

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Third Semester)

Branch – COMPUTER SCIENCE WITH DATA ANALYTICS

LINEAR ALGEBRA

Time: Three Hours

Maximum: 75 Marks

SECTION-A (10 Marks)

Answer ALL questions

ALL questions carry EQUAL marks

(10 × 1 = 10)

Question No.	Question	K Level	CO
1	Which of the following is true for matrices? (a) $(AB)^{-1} = B^{-1}A^{-1}$ (b) $(A)^T = A$ (c) $AB = BA$ (d) $A * I = I$	K1	CO1
2	A _____ matrix is a matrix which contains only one row. (a) row (b) rectangle (c) column (d) None	K2	CO1
3	The dimension of zero vector space is _____. (a) not defined (b) 1 (c) 0 (d) infinite	K1	CO2
4	If A is 3X5 matrix, then the rank of A^T is at most _____. (a) 4 (b) 2 (c) 5 (d) 3	K2	CO2
5	A matrix A is orthogonal if and only if AA^T is _____. (a) A (b) I (c) A^T (d) None	K1	CO3
6	If A is a square matrix of order 3 such that $ A = 3$, then $\text{adj}(\text{adj } A)$ is _____. (a) 27A (b) 3A (c) 9A (d) A	K2	CO3
7	When two rows or columns of a determinant are interchanged, then the value of the determinant is _____. (a) changed (b) unchanged (c) zero (d) one	K1	CO4
8	Find the eigen value for $\begin{bmatrix} 1 & 8 \\ 2 & 1 \end{bmatrix}$. (a) 4 (b) 2 (c) -3 (d) 6	K2	CO4
9	If $T(v + w) = T(v) + T(w)$ and $T(cv) = cT(v)$, then T is _____ transformation (a) linear (b) non-linear (c) Zero (d) None	K1	CO5
10	Which of the following is correct, when we consider the Eigen values? (a) $A = -A^T$ (b) $A = A^{2T}$ (c) $A = A^T$ (d) None	K2	CO5

Cont...

SECTION - B (35 Marks)Answer **ALL** questions**ALL** questions carry **EQUAL** Marks

(5 × 7 = 35)

Question No.	Question	K Level	CO
11.a.	The linear combinations of $v = (1, 1, 0)$ and $w = (0, 1, 1)$ fill a plane. Demonstrate that plane and classify a vector that is not a combination of v and w .	K2	CO1
	(OR)		
11.b.	Interpret $2u+2v+w$, if $u = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$, $v = \begin{pmatrix} -3 \\ 1 \\ -2 \end{pmatrix}$ and $w = \begin{pmatrix} 2 \\ -3 \\ -1 \end{pmatrix}$		
12.a.	Identify the rank of $A = \begin{bmatrix} 1 & -1 & 0 & 0 \\ -1 & 2 & -1 & 0 \\ 0 & -1 & 2 & -1 \\ 0 & 0 & -1 & 1 \end{bmatrix}$	K3	CO2
	(OR)		
12.b.	If $v_1, \dots, v_m$ and $w_1, \dots, w_m$ are both bases for the same vector space, then construct that $m=n$.		
13.a.	Examine the parabola $C + Dt + Et^2$ that comes closest (least squares error) to the values $b = (0, 0, 1, 0, 0)$ at the times $t = -2, -1, 0, 1, 2$.	K4	CO3
	(OR)		
13.b.	Examine the projection matrix $P = \frac{aa^T}{a^T a}$ onto the line through $a = \begin{pmatrix} 1 \\ 1 \\ 2 \end{pmatrix}$.		
14.a.	Inspect that the determinant changes its sign when two rows are exchanged.	K4	CO4
	(OR)		
14.b.	Examine the following linear equations by Cramer's rule: $2x+5y=21$; $x+2y=8$.		
15.a.	Identify the range and kernel of T : $T(v_1, v_2) = (v_1 - v_2, 0)$	K3	CO5
	(OR)		
15.b.	If S rotates by θ and T rotates by $-\theta$. Then solve $TS = I$ matches $AB = I$.		

SECTION -C (30 Marks)Answer **ANY THREE** questions**ALL** questions carry **EQUAL** Marks

(3 × 10 = 30)

Question No.	Question	K Level	CO
16	Examine the inverse of the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 2 & 5 & 4 \\ 3 & 6 & 9 \end{bmatrix}$	K4	CO1
17	Analyze Gauss Jordan elimination method to find the solution for $x+y+z=3$; $2x-y-z=3$; $x-y+z=9$	K4	CO2
18	List the orthonormal basis for the column space of $A = \begin{pmatrix} 1 & -2 \\ 1 & 0 \\ 1 & 1 \\ 1 & 3 \end{pmatrix}$ and $b = \begin{pmatrix} -4 \\ -3 \\ 3 \\ 0 \end{pmatrix}$ and Examine the projection of b onto that column space.	K4	CO3
19	Examine the Eigen values and Eigen vectors of A and A^2 if $A = \begin{pmatrix} 2 & -1 \\ -1 & 2 \end{pmatrix}$	K4	CO4
20	Examine the pseudoinverse of the matrix $A = \begin{pmatrix} 2 & 2 \\ 1 & 1 \end{pmatrix}$	K4	CO5