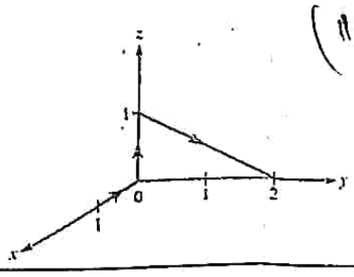
Sub Code: BEC-259	Roll No.	2	0	2

B. Tech. ECE
Year: 2nd, Semester: IV
Minor Test(Examination): 2025-2026
Electromagnetic Field Theory

Time: 2 Hr. **Max Marks: 30**

Note: Attempt ALL questions.

			Mark	CO	BL	PO	PI Code
Q1.		Attempt any three parts of the following.					
	a)	Define electric dipole. Derive the potential and electric field of electric dipole. Draw the flux lines and equipotential surface of the dipole.	4	CO1	1,2	1	1.2.1
	b)	Two large parallel conducting plates are separated by a distance d, and maintained at $V=0$ and $V=V_0$. The space between the plates is filled with a volume charge density $\rho_v = \rho_0 \sin(\pi z/d)$. Find the electric field at any point between the plates.	4	CO1	3	2	1.2.3
	c)	A current distribution gives rise to the vector magnetic potential $A = x^2 y\, a_x + y^2 x\, a_y - 4 x y\, a_z$ Wb/m. Calculate B at (-1, 2, 5) and the flux through the surface defined by $z=1, 0 \le x \le 1, -1 \le y \le 4$.	4	CO2	3	2	2.2.3
	d)	If magnetic field intensity $\vec{H} = (x-y)\hat{a}_x + (x^2+yz)\hat{a}_y + 5yz\hat{a}_z$, evaluate $\int \vec{H}.\vec{dl}$ along the contour in the figure given. 	4	CO2	3	2	2.2.3
Q2.		Attempt any three parts of the following.					
	a)	Write the Maxwell's equations in differential and integral form and also discuss their physical significance in detail. Explain displacement current with the help of suitable example.	3	CO1	1,2	1	1.2.1
	b)	The field of an electric dipole is given by $\vec{E} = k\frac{(2\cos\theta\hat{a}_r + \sin\theta\hat{a}_\theta)}{r^3}$, where k is constant, comment on the nature of conservation of the field given through rigorous proof.	3	CO1	1,2	1	1.2.3
	c)	Given, $\vec{D} = 2\rho z^2\, \hat{a}_\rho + \rho\cos^2\phi\, \hat{a}_z$, evaluate $\oint \vec{D}.\vec{dS}$ and verify the stokes theorem over a region defined by $2 \le \rho \le 5, -1 \le z \le 1$, and $0 < \phi < 2\pi$.	3	CO1	1,2	1	1.2.3

	d)	Derive and define the time required for the decay of volume charge density when a charge is introduced at some interior point of the material.	3	CO1	3	2
Q3.		Attempt any three parts of the following.				
	a)	The flux density at a point distance r from a long filamentary conductor carrying a current I in z-direction is given by $\mathbf{B} = (\mu_0 I/2\pi r)\,\hat{a}_\phi$. Calculate the flux crossing the portion of the plane $\phi = \pi/4$ defined by $0.01 < r < 0.05\ m$ and $0 < z < 2\ m$ for a current of 2A.	3	CO2	1,2	1
	b)	Derive the conditions that must be satisfied by magnetostatic fields at the boundary between two different media. Also, discuss the law of refraction for magnetic flux lines at a boundary with no surface current.	3	CO2	3	2
	c)	Derive and discuss the magnetic scalar and vector potentials for different current distributions.	3	CO2	3	2
	d)	What is Ampere's circuital law? Find the magnetic field intensity of an infinite line current placed along the z-axis using Ampere's law.	3	CO2	2,3	1

BL – Bloom's Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)

CO – Course Outcomes, PO – Program Outcomes, PI Code – Performance Indicator Code