Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3141009 Date:24-01-2024

Subject Name:Electromagnetic 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.**

Q-1	**(a)**	Define: Divergence, Gradient and Curl.	**03**
	(b)	Transform the following vectors to spherical co-ordinates at the points given: (i) $10a_x \; at \; P(x=-3, y=2, z=4)$**;** (ii) $10a_z \; at \; M(r=4, \theta=110^o, \phi=120^o)$**.**	**04**
	(c)	Explain Cylindrical co-ordinate system in detail.	**07**
Q-2	**(a)**	State and explain Coulombs law.	**03**
	(b)	Find the gradient of scalar fields, (i) $V = e^{-z} \sin 2x \cosh y$; (ii) $U = \rho^2 z \; cos \; 2\phi$.	**04**
	(c)	Derive expression of electric field intensity due to a uniform line charge over z-axis having a charge density of ρ_L C/m.	**07**
		OR	
	(c)	Derive expression of electric field intensity due to a surface charge.	**07**
Q-3	**(a)**	Write Maxwell's equation in point and integral form.	**03**
	(b)	Three infinite uniform sheets of charge are located in free space as follows; *3 nC/m²* at *z = -4*, *6 nC/m²* at *z = 1*, and *-8 nC/m²* at *z = 4*. Find **E** at the point (a) *A(2, 5, -5)*, (b) *B(4, 2, -3)*, (c) *C(-1, -5, 2)*, (d) *D(-2, 4, 5)*.	**04**
	(c)	State and prove Gauss's Law.	**07**
		OR	
Q-3	**(a)**	Define Gaussian surface.	**03**
	(b)	Calculate **D** in rectangular co-ordinates at point *P(2, -3, 6)* produced by: (a) a point charge $Q_A = 55 \; mC$ at *Q(-2, 3, -6)*; (b) a uniform line charge $\rho_{LB} = 20 \; mC/m$ on the *x*-axis**.**	**04**
	(c)	State and explain Ampere's circuital law.	**07**
Q-4	**(a)**	Briefly explain the wave polarization.	**03**
	(b)	If we take the zero reference for potential at infinity, find the potential at *(0, 0, 2)* caused by this charge configuration in free space (a) *12 nC/m* on the line $\rho = 2.5$ m, $z = 0$; (b) point charge of *18 nC* at *(1, 2, –1)*.	**04**
	(c)	State and explain Faraday's Law.	**07**
		OR	
Q-4	**(a)**	Define: Electric potential.	**03**
	(b)	Derive the continuity equation from Maxwell's equation.	**04**
	(c)	Write short note on wave propagation in dielectrics.	**07**
Q-5	**(a)**	Define displacement current.	**03**
	(b)	What is skin effect?	**04**
	(c)	Discuss, Plane Wave Propagation in General Directions.	**07**
		OR	
Q-5	**(a)**	Define voltage standing wave ratio (VSWR).	**03**
	(b)	Discuss applications of transmission lines.	**04**
	(c)	Write short note on Lossless Propagation.	**07**

****