Roll No.												

PRESIDENCY UNIVERSITY
BENGALURU
School of Engineering
Mid - Term Examinations - November 2024

Semester: III
Date: 07-11-2024
Course Code: ECE3004
Time: 09:30am – 11:00 am
Course Name: ELECTROMAGNETIC THEORY
Max Marks: 50
Program: SOE/BTECH/ECEC
Weightage: 25%

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. **2Mx5Q=10M**

1	Differentiate scalar, vector, scalar field, vector field with examples.	**2 Marks**	**L1**	**CO1**
2	Define Unit Vector.	**2 Marks**	**L1**	**CO1**
3	If $\vec{A} = 3\widehat{a_x} + 4\widehat{a_y} + \widehat{a_z}$ and $\vec{B} = 2\widehat{a_y} - 5\widehat{a_z}$, Find the angle between them by using cross product?	**2 Marks**	**L1**	**CO1**
4	Define Gauss's law.	**2 Marks**	**L1**	**CO2**
5	Define Coulomb's law.	**2 Marks**	**L1**	**CO2**

Part B

Answer ALL Questions. Each question carries 10 marks. **4QX10M=40M**

6	**6a**	If **A = 5ax + 3ay – 6az** and **B = 3ax – ay.** Find the (i) Component of **A** along ay (ii) Magnitude of **2A – B** (iii) Unit Vector along **A + 2B**	**3 Marks**	**L1**	**CO1**
	6b	If **A = 2ax + 4 az, B = 3ax + 5ay – 3az.** Find (i) $\|\boldsymbol{A} + \boldsymbol{B}\|$	**5 Marks**	**L1**	**CO1**

(ii) **5A – B**

(iii) The component of **A** along ay

(iv) A unit vector parallel to **3A + B**

	6c.	Point P and Q are Located at (0,2,4) and (-3,1,5). Find the distance vector from P to Q	**2 Marks**	**L3**	**CO1**

Or1

7		Given the field quantities $\vec{P} = 2\widehat{a_x} + \widehat{a_z}$, $\vec{Q} = 2\widehat{a_x} - \widehat{a_y} + 2\widehat{a_z}$, $\vec{R} = 2\widehat{a_x} - 3\widehat{a_y} + \widehat{a_z}$,	**10 Marks**	**L2**	**CO1**

Calculate the following

(a) $(\vec{P}+\vec{Q})$ x $(\vec{P}-\vec{Q})$,

(b) $\vec{Q}.\vec{R}x\vec{P}$

(c) $\vec{P}.\vec{Q}x\vec{R}$

(d) sin θ_{QR}

(e) $\vec{P}$x$(\vec{Q}x\vec{R})$

(f) A unit vector perpendicular to both **Q** and **R**

(g) Component of **P** along **Q.**

8	**8a**	Draw the spherical coordinates system and write the expression for differential length, surface and volume.	**4Marks**	**L2**	**CO1**
	8b	Convert the points P(1,3,5), Q(0,-4,3) and R(-3,-4,-10) from Cartesian to Cylindrical and Spherical Coordinates.	**6 Marks**	**L2**	**CO1**

Or

9	**9a**	Given that $F = x^2yz^2\ ax + xyz\ ay + 4z\ az$. Find $\int_a^b \boldsymbol{F}.\boldsymbol{dl}$ along the path AB if A is at (2,3,1) and B is at (3,3,1).	**5 Marks**	**L3**	**CO1**
	9b	If a vector field $\boldsymbol{F} = (x-y)\widehat{ax} + xy\ \widehat{ay}$ then determine $\int_c\ \boldsymbol{F}.\boldsymbol{dl}$, where c is an arc of curve $y = x^2$ in the xy plane from (0,0) to (3,5).	**5 Marks**	**L3**	**CO1**

10	**10a**	Find the surface area of the plane with equation $2x + 3y + 6z = 60$, $0 \leq x \leq 4, 0 \leq y \leq 6$	**5 Marks**	**L3**	**CO2**
	10b	The plane with the equation $2x + 2y + z = 18$ with equation $x^2 + y^2 = 81$. Determine the surface area of the cross-sectional cut?	**5 Marks**	**L3**	**CO2**
		Or			
11	**11a**	Find the constant m and n such that the surface $mx^2 - 2nyz = (m + 4)x$ will be orthogonal to the surface $4x^2y + z^3 = 4$ at (1, 1, 2).	**6 Marks**	**L3**	**CO1**
	11b	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x^2 + y^2 - z = 3$ at (2,-1,2).	**4 Marks**	**L3**	**CO1**
12	**12a**	State Greens Theorem	**2Marks**	**L1**	**CO1**
	12b	Evaluate $\oint_c (2x^2 - y^2)dx + (x^2 + y^2)dy$ where C is the boundary enclosed by line x=0, y=0, x=2, y=3.	**8Marks**	**L3**	**CO1**
		Or			
13	**13a**	Two point charges of 1mC and -2mC are located at (3,2,1) and (-1,-1,4) respectively. Calculate the force acting on a 10nC located at (0,3,1).	**5 Marks**	**L3**	**CO2**
	13b	Two-point charges of 5μC and -3 μC are placed along a straight line 10m apart. Determine the force between them.	**2 Marks**	**L3**	**CO2**
	13c	Suppose if there are N charges $Q_1, Q_2, ..Q_N$ at various points then apply the superposition theorem and determine the force acting on a particular charge Q with a position vector $\vec{r}$.	**3 Marks**	**L3**	**CO3**