

Enrolment No./Seat No _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-V (NEW) EXAMINATION – SUMMER 2024

Subject Code:2151002

Date:16-05-2024

Subject Name:Engineering Electromagnetics

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) Compare Cartesian and Cylindrical coordinate systems.	03
	(b) Express the unit vector which is directed towards the origin from an arbitrary point on the plane $z = -4$	04
	(c) Derive the electric field intensity and electric flux density due to an infinite line charge having a uniform line charge density ρ_L C/m.	07
Q.2	(a) Prove that $\mathbf{a}_y \cdot \mathbf{a}_r = \sin\theta \sin\phi$ and $\mathbf{a}_z \cdot \mathbf{a}_\phi = 0$	03
	(b) State and prove the Maxwell's first equation.	04
	(c) Two uniform line charges of density $\rho_L = 4$ nC/m lie in the $x = 0$ plane at $y = \pm 4$ m. Find E at $(4, 0, 10)$	07
	OR	
	(c) A uniform line charge density of 20 nC/m lies on the z axis between $z = 1$ and $z = 3$. No other charge present. Find the electric field at origin.	07
Q.3	(a) What do you mean by equipotential surface? Derive the expression of potential gradient.	07
	(b) Derive an equation of energy stored in capacitor and also find capacitance of an isolated sphere.	07
	OR	
Q.3	(a) State Gauss's law. Deduce Coulomb's law from Gauss's law thereby affirming that Gauss's law is an alternative statement of Coulomb's and that Coulomb's law is implicit in Maxwell's equation $\nabla \cdot \mathbf{D} = \rho_v$	07
	(b) Derive Poisson's and Laplace's equations.	07
Q.4	(a) Explain the boundary conditions for conductor- free space of boundary in electrostatics.	07
	(b) Determine electric flux density $\mathbf{D}$ at $(4, 0, 3)$ if there is a point charge -5π mC at $(4, 0, 0)$ and a line charge 3π mC/m along y axis.	07
	OR	
Q.4	(a) Explain the magnetic boundary conditions.	07
	(b) Find the flux passing the portion of the plane $\phi = \pi/4$ defined by $0.01 < r < 0.05$ m and $0 < z < 2$ m. A current filament of 2.5 A is along the z axis in the $\mathbf{a}_z$ direction, in free space.	07

- Q.5 (a)** State and explain ampere's circuital law and derive the expression for curl of magnetic field intensity. **07**
- (b)** Write short note on wave polarization. **07**
- OR**
- Q.5 (a)** State and explain Faraday's law. **07**
- (b)** Write short note on wave propagation in good conductor. **07**
