Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – SUMMER 2025

Subject Code: 3140912 Date:12-05-2025

Subject Name: Electromagnetic Fields

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.**

			MARKS
Q.1	**(a)**	Explain dot product and cross product of two vectors.	**03**
	(b)	Explain Electric Flux density and its relationship with electric field intensity.	**04**
	(c)	Explain spherical coordinate system and give its relationship with Cartesian coordinate system.	**07**
Q.2	**(a)**	State and explain Gauss's law. Also write limitations of Gauss's law.	**03**
	(b)	State and Explain various types of charge distribution with mathematical equation.	**04**
	(c)	Derive the expression for E at point P on the axis of charged circular ring, carrying a charge uniformly along its circumference with density ρL	**07**
		OR	
	(c)	A positively charged circular ring with ρL = 10 nC/m having radius of 5m lies on z = 0 plane with its centre at origin. Find E at point (0, 0, 5) and also find the value of a point charge Q which will produce the same E at a point (0, 0, 5) m.	**07**
Q.3	**(a)**	Explain Physical meaning of divergence and state its properties.	**03**
	(b)	Verify that the potential field given below satisfies the Laplace's equation. $V=2x^2-3y^2+z^2$	**04**
	(c)	Define potential difference and potential gradient. Also Establish relation between Electrical field and potential gradient.	**07**
		OR	
Q.3	**(a)**	Derive the relation between I and J.	**03**
	(b)	Derive Poisson's and Laplace's equation.	**04**
	(c)	Explain Electrical dipole. Derive the expression for E and V at any distant point from dipole.	**07**
Q.4	**(a)**	Explain magnetization and polarization.	**03**
	(b)	State and Explain Ampere circuit law, both in integral and differential form as used in magnetic field.	**04**
	(c)	State and Explain Lorentz force equation on charged particles.	**07**
		OR	
Q.4	**(a)**	Explain scalar and vector magnetic potentials.	**03**
	(b)	Explain force between two differential current elements.	**04**
	(c)	Obtain the Expression for field intensity H at the centre of a circular carrying current I, using Biot-Savart law.	**07**

Q.5	**(a)**	Define curl and write significance to decide types of field on bases of curl.	**03**
	(b)	State and explain Stoke's Theorem with its mathematical expression.	**04**
	(c)	Explain the terms conduction current density and displacement current density.	**07**

OR

Q.5	**(a)**	Classify magnetic materials.	**03**
	(b)	Discuss inductance. Explain self-inductance and mutual inductance.	**04**
	(c)	State Maxwell's equation in point form and integral form for static electromagnetic field.	**07**

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