

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023****Subject Code:2140909****Date:24-01-2024****Subject Name: Field Theory****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.
5. Bold letters indicate vector quantity.

		MARKS
Q.1	(a) Explain dot product and cross product of vectors.	03
	(b) Explain cylindrical coordinate system.	04
	(c) Given the points M($r = 5$, $\theta = 20$, $\Phi = 120$) and N ($r = 2$, $\theta = 80$, $\Phi = 30$): (a) find the distance from M to N. (b) find a unit vector in Cartesian coordinates at M that is directed towards N.	07
Q.2	(a) State and explain Coulomb's law.	03
	(b) Define electric field intensity. Obtain an expression for electric field intensity at a point which is at a distance of R from a point charge Q.	04
	(c) An infinite uniform line charge having line charge density of $\rho_L = 10 \text{ nC/m}$ placed at $y = 3$, $z = 5$. Find the total electric field intensity at (5,6,1).	07
	OR	
	(c) The surface charge density of $0.1 \times 10^{-9} \text{ C/m}^2$ exist on the plane $z = -3$. Find E at (I) P1 (0,1,4) (II) P2 (1,4,-5).	07
Q.3	(a) State Gauss's law. Also write limitations of Gauss's law.	03
	(b) Derive relationship between Electrical field intensity and Electrical flux density.	04
	(c) Derive an expression for static potential due to electrical dipole.	07
	OR	
Q.3	(a) Write Maxwell's equations for Static Electromagnetic field in point form and integral form.	03
	(b) Derive the point form of continuity equation	04
	(c) Derive the expression for electric field intensity due to line charge.	07
Q.4	(a) Derive Poisson's and Laplace's equation.	03
	(b) Drive electrostatic boundary condition for the boundary between two perfect dielectrics.	04
	(c) Write short note on 'magnetic materials'	07
	OR	
Q.4	(a) Explain concept of electric potential difference.	03
	(b) State and explain Ampere's circuital law.	04
	(c) Write a short note on sources of EMI.	07
Q.5	(a) State and explain Biot Savart's law.	03
	(b) Explain the physical significance of the term: Curl of a vector.	04
	(c) Explain Stoke's theorem with its mathematics expression.	07
	OR	
Q.5	(a) Derive equation of energy stored in magnetic fields	03
	(b) Derive Lorentz force equation on charge particle.	04
	(c) Describe the physical description of transmission line propagation.	07
