H.T.No: | | | | | | | | | | | **Course Code: 241MA001**

ADITYA UNIVERSITY

B.Tech – I Semester End Examinations Supplementary – Dec 2025

LINEAR ALGEBRA AND CALCULUS

(Common to CE, EEE, ME, ECE, CSE, IT, Min.E, PT, DS & AIML)

Time: 3 hours **Max. Marks: 100**

Answer ONE question from each unit
All Questions Carry Equal Marks
All parts of the questions must be answered at one place only

UNIT-I

1	a	Find the rank of the matrix using Echelon form for $\begin{bmatrix} 5 & 13 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$	L3	CO1	[10M]
	b	Solve the system of equations $3x + y - z = 0, 4x - 2y - 3z = 0, 2x + 4y + z = 0$	L3	CO1	[10M]
		(OR)			
2	a	Find the inverse of the matrix A=$\begin{bmatrix} -2 & 1 & 3 \\ 0 & -1 & 1 \\ 1 & 2 & 0 \end{bmatrix}$ by Gauss-Jordan Method	L3	CO1	[10M]
	b	Solve the system of equations x+2y+3z=1, 2x+3y+8z=2, x+y+z=3 by Gauss Elimination method	L2	CO1	[10M]

UNIT-II

3		Find A^{-1} and A^4 using Cayley-Hamilton theorem for $A = \begin{bmatrix} 1 & 0 & 3 \\ 2 & -1 & -1 \\ 1 & -1 & 1 \end{bmatrix}$	L3	CO2	[20M]
		(OR)			
4		Reduce the quadratic form by orthogonal reduction and hence find rank, index, signature, nature. $2x^2 + 2y^2 + 2z^2 - 2xy - 2yz - 2xz$	L3	CO2	[20M]

UNIT-III

5	a	Verify Cauchy's mean value theorem for $f(x) = log x_e, g(x) = \frac{1}{x}$ on [1,2]	L2	CO3	[10M]
	b	Find $\lim_{\substack{x\to 1 \\ y\to 2}} \left(\frac{2x^2y}{x^2+y^2+1}\right)$	L3	CO3	[10M]
		(OR)			
6	a	Verify whether $\frac{\partial^2 z}{\partial x \partial y} = \frac{\partial^2 z}{\partial y \partial x}$ for $z = x^3 y + e^{xy^2}$	L2	CO3	[10M]
	b	Expand $cosx$ about $x = \frac{\pi}{4}$ as a Taylor's series	L3	CO3	[10M]

(P.T.O)

UNIT-IV

7	a	If $x = r\cos\theta,\ y = r\sin\theta$ then prove that $\frac{1}{r}\frac{\partial x}{\partial \theta} = r.\frac{\partial \theta}{\partial x}$	L2	CO4	[10M]
	b	Find the extreme values of $f(x,y) = x^2 + y^2 + 6x + 12$	L3	CO4	[10M]

(OR)

8	a	Find $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ using Euler's theorem for $u = \cos^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$	L3	CO4	[10M]
	b	if $x = uv, y = \frac{u+v}{u-v}$ then find $J\left(\frac{x,y}{u,v}\right)$	L3	CO4	[10M]

UNIT-V

9	a	Evaluate $\int_0^{\pi/2}\int_0^{a\ cos\ \theta}\int_0^{\sqrt{a^2-r^2}} r\ dr\ d\theta\ dz$	L5	CO5	[10M]
	b	Find the area enclosed by curves $y^2 = x^3$ and $x^2 = y^3$.	L3	CO5	[10M]

(OR)

10		Evaluate $\iiint_V z(x^2+y^2)$, bounded by the planes $z = 2$ and $z = 3$ and cylinder $x^2 + y^2 = 1$ by changing into cylindrical polar co-ordinates	L5	CO5	[20M]

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