

# C.U.SHAH UNIVERSITY

## Winter Examination-2015

**Subject Name:** Electromagnetics

**Subject Code:** 4TE05EMS1

**Branch:** B.Tech (EC)

**Semester:** 5    **Date:** 04/12/2015    **Time:** 2:30 To 5:30    **Marks:** 70

**Instructions:**

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at the right places.
- (4) Assume suitable data if needed.

**Q-1**                      **Attempt the following questions** **(14)**

- a) Define the electric flux.
- b) Define electric field intensity.
- c) Write only relation between electric flux density and electric field intensity.
- d) Write statement of Coulomb's law.
- e) Write statement of Gauss's law.
- f) Write expression for divergence of D.
- g) Write an expression for line charge density.
- h) Write expression for surface charge density.
- i) Write statement of Maxwell's first equation.
- j) Write transformation formula of cylindrical co-ordinates into Cartesian coordinates.
- k) Write transformation formula of spherical coordinates into Cartesian coordinates.
- l) Write expression for volume charge density.
- m) Write expression of current density.
- n) Define magnetic flux & magnetic field intensity.

**Attempt any four questions from Q-2 to Q-8**

**Q-2**                      **Attempt all questions** **(14)**

- (a) Derive the expression for electric field intensity at any point due to a line charge with uniform charge density  $\rho_L$  C/m on the infinitely long Z-axis. **(09)**  
An infinitely long, uniform line charge is located at  $y = 3, z = 5$ . If  $\rho_L = 30$  nC/m, find E' at 1) the origin 2)  $P_B(0, 6, 1)$  3)  $P_C(5, 6, 1)$ .
- (b) Transform each of the following vectors to spherical coordinates at the Point specified 1)  $5\mathbf{a}'_x$  at B ( $r=4, \theta=25^\circ, \phi=120^\circ$ ) 2)  $5\mathbf{a}'_x$  at A ( $x = 2, y = 3, z = -1$ ). **(05)**

**Q-3**                      **Attempt all questions** **(14)**

- (a) Using Gauss's law explain the concept of divergence. Prove the Divergence theorem and obtain Maxwell's first equation. **(10)**
- (b) Find the numerical value for the divergence of D' at the point indicated if 1)  $D' = 20xy^2(z+1)\mathbf{a}'_x + 20x^2y(z+1) + 10x^2y^2\mathbf{a}'_z$  C/m<sup>2</sup> at  $P_A(0.3, 0.4, 0.5)$  **(04)**



2)  $D' = 4 \rho z \sin\theta a'_\rho + 2 \rho z \cos\theta a'_\phi + 2 \rho^2 \sin\theta a'_z$  C / m<sup>2</sup> at P<sub>B</sub> (1,  $\pi/2$ , 2).

- Q-4** **Attempt all questions** (14)  
 (a) Write a detailed note on Magnetization and permeability. (07)  
 (b) Explain Point and integral form of Maxwell's Equations. (07)
- Q-5** **Attempt all questions** (14)  
 (a) Explain in details the Electrostatic boundary conditions between perfect dielectrics. (07)  
 (b) State and prove uniqueness theorem. (07)
- Q-6** **Attempt all questions** (14)  
 (a) State and explain Biot-Savart's law. (05)  
 (b) State Ampere's Circuital law. Derive the expression for curl of magnetic field intensity. (09)
- Q-7** **Attempt all questions** (14)  
 (a) Explain Magnetic boundary conditions in brief. (07)  
 (b) Describe the boundary conditions between free space and a conductor. What is importance of boundary condition? (07)
- Q-8** **Attempt all questions** (14)  
 (a) Derive Poisson's and Laplace's equations and state their applications. (07)  
 (b) Write Short note on the followings (07)  
 1) Skin effect  
 2) The retarded potentials

