

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER– IV (New) EXAMINATION – WINTER 2019

**Subject Code: 2140909**

**Date: 14/12/2019**

**Subject Name: Field Theory**

**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.

		MARKS
<b>Q.1</b>	(a) Define scalar Field and Vector field with proper example.	<b>03</b>
	(b) In Free Space $V = x^2y(z + 3)$ Find $\mathbf{V}$ and $\mathbf{E}$ at point (3,4,-6)	<b>04</b>
	(c) Explain Spherical co-ordinate system. Also give expression of differential elements in the system.	<b>07</b>
<b>Q.2</b>	(a) Write mathematical Expression of Divergence in rectangle co-ordinate system. Explain physical meaning of Divergence.	<b>03</b>
	(b) State and Explain Stokes' theorem.	<b>04</b>
	(c) Derive Maxwell's first equation as applied to the electrostatics, using Gauss's law.	<b>07</b>
	<b>OR</b>	
	(c) Derive expression of electric field intensity due to an infinite line charge over z-axis having a uniform charge density of $\rho_L$ C/m.	<b>07</b>
<b>Q.3</b>	(a) Explain concept of dot product and cross product.	<b>03</b>
	(b) Explain concept of magnetic torque.	<b>04</b>
	(c) If a particular Field is given by , $\mathbf{F} = (x + 3y + az)\mathbf{a}_x + (bx + 2y + z)\mathbf{a}_y + (4x + cy + 2z)\mathbf{a}_z$ , Than Find the constant a,b,c such that the Field is irrotational.	<b>07</b>
	<b>OR</b>	
<b>Q.3</b>	(a) Write Maxwell's equations for steady field in integral and differential form.	<b>03</b>
	(b) Explain Electrical field as the Gradient of the electrical potential.	<b>04</b>
	(c) Two uniform line charges of Density $\rho_L = 4\text{nC/m}$ lie in the $x=0$ plane at $y = \pm 4\text{m}$ . Find $\mathbf{E}$ at (4,0,10)	<b>07</b>
<b>Q.4</b>	(a) Explain Characteristics impedance and propagation constant of the transmission line.	<b>03</b>
	(b) Explain EMI control techniques.	<b>04</b>
	(c) Discuss poisson's and Laplace Equation	<b>07</b>
	<b>OR</b>	
<b>Q.4</b>	(a) Write any three equations which Shows current density- $\mathbf{J}$ and field density- $\mathbf{D}$ are Dual.	<b>03</b>
	(b) Explain polarization with reference to dielectrics.	<b>04</b>
	(c) Derive equation for lossless transmission line.	<b>07</b>
<b>Q.5</b>	(a) State and explain source of EMI.	<b>03</b>
	(b) Find the displacement current within a parallel plate capacitor where $\epsilon = 100\epsilon_0$ , $A = 0.01\text{m}^2$ , $d = 0.05\text{ mm}$ and the capacitor voltage is $100 \sin(2000\pi t)$ volts.	<b>04</b>
	(c) State and Explain Ampere Circuital Law both in integral and differential form.	<b>07</b>

- Q.5** (a) Explain Physical significance of displacement Current. **03**  
(b) Explain conduction current density and displacement current Density. **04**  
(c) The magnetic field intensity is given in certain region of space as **07**

$$\vec{H} = \left[ \frac{(x+2y)}{z^2} \right] \vec{a}_y + \frac{2}{z} \vec{a}_z \text{ A/m. Find 1. } \nabla \times \vec{H} \text{ 2. } \vec{J} \text{ 3. Use } \vec{J} \text{ to find}$$

the total current passing through the surface  $Z=4$ ,  $1 \leq x \leq 2$ ,  $3 \leq y \leq 5$ . In  $\vec{a}_z$  direction

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