

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER-IV EXAMINATION – WINTER 2025****Subject Code:3141009****Date:24-11-2025****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) Define 1) Divergence, 2) Gradient and 3) Curl	03
	(b) Prove that the divergence of curl of any vector field is zero.	04
	(c) Derive an equation of electric field due to surface charge distribution.	07
Q.2	(a) Given vectors $A = 3a_x + 4a_y + a_z$ and $B = 2a_y - 5a_z$, find angle between vector A and B.	03
	(b) State and explain Gauss's Law.	04
	(c) What is the application of Poynting's Theorem? Derive its equation for total power leaving the volume.	07
	OR	
	(c) Derive and sketch the standing wave pattern when the intrinsic impedance of medium 1 is less than medium 2 ($\eta_1 < \eta_2$).	07
Q.3	(a) Explain Electric Field Intensity.	03
	(b) Briefly describe magnetic boundary condition between two different media.	04
	(c) Draw the equivalent circuit of the transmission line and derive its voltage and current equations.	07
	OR	
Q.3	(a) Write Maxwell's equation in differential form and integral form for static electric and magnetic fields.	03
	(b) State and prove Stokes's Theorem.	04
	(c) Write short note on wave propagation in good conductor.	07
Q.4	(a) Compare Cartesian and Cylindrical coordinate systems.	03
	(b) Obtain the expression of impedance for a lossless transmission line terminated in short circuit.	04
	(c) Explain the boundary condition between two dielectric material having permittivity ϵ_1 and ϵ_2 .	07
	OR	
Q.4	(a) Define following terms:	03
	1. Standing wave ratio	
	2. Reflection coefficient	
	3. Characteristic impedance	
	(b) State and explain Faraday's Law.	04
	(c) Explain Pulse Broadening in Dispersive Media.	07
Q.5	(a) Explain Lorentz Force equation.	03
	(b) How electric dipole is formed? Derived an equation of electric field due to electric dipole.	04

(c) Write short note on loss less and distortion less transmission line. **07**

OR

Q.5 (a) Derive an equation for variation in flux by moving loop in static magnetic field. **03**

(b) State and derived the Biot-Savart Law. **04**

(c) Write a short note on Smith Chart **07**

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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. (b) Explain the position vector and distance vector with example. (c) Explain the various types of charge distributions and its charge density.	03 04 07
Q.2	(a) Calculate the volume of the sphere of radius R using integration. (b) State and derive the Gauss' law in point form. (c) A charge distribution with spherical symmetry has density $\rho_v = \rho_0(r/R)$, at $0 \leq r \leq R$ and 0 for $r > R$, Determine E everywhere.	03 04 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. (b) What is streamlines? Explain the equations of streamlines in various coordinate systems. (c) Two uniform line charges of density $\rho_l = 2 nC/m$ lie in the $x = 0$ plane at $y = \pm 4$ m. Find E at $(4, 0, 12)$ m.	03 04 07
	OR	
Q.3	(a) Why the divergence of curl of any vector is zero? Explain. (b) State and prove divergence theorem. (c) What is the potential at the center of a square with aside $a = 4$ m? While charges $2 \mu C$, $-2 \mu C$, $4 \mu C$ and $-2 \mu C$ are located at its corner.	03 04 07
Q.4	(a) State and explain Ampere's circuital law. (b) Explain the reflection of uniform plane wave at normal incidence. (c) A current filament carrying $20 A$ in the a_z direction lies along the entire z axis. Find H in rectangular coordinates at $P (10,0,4)$.	03 04 07
	OR	
Q.4	(a) Write and explain the properties of Curl. (b) State and explain Biot-Savart Law. (c) Given the vector magnetic $A = -r^2/4 a_z$ Wb/m. Calculate the total magnetic flux crossing the surface $\phi = \pi/2$, $1 \leq r \leq 2m$; $0 \leq z \leq 5m$.	03 04 07
Q.5	(a) Write and explain the Maxwell's equations in integral form. (b) Explain the propagation constant and characteristic impedance of transmission line. (c) Write short note on electromagnetic waves in good conductor.	03 04 07
	OR	
Q.5	(a) Explain poynting vector. (b) Define and explain wave polarizations. (c) What are the applications of transmission line? Write the equations of transmission lines and their solutions in phasor form.	03 04 07

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – WINTER 2023****Subject Code:3141009****Date:24-01-2024****Subject Name:Electromagnetic 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.

Q-1 (a) Define: Divergence, Gradient and Curl. **03**
 (b) Transform the following vectors to spherical co-ordinates at the points given: **04**
 (i) $10a_x$ at $P(x = -3, y = 2, z = 4)$; (ii) $10a_z$ at $M(r = 4, \theta = 110^\circ, \phi = 120^\circ)$.
 (c) Explain Cylindrical co-ordinate system in detail. **07**

Q-2 (a) State and explain Coulombs law. **03**
 (b) Find the gradient of scalar fields, (i) $V = e^{-z} \sin 2x \cosh y$; (ii) $U = \rho^2 z \cos 2\phi$. **04**
 (c) Derive expression of electric field intensity due to a uniform line charge over z-axis having a charge density of ρ_L C/m. **07**

OR

(c) Derive expression of electric field intensity due to a surface charge. **07**

Q-3 (a) Write Maxwell's equation in point and integral form. **03**
 (b) Three infinite uniform sheets of charge are located in free space as follows; 3 nC/m^2 at $z = -4$, 6 nC/m^2 at $z = 1$, and -8 nC/m^2 at $z = 4$. Find \mathbf{E} at the point (a) $A(2, 5, -5)$, (b) $B(4, 2, -3)$, (c) $C(-1, -5, 2)$, (d) $D(-2, 4, 5)$. **04**
 (c) State and prove Gauss's Law. **07**

OR

Q-3 (a) Define Gaussian surface. **03**
 (b) Calculate \mathbf{D} in rectangular co-ordinates at point $P(2, -3, 6)$ produced by: (a) a point charge $Q_A = 55 \text{ mC}$ at $Q(-2, 3, -6)$; (b) a uniform line charge $\rho_{LB} = 20 \text{ mC/m}$ on the x-axis. **04**
 (c) State and explain Ampere's circuital law. **07**

Q-4 (a) Briefly explain the wave polarization. **03**
 (b) If we take the zero reference for potential at infinity, find the potential at $(0, 0, 2)$ caused by this charge configuration in free space (a) 12 nC/m on the line $\rho = 2.5 \text{ m}$, $z = 0$; (b) point charge of 18 nC at $(1, 2, -1)$. **04**
 (c) State and explain Faraday's Law. **07**

OR

Q-4 (a) Define: Electric potential. **03**
 (b) Derive the continuity equation from Maxwell's equation. **04**
 (c) Write short note on wave propagation in dielectrics. **07**

Q-5 (a) Define displacement current. **03**
 (b) What is skin effect? **04**
 (c) Discuss, Plane Wave Propagation in General Directions. **07**

OR

Q-5 (a) Define voltage standing wave ratio (VSWR). **03**
 (b) Discuss applications of transmission lines. **04**
 (c) Write short note on Lossless Propagation. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV(NEW) EXAMINATION – WINTER 2022****Subject Code:3141009****Date:17-12-2022****Subject Name:Electromagnetic 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.

		MARKS
Q.1	(a) State Gauss's law and give its mathematical expression.	03
	(b) Explain the phenomena of skin depth.	04
	(c) State and prove Ampere's Circuital Law.	07
Q.2	(a) State Biot-Savart's law and give its mathematical expression.	03
	(b) Explain properties of Smith Chart.	04
	(c) Find total Electric field intensity at origin if the following charge distributions are present in free space. Point charge 12nC at (2,0,6), line charge 3nC/m at x=-2,y=3 and surface charge density 0.2nC/m ² at x=2.	07
	OR	
	(c) State Electric field intensity and obtain the derivation of it due to infinite line charge.	07
Q.3	(a) State and explain Faraday's law.	03
	(b) Write Maxwell's equation in differential form and integral form for static electric and magnetic fields.	04
	(c) Give statement & mathematical expression of Poynting Theorem.	07
	OR	
Q.3	(a) Define VSWR and reflection coefficient.	03
	(b) Derive continuity equation.	04
	(c) Draw the equivalent circuit of the transmission line and derive its voltage and current equations.	07
Q.4	(a) State Stoke's theorem and Divergence theorem	03
	(b) Prove that curl of gradient of any scalar is zero.	04
	(c) Explain the concept of potential gradient and obtain the relation between electric field (E) and potential (V)	07
	OR	
Q.4	(a) State Lorentz Force Equation.	03
	(b) Prove that divergence of curl of any vector is zero.	04
	(c) Write a short note on wave propagation in good conductor.	07
Q.5	(a) Explain spherical co-ordinate system.	03
	(b) Explain Retarded Vector Potential.	04
	(c) Write a short note on Wave Reflection from Multiple Interfaces.	07
	OR	
Q.5	(a) Explain cylindrical co-ordinate system.	03
	(b) Transform the given vector $\mathbf{A}=10\mathbf{a}_z$ into spherical co-ordinates at the point P(4,110 ⁰ ,120 ⁰)	04

(c) Write a short note on Plane Wave Reflection at Oblique Incidence Angle. 07
