

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:2140909**Date:19-07-2023****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.
4. Simple and non-programmable scientific calculators are allowed.
5. Bold letters indicate vector quantity.

		MARKS
Q.1	(a) Explain cylindrical coordinate system in brief.	03
	(b) Derive the expression for electric field due to infinite surface charge distribution in free space.	04
	(c) Obtain the Spherical co-ordinates of $10 \mathbf{ax}$ at the point $P(x = 2, y = 3, z = 4)$.	07
Q.2	(a) Define (1) Electric field intensity (2) Potential Difference (3) Potential gradient.	03
	(b) Define and explain unit vectors in cylindrical and spherical co-ordinate systems.	04
	(c) An infinite uniform linear charge $\rho_L = 2.0 \text{ nC/m}$ lies along the x axis in free space, while point charge of 8.0 nC is located at $(0, 0, 1)$ Find $\mathbf{E}$ at $(2, 3, 4)$.	07
	OR	
	(c) Derive the expression for $\mathbf{E}$ at point P on the y-axis of an infinite uniform line charge along z-axis, carrying a charge ρ_L .	07
Q.3	(a) Define conservative field.	03
	(b) State Maxwell's equation in point form and integral form for static electromagnetic field.	04
	(c) An Electrical potential is given by $V = \frac{60 \sin \theta}{r^2} \text{ v}$. Find V and $\mathbf{E}$ at spherical coordinate $P(3, 60^\circ, 25^\circ)$.	07
	OR	
Q.3	(a) Derive Poisson's and Laplace's equation.	03
	(b) State and prove Stoke's Theorem.	04
	(c) Obtain equation for flux density due to infinite line charge using Gauss's law.	07
Q.4	(a) List any three effects of EMI.	03
	(b) State and explain Ampere's circuital law.	04
	(c) A dielectric-free space interface has the equation $3x + 2y + z = 12 \text{ m}$. The origin side of the interface has $\epsilon_r = 3.0$, $\mathbf{E}_1 = 2 \mathbf{a}_x + 5 \mathbf{a}_z \text{ v/m}$. Find $\mathbf{E}_2$.	07
	OR	
Q.4	(a) Explain briefly about lossless propagation of sinusoidal voltages.	03
	(b) Explain electric dipole. Derive the expression for $\mathbf{E}$ at any distant point from dipole.	04

- (c) Two uniform line charges of density $\rho_L = 4 \text{ nC/m}$ lie on the $X = 0$ plane and $Y = \pm 4$ are parallel to Z -axis. Find $\mathbf{E}$ at $(4,0,10) \text{ m}$. **07**
- Q.5** (a) State and prove the Gauss's law. **03**
- (b) Find $\text{div } \mathbf{D}$ at $P(5, \pi/2, 1)$ if $\mathbf{D} = r z \sin \phi \mathbf{a}_r + 3 r z^2 \cos \phi \mathbf{a}_\phi$ **04**
- (c) Describe the physical description of transmission line propagation. **07**
- OR**
- Q.5** (a) State and explain Biot Savart's law. **03**
- (b) State and explain Faraday's law for statically induced emf with derivation. **04**
- (c) State and prove Uniqueness theorem. **07**
