



PRESIDENCY UNIVERSITY

BENGALURU

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Mid - Term Examinations - March 2026

Date: 12- 03-2026

Time: 02:00pm - 03:30pm

School: SOE	Program: B.Tech-EEE	
Course Code : EEE2501	Course Name: Electromagnetic Field Theory	
Semester: IV	Max Marks: 50	Weightage: 25%

CO - Levels	C01	C02	C03	C04	C05
Marks	24	24	2	-	-

Instructions:

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks.

5Q x 2M=10M

1	Given vectors $A = a_x + 3a_z$ and $B = 5a_x + 2a_y - 6a_z$, determine the component of A along a_y .	2 Marks	L2	C01
2	Depending upon the nature of the quantity under consideration, the field may be a vector or a scalar field. Define a scalar and vector with some examples.	2 Marks	L1	C01
3	Write the differential and integral form of Gauss law.	2 Marks	L1	C02
4	List the boundary conditions with respect to Electric field at the boundary of a conductor and free space.	2 Marks	L1	C02
5	Write the expressions for Poisson's equation in rectangular and cylindrical System.	2 Marks	L1	C03

Part B

Answer the Questions.

Total Marks 40M

6.	a.	Explain the concept of directional derivative.	3Marks	L2	CO1
	b.	The temperature in an auditorium is given by, $T = x^2 + y^2 - z$ A mosquito located at (1, 1, 2) in the auditorium desires to fly in such a direction that it will get warm as soon as possible. In what direction must it fly?	7Marks	L3	CO1
Or					
7.	a.	The divergence of a vector field simply measures how much the field is expanding at a given point. If a gas is heated, it will expand. This will cause a net motion of gas particles outward in all directions. Consider the vector field given below, and identify its strength at the point P (-2,1,6). Comment on the result. $P = x^2yz \mathbf{a}_x + xz \mathbf{a}_z$	5Marks	L3	CO1
	b.	A vector field is uniquely characterized by its divergence and curl. Neither the divergence nor curl of a vector field is sufficient to completely describe the field. Given the vector field $G = (16xyz) \mathbf{a}_x + (8x^2) \mathbf{a}_y - (x) \mathbf{a}_z$. Identify whether the given field is irrotational or not	5Marks	L3	CO1
Or					
8	a.	A point or vector can be represented in any curvilinear coordinate system, which may be orthogonal or nonorthogonal. Examples of orthogonal coordinate systems include the Cartesian (or rectangular), the circular cylindrical, the spherical, the elliptic cylindrical, the parabolic cylindrical. Given the point P(-2, 6, 3), extend P to cylindrical and spherical coordinates.	4Marks	L2	CO1
	b.	The divergence of a vector field simply measures how much the field is expanding at a given point. It does not indicate in which direction the expansion is happening. Hence, the divergence is a scalar. Develop the divergence of the following vector fields: (a) $P = x^2yz \mathbf{a}_x + xz \mathbf{a}_z$ (b) $Q = \rho \sin\phi \mathbf{a}_\rho + \rho^2 z \mathbf{a}_\phi + z \cos\phi \mathbf{a}_z$	6Marks	L3	CO1
Or					
9	a.	The steepness of the slope at a point is given by the magnitude of the gradient vector. The gradient can also be used to measure how a scalar field changes in other directions. In view of this	6Marks	L3	CO1

		obtain the gradient of the following functions in their respective coordinates. $P = 10x^2y + 8y^3z$, $Q = \rho z \cos \Phi$			
	b.	The collection of partial derivative operators. is commonly called the del operator. Mention the possible ways of using the del operator in electromagnetic fields.	4Marks	L2	CO1
or					
10	a.	The space around an electric charge in which its influence can be felt is known as the electric field. The electric field intensity at a point is the force experienced by a unit positive charge placed at that point. Point charges 1 mC and - 2 mC are located at (3, 2, -1) and (-1, -1,4), respectively. Calculate the electric force on a 10-nC charge located at (0, 3, 1) and the electric field intensity at that point	10Marks	L3	CO2
or					
11	a.	Consider a sphere with volume charge density as shown below. $\rho_v = \begin{cases} \frac{10}{r^2} \text{ mC/m}^3, & 1 < r < 4 \\ 0, & r > 0 \end{cases}$ <p>(a) Identify the net flux crossing surface $r = 2$ m and $r = 6$ m. Solve for D at $r = 1$ m and $r = 5$ m.</p>	10Marks	L3	CO2
or					
12	a.	Explain the behaviors of conductors and dielectrics in the presence of Electro static field	4Marks	L2	CO2
	b.	Two-point charges $-4 \mu\text{C}$ and $5 \mu\text{C}$ are located at (2, -1, 3) and (0, 4, -2), respectively. Identify the potential at (1, 0, 1) assuming zero potential at infinity.	6 Marks	L3	CO2
or					
13	a.	Let $V = xy^2z$, solve for the energy expended in transferring a $2\mu\text{C}$ point charge from (1, -1, 2) to (2, 1, -3).	6Marks	L3	CO2
	b.	Explain the concept of energy density in Electrostatic fields.	4Marks	L2	CO2

