** (a) Explain Faraday's law and lenz's law . **07**
- (b) Write a short note on stoke's theorem. **07**
