Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER– III• EXAMINATION – SUMMER 2015

Subject Code:X31102 **Date:01/06/2015**

Subject Name: Engineering Electromagnetics

Time:02.30pm-05.00pm **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 neat and clean sketches explain spherical coordinate system. Give the transformation table of spherical coordinate to Cartesian coordinate system and vice versa.	07
	(b)	The surfaces r=2, r=4, θ=30°, θ=50°, ϕ=20° and ϕ=60°.Identify a closed surface. (a) find the enclosed volume.(b) find the total area of the enclosing surface. (c) find the total length of the twelve edges of the surface. (d) find the length of the longest straight line that lies entirely within the surface.	07
Q.2	(a)	Define Electric field intensity. Derive the expression of electric field intensity due to a infinite sheet of charge with surface charge density of ρ_s C/m^2 lies in the yz plane.	07
	(b)	Given three points M(6, 2, -3),N(-2, 3, 0) and P(-4, 6, 7) Find: a) area of triangle. b) a unit vector perpendicular to this triangular surface.	07
		OR	
	(b)	Calculate the total charge within each of the indicated volumes: (a) $0.1 \le \lvert x\rvert\lvert y\rvert\lvert z\rvert \le 0.2; \rho_v = \frac{1}{x^3y^3z^3}$ (b) $0 \le \rho \le 0.1, 0 \le \phi \le \pi, 2 \le z \le 4; \rho_v = \rho^2 z^2 \sin 0.6\phi$	07
Q.3	(a)	Derive the expression of Electric field Intensity due to Dipole.	07
	(b)	Cylindrical surfaces at ρ = 2, 4 and 6 m carry uniform charge densities of 20nC/m^2, -4 nC/m^2 and ρ_{so}, respectively. (a) Find D at ρ = 5 m. (b) Determine ρ_{so} such that D = 0 at ρ = 7 m.	07
		OR	
Q.3	(a)	Derive the conductor- free space boundry conditions.	07
	(b)	vector G= $24xya_x + 12(x^2+2)a_y + 18z^2a_z$ and points P(1, 2, -1) & Q(-2, 1, 3) are given find (a) G at P (b) unit vector in direction of G at Q (c) a unit vector directed from Q toward P (d) equation of surface on which |G|=60.	07
Q.4	(a)	Derive expression for Magnetic Field Intensity due to co-axial cable at four points (a) inside conductor, (b) Between conductor & wire mesh (c) in wire mesh (d) outside cable.	07
	(b)	The field B=$-2a_x+3a_y+4a_z$ is present in free space. Find the vector force exerted on straight wire carrying current 12A in a_{AB} direction given A(1,1,1) & B (3,5,6)	07
		OR	
Q.4	(a)	Write down the Biot Savart's law and Ampere circuital law in brief.	07

(b) Calculate the value of the vector current density (a) in rectangular co-ordinates at P_a (2, 3, 4) if $H = x^2 z\, a_y - y^2 x\, a_z$ (b) in cylindrical co-ordinates at P_b (1.5 , 90°,0.5) if $H = \frac{2}{\rho}\cos 0.2\phi\, a_\rho$ (c) in spherical co-ordinates at Pc (2, 30°, 20°) if $H = \frac{1}{\sin\theta} a_\theta$ 07

Q.5 (a) Explain all four Maxwell equations for time varying fields in point form and integral form. 07

(b) A copper conductor has a diameter of 0.6 inch and it is 1200 ft long; assume that it carries a total dc current of 50 A: (a) find the total resistance of the conductor (b) what current density exists in it? (c) what is the dc voltage between the conductor ends? (d) how much power is dissipated in the wire. 07

OR

Q.5 (a) Derive the wave equations for electric field and magnetic fields. 07

(b) Short note on uniform plane wave propagation in free space. 07

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