Enrolment No./Seat No_____

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

Subject Code:3141009　　　　　　　　　　　　　　　　**Date:27-11-2024**

Subject Name: Electromagnetic Theory

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)**	Explain the difference between scalar and scalar field with example.	**03**
	(b)	Explain the position vector and distance vector with example.	**04**
	(c)	Explain the various types of charge distributions and its charge density.	**07**
Q.2	**(a)**	Calculate the volume of the sphere of radius R using integration.	**03**
	(b)	State and derive the Gauss' law in point form.	**04**
	(c)	A charge distribution with spherical symmetry has density $\rho_v = \rho_0(r/R)$, at $0 \le r \le R$ and 0 for r > R, Determine E everywhere.	**07**

OR

	(c)	The flux density D = r/3 a_r nC/m^2 is in free space: 1. Find E at 0.4 m 2. Find the total electric flux leaving the sphere of r=0.4m 3. Find the total charge within the sphere of r = 0.5 m	**07**
Q.3	**(a)**	Define the Gaussian surface, Discuss satisfying conditions for Gaussian surface.	**03**
	(b)	What is streamlines? Explain the equations of streamlines in various coordinate systems.	**04**
	(c)	Two uniform line charges of density $\rho_l = 2$ nC/m lie in the x = 0 plane at y = ± 4 m. Find E at (4, 0, 12) m.	**07**

OR

Q.3	**(a)**	Why the divergence of curl of any vector is zero? Explain.	**03**
	(b)	State and prove divergence theorem.	**04**
	(c)	What is the potential at the center of a square with aside a = 4 m? While charges 2 µC, -2 µC, 4 µC and -2 µC are located at its corner.	**07**
Q.4	**(a)**	State and explain Ampere's circuital law.	**03**
	(b)	Explain the reflection of uniform plane wave at normal incidence.	**04**
	(c)	A current filament carrying 20 A in the a_z direction lies along the entire z axis. Find H in rectangular coordinates at P (10,0,4).	**07**

OR

Q.4	**(a)**	Write and explain the properties of Curl.	**03**
	(b)	State and explain Biot-Savart Law.	**04**
	(c)	Given the vector magnetic A = -r^2/4 a_z Wb/m. Calculate the total magnetic flux crossing the surface $\varphi = \pi/2$, $1 \le r \le 2$m; $0 \le z \le 5$m.	**07**
Q.5	**(a)**	Write and explain the Maxwell's equations in integral form.	**03**
	(b)	Explain the propagation constant and characteristic impedance of transmission line.	**04**
	(c)	Write short note on electromagnetic waves in good conductor.	**07**

OR

Q.5	**(a)**	Explain poynting vector.	**03**
	(b)	Define and explain wave polarizations.	**04**
	(c)	What are the applications of transmission line? Write the equations of transmission lines and their solutions in phasor form.	**07**

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