O.P.Code:23HS0830	R23	H.T.No.

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
B.Tech. I Year I Semester Regular & Supplementary Examinations December/January-2024/2025
LINEAR ALGEBRA & CALCULUS
(Common to All)

Time: 3 Hours **Max. Marks: 70**

PART-A

(Answer all the Questions **10 x 2 = 20** Marks)

1	a	Define rank of the matrix.	CO1	L1	2M
	b	What is the Consistency and Inconsistency of system of linear equations?	CO1	L1	2M
	c	Define Eigen values and Eigen vectors of a matrix.	CO2	L1	2M
	d	Find the symmetric matrix corresponding to the quadratic form $ax^2 + 2hxy + by^2$.	CO2	L2	2M
	e	Expand Taylor's series of the function $f(x)$ in powers of $(x - a)$.	CO3	L2	2M
	f	State Cauchy's mean value theorem.	CO3	L1	2M
	g	Evaluate $\lim_{\substack{x\to 1 \\ y\to 2}} \frac{2x^2y}{x^2+y^2+1}$	CO5	L5	2M
	h	State Functional Dependence.	CO5	L1	2M
	i	Evaluate $\int_0^2 \int_0^x y\,dy\,dx$	CO6	L5	2M
	j	Evaluate $\int_0^{\pi} \int_0^{a\sin\theta} r\,dr\,d\theta$	CO6	L5	2M

PART-B

(Answer all Five Units 5 x 10 = 50 Marks)

UNIT-I

2	a	Reduce the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ into Echelon form and find its rank.	CO1	L3	5M
	b	Find whether the following equations are consistent if so solve them $x + y + 2z = 4\,; 2x - y + 3z = 9\,; 3x - y - z = 2$.	CO1	L3	5M
		OR			
3		Solve the equations $3x+y+2z=3$; $2x-3y-z=-3$; $x+2y+z=4$ Using Gauss elimination method.	CO1	L3	10M

UNIT-II

4		Determine the modal matrix P of $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$ .Verify that $P^{-1}AP$ is a diagonal matrix.	CO2	L2	10M
		OR			
5	a	Show that the matrix $A = \begin{bmatrix} 8 & -8 & 2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$ satisfies its characteristic equation.	CO2	L2	5M
	b	State the nature of the Quadratic form $2x_1x_2 + 2x_1x_3 + 2x_2x_3$.	CO2	L1	5M

UNIT-III

6	a	Verify Lagrange's mean value theorem for $f(x) = log_e x$ in $[1, e]$.	CO3	L2	5M
	b	Express the polynomial $2x^3 + 7x^2 + x - 6$ in power of $(x - 2)$ by Taylor's series.	CO4	L3	5M
		OR			
7	a	Show that $log(1 + x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$ by Maclaurin's theorem.	CO4	L2	5M
	b	Verify Rolle's Theorem for the function $f(x) = \frac{\sin x}{e^x}$ in $[0, \pi]$	CO3	L2	5M

UNIT-IV

Q.No		Question	CO	Level	Marks
8	a	If $= log(x^3 + y^3 + z^3 - 3xyz)$, $prove\ that$ $\left(\frac{\partial}{dx} + \frac{\partial}{dy} + \frac{\partial}{dz}\right)^2 U = \frac{-9}{(x+y+z)^2}$.	CO5	L5	5M
	b	If $u = tan^{-1}[\frac{2xy}{x^2-y^2}]$ then Prove that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$=0.	CO5	L5	5M
		OR			
9	a	Find a point on the plane $3x + 2y + z - 12 = 0$, which is nearest to the origin.	CO5	L1	5M
	b	Find the points on the sphere $x^2 + y^2 + z^2 = 4$ that are closest and farthest from the point $(3, 1, -1)$.	CO5	L1	5M

UNIT-V

Q.No		Question	CO	Level	Marks
10		Change the order of integration in $I = \int_0^1 \int_{x^2}^{2-x} (xy) dydx$ and hence evaluate the same.	CO6	L1	10M
		OR			
11	a	Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$	CO6	L1	5M
	b	Evaluate $\int_1^e \int_1^{logy} \int_1^{e^x} logz\ dzdxdy$	CO6	L5	5M

***** END *****