GUJARAT TECHNOLOGICAL UNIVERSITY
BE- SEMESTER–IV (NEW) EXAMINATION – WINTER 2024

Subject Code:3140912   **Date:21-11-2024**

Subject Name: Electromagnetic Fields

Time:02:30 PM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	List the applications of the cross product.	03
	(b)	Calculate the divergence of the vector field G at the point P(1,−2,3) where G=yz ax + 4xy ay + y az.	04
	(c)	Explain the Cartesian coordinate system and derive the equations for differential length, differential surface area, and differential volume elements.	07
Q.2	**(a)**	Describe the concept of the magnetic dipole moment.	03
	(b)	Analyse the expression for the electric field due to an infinite surface charge distribution in free space.	04
	(c)	Given point charges of 1 mC and −2 mC located at (3,2,−1) and (−1,−1,4) respectively, calculate the electric force on a 10 nC charge located at (0,3,1) and determine the electric field intensity at that point.	07
		OR	
	(c)	Explain the physical significance of divergence and state its properties.	07
Q.3	**(a)**	Explain the phenomenon of polarization.	03
	(b)	Describe the boundary conditions for dielectric materials.	04
	(c)	Derive the boundary conditions at a dielectric-dielectric interface.	07
		OR	
Q.3	**(a)**	Explain concept of electric potential difference	03
	(b)	Write Poisson's and Laplace equation. Also state use of this equation.	04
	(c)	Define potential difference and potential gradient. Also Establish relation between Electrical field and potential gradient.	07
Q.4	**(a)**	State and explain Biot-Savart's law.	03
	(b)	State and explain Ampere's circuital law.	04
	(c)	Derive Maxwell's equations in both integral and differential forms.	07
		OR	
Q.4	**(a)**	Differentiate between a steady magnetic field and a time-varying magnetic field.	03
	(b)	Define the physical significance of the curl of a vector field.	04
	(c)	Derive Stokes' theorem and present its mathematical expression.	07
Q.5	**(a)**	Define inductance and explain the concepts of self-inductance and mutual inductance.	03
	(b)	Classify different types of magnetic materials.	04
	(c)	Explain the force between two differential current elements.	07

OR

Q.5   **(a)**   Discuss the applications of the Lorentz force equation.   **03**

       (b)   Define displacement current and current density.   **04**

       (c)   Analyze Maxwell's equations for Static fields. Explain how they are modified for time varying electric and magnetic fields. Derive the time varying Maxwell's equation for curl of H and also mention its physical significance.   **07**

****