Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV • EXAMINATION – SUMMER 2013

Subject Code: X40904 Date: 13-06-2013

Subject Name: Theory of Electromagnetic

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)**	Explain spherical co-ordinate system. How a vector in cartesian system can be converted in spherical system	**07**
	(b)	Explain Coulomb's law. A charge $Q_1 = -20\mu C$ is located at P(-6,4,6) and a charge $Q_2 = 50\ \mu C$ is located at R(5,8,-2). Find the force exerted by Q_2 on Q_1.	**07**
Q.2	**(a)**	Derive the formula for electric field intensity due to infinite line charge which lies along the z-axis	**07**
	(b)	Transform the vector field $W= 10a_x -8a_y + 6a_z$ to cylindrical co-ordinate system at point P(10,-8,6)	**07**
		OR	
	(c)	Derive the expression for electric field intensity at any point on the z-axis due to sheet charge which lies in z = 0 plane	**07**
Q.3	**(a)**	Discuss application of Gauss' law to differential volume element and hence find divergence of electric flux density.	**08**
	(b)	Two co-axial conducting cylinders have inner radius of 'a' and outer radius of 'b' Use Gauss' law to find D in all the regions	**06**
		OR	
Q.3	**(a)**	A sheet charge lies on the circular disc with $\rho \leq 4m$, z = 0, with density $\rho_S = 10^{-4}/\rho$ C/m^2. Determine E at $\rho = 0$, z =3.	**08**
	(b)	Find the divergence of A at P $(5, 90^0,1)$ where $A = rz\sin\phi\ a_r + 3rz^2\cos\phi\ a_\phi$	**06**
Q.4	**(a)**	Discuss the procedure to find the work done in moving a point charge from one point to another in an electric field. Also explain and define potential and potential difference	**07**
	(b)	Define potential gradient and hence prove that E = -grad V	**07**
		OR	
Q.4	**(a)**	Write a short note on boundary conditions between conductor and free space	**07**
	(b)	State and explain continuity equation of current in integral form and point form	**07**
Q.5	**(a)**	Explain uniqueness theorem	**06**
	(b)	Discuss how Ampere's law can be applied to differential surface element to develop the concept of curl and hence prove that curl H = J	**08**
		OR	
Q.5	**(a)**	Explain Lorentz force equation	**06**
	(b)	Explain Maxwell's equations for time varying fields.	**08**

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