GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VI- EXAMINATION – SUMMER 2016
Subject Code:160906   **Date:13/05/2016**
Subject Name:Theory of Electromagnetics
Time: 10:30 AM to 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.**
4. **Symbols have their usual meanings**

Q.1
(a) Explain how ρ, Φ and z are defined in cylindrical co-ordinate system. Also discuss   (7)
    the relationship cartesian and cylindrical co-ordinate system
(b) Find a vector directed from A $(10, 3\pi/4, \pi/6)$ to B $(5, \pi/4, \pi)$ in Cartesian co-ordinate   (7)
    system

Q.2
(a) State and explain Coulomb's law. Using Coulomb's law find the vector force on   (7)
    $Q_1 = 20\mu C$, due to charge $Q_2 = -300\mu C$, where Q_1 is at $(0,1,2)$ and Q_2 at $(2,0,0)$
(b) Define electric field intensity. Derive the expression for electric field intensity   (7)
    due to infinite sheet charge
                                        OR
(b) Derive the expression for electric field intensity at a point located at a height of 'h'   (7)
    metres from z = 0 plane, due to uniformly charged thin circular ring having a radius
    of 'a' metres in z = 0 plane

Q.3
(a) State and explain Gauss' law. Use Gauss' law to find the total charge enclosed inside   (7)
    the cylinder due to line charge which passes through the centre of the cylinder resting
    on z = 0 plane. Assume that the cylinder has a radius of 'ρ' and length of 'L' metres
(b) Discuss the application of Gauss' law to differential volume element and hence   (7)
    explain the divergence theorem
                                        OR
Q.3
(a) Define potential and potential difference. Derive the relationship between electric   (7)
    field intensity and electric potential
(b) Explain how polarization in dielectrics takes place when electric field is applied   (7)

Q.4
(a) Explain Poisson's and Laplace's equations. Write the expression for Laplace's   (7)
    equations in cartesian, cylindrical and spherical co-ordinate system
(b) State and explain Ampere's circuital law   (7)
                                        OR

Q.4
(a) Derive the formula for magnetic field intensity 'H' due to infinitely long straight   (7)
    straight conductor
(b) Explain Magnetic Resonance Imaging technique in brief

Q.5
(a) What is curl operation? Prove that curl H = J   (7)
(b) Explain how force on a moving charge can be found out using Lorentz force   (7)
    equation. A point charge of Q = -1.2C has velocity $v = 5a_x + 2a_y - 3a_z$ m/s. Find
    the magnitude of force exerted on charge if (i) $E = -18a_x + 5a_y - 10a_z$ V/m
    (ii) $B = -4a_x + 4a_y + 3a_z$ T (iii) both are present simultaneously
                                        OR
Q.5
(a) With the help of neat diagram explain the working of MHD generator   (7)
(b) Explain FDM method in brief   (7)