PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

BSc DEGREE EXAMINATION MAY 2026
(Sixth Semester)

Branch – **MATHEMATICS WITH COMPUTER APPLICATIONS**

LINEAR ALGEBRA

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	Interchanging two rows changes determinant by (i) no change (ii) sign change (iii) makes zero (iv) doubles it	K1	CO1
	2	If the matrix is invertible if and only if ______________ (i) $\det A \neq 0$, (ii) $\det A = 0$, (iii) $\det A \neq 1$, (iv) $\det A = 1$,	K2	CO1
2	3	A subset S of V is said to be _____________ all scalars are zero. (i) Linearly independent (ii) Linearly dependent (iii) Linear span (iv) Linear combination.	K1	CO2
	4	The dimension of a vector space is______________ (i) number of elements (ii) number of vectors in any basis (iii) rank of matrix (iv) determinant	K2	CO2
3	5	If T and S are linear transformations, then T+S is___________ (i) not linear (ii) linear (iii) undefined (iv) constant	K1	CO3
	6	Two vector spaces are isomorphic if_____________ (i) they have same elements (ii) there exists a bijective linear transformation between them (iii) they have same basis vectors (iv) they are subsets	K2	CO3
4	7	In an inner product space, $\|x\| = 0$ implies: (i) $x = 0$ (ii) $x = 1$ (iii) $x \neq 0$ (iv) Cannot be determined	K1	CO4
	8	Which space is an inner product space? (i) Any vector space (ii) Vector space with a defined inner product (iii) Only finite-dimensional spaces (iv) Only real spaces	K2	CO4
5	9	The sum of eigen values of a matrix equals: (i) Determinant (ii) Trace (iii) Rank (iv) Norm	K1	CO5
	10	If A is an identity matrix, then its eigenvectors are: (i) Only zero vector (ii) All non-zero vector (iii) Only unit vectors (iv) None	K2	CO5

SECTION - B (35 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Show that $\det AB = \det A \det B$, for $A = \begin{bmatrix} 6 & 1 \\ 3 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 4 & 3 \\ 1 & 2 \end{bmatrix}$.	K3	CO1
		OR		
	11.b.	Construct the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 5 & 7 \end{bmatrix}$.		

Cont…

2	12.a.	Let V be a vector space over the field F. Then show that the intersection of any collection of subspaces of V is a subspace of V.	K3	CO2
		OR		
	12.b.	Make use of the vectors $\alpha_1 = (1, -1, -4, 0)$, $\alpha_2 = (2,\ 1, 1, 6)$ and show it is linearly independent in R^4.		
3	13.a.	Let V and W be vector spaces over the field F and let T be a linear transformation from V into W. Suppose that V is finite –dimensional, then show that $rank(T) + nullity(T) = \dim V$.	K4	CO3
		OR		
	13.b.	Let T be a linear transformation from V into W. then T is non-singular show that if and only if T carries each linearly independent subset of V onto a linearly independent subset of W.		
4	14.a.	Choose the V be the set of all continuous complex valued function on the closed unit interval [0, 1] if $g \in V$ defined by $\langle f, g\rangle = \int_0^1 f(t)\overline{g(t)}\,dt$, then show that $\langle f, g\rangle$is a inner product space.	K4	CO4
		OR		
	14.b.	Recall and analyze the statement and proof of Bessel's inequality theorem.		
5	15.a.	Find the characteristics equation of $A = \begin{bmatrix} 5 & -2 & 6 & -1 \\ 0 & 3 & 8 & 0 \\ 0 & 0 & 5 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$.	K3	CO5
		OR		
	15.b.	Construct $\det A$ $for\ A = \begin{bmatrix} 1 & 5 & 0 \\ 2 & 4 & -1 \\ 0 & -2 & 0 \end{bmatrix}$.		

SECTION -C (30 Marks)

Answer **ANY THREE** questions

ALL questions carry **EQUAL** Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Find a basis for the null space of the matrix $\begin{bmatrix} -3 & 6 & -1 & 1 & -7 \\ 1 & -2 & 2 & 3 & -1 \\ 2 & -4 & 5 & 8 & -4 \end{bmatrix}$.	K3	CO1
2	17	Show that If V is a finite dimensional vector space, and then any two bases of V have the same numbers of elements.	K4	CO2
3	18	Let V be a finite dimensional vector space over the field F and let $\{\alpha_1, \alpha_2, \dots \alpha_n\}$be an ordered basis for V. Let W be a vector space over the same field and let $\{\beta_1, \beta_2, \dots \beta_n\}$ be any vectors in W, then show that there is one linear transformation T from V into W such that $T(\alpha_j) = \beta_i$.	K4	CO3
4	19	Recall and analyze the statement and proof of the Gram-Schmidt Orthogonalization process.	K5	CO4
5	20	Select an $n\ x\ n$ matrix A and show that it is diagonalizable if and only if A has n linearly independent eigen vectors.	K5	CO5

Z-Z-Z END