Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (OLD) EXAMINATION – WINTER 2023

Subject Code:151002   **Date:13-12-2023**
Subject Name:Engineering Electromagnetics
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 Coulomb's law and derive the expression for electric field intensity E due to point charge.	**07**
	(b)	State Gauss's law. Also derive mathematical formulation for the same.	**07**
Q.2	**(a)**	Derive the expression of gradient of scalar field in all the systems and list computational formulas on gradient.	**07**
	(b)	Write down point and integral forms of all four Maxwell's equations for steady & time-varying electro-magnetic fields.	**07**
		OR	
	(b)	A sheet of charge lies in yz plane at x=0 and has uniform surface charge density of 5 pC/m^2 . Find the electric field at a point P(-5,0,0) on x-axis.	**07**
Q.3	**(a)**	What is an electric dipole? Derive the expression for the potential and electric field intensity due to a dipole at distances very large from the origin compared to the spacing between the charges of the dipole	**07**
	(b)	Derive the relationship between J &E for a metallic conductor.	**07**
		OR	
Q.3	**(a)**	State and derive Biot-Savart's Law.	**07**
	(b)	Derive an expression for the capacitance of spherical capacitor.	**07**
Q.4	**(a)**	State Ampere's circuit law and derive the expression for curl of magnetic field intensity.	**07**
	(b)	Three infinite uniform sheets of charges are located in the free space as follows: 3 nC/m2 at z = - 4, 6 nC/m2 at z = 1, and -8 nC/m2 at z = 4. Determine E at the point P(2, 5, -5) & Q(4, 2, -3).	**07**
		OR	
Q.4	**(a)**	Derive electrostatic Boundary conditions for Dielectric to Dielectric interface	**07**
	(b)	Define Torque. Derive the equation of Torque on a close current carrying loop which is placed in steady magnetic field.	**07**
Q.5	**(a)**	With the help of necessary expressions, explain uniform plane wave propagation/motion in free space	**07**
	(b)	A current filament carrying 15 A in the a$_z$ direction lies along the entire z axis. Find H in rectangular coordinates at: (i) PA(201/2, 0, 4).	**07**
		OR	
Q.5	**(a)**	Explain Faraday's law with neat diagram	**07**
	(b)	State and prove Poynting theorem relating to the flow of energy at a point in space.	**07**

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