Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: X40904 Date: 02-01-2015

Subject Name: Theory of Electromagnetics

Time: 02:30 pm - 05:00 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)** What are scalars and vectors? Discuss with the help of suitable example how dot product and cross product of vectors can be obtained. Also explain why vector cross product does not obey the commutative law? **07**

(b) Derive the formula for electric field intensity at any point on the y-axis due to infinite line charge along the z-axis **07**

Q.2 **(a)** What is electric flux and electric flux density? Discuss the application of Gauss' law to the field of a point charge Q on a spherical surface. Also give the relationship between electric flux density and electric field intensity **07**

(b) Define potential and potential difference. Also prove that E = -gradV **07**

OR

(b) Show that the potential field $V = 100[\rho - (1/\rho)]\cos\Phi$ satisfies Laplace's equation **07**

Q.3 **(a)** What is an electric dipole? Derive the equation for electric and potential fields due to electric dipole **07**

(b) State and explain divergence theorem **07**

OR

Q.3 **(a)** A uniform line charge $\rho_{L1} = 15nC/m$ is at y = -1, z = 0, while $\rho_{L2} = -15nC/m$ is located at y = 1, z = 0. Find E as a function of z at y = 0. **07**

(b) Let $D = (10xyz^2 + 4x)a_x + 5x^2z^2a_y + 10x^2yz\ a_z\ nC/m^2$.(i) Find the total charge enclosed in a cube having a volume of $10^{-10}\ m^3$ located at (2,3,4). (ii) How much flux leaves this volume? (iii) What is average volume charge density within this volume? **07**

Q.4 **(a)** State the principle of electrostatic spraying. Explain how electrostatic spraying of paints and pesticides is carried out **07**

(b) Explain corona phenomenon. State its application in xerographic and laser printers **07**

OR

Q.4 **(a)** State and explain Biot Savart's law. Derive the mathematical form of Biot Savart's law **07**

Q.4 **(b)** What is curl? Prove that curl H = J **07**

Q.5	**(a)**	Explain Stoke's theorem. Prove that divergence of a curl of vector is zero using Stoke's theorem	**07**
	(b)	Write a short notes on magnetic boundary conditions	**07**

OR

Q.5	**(a)**	State and explain Maxwell's equation for static fields and time varying fields	**07**
	(b)	Explain the following in brief (i) Faraday's law (ii) Lenz's law (iii) Lorentz force equation	**07**

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