Parul University NAAC A++	**Parul University** **Faculty of Engineering and Technology** **Parul Institute of Engineering and Technology** **CSE/IT Department**

Subject Name	**Linear Algebra**	**A.Y**	**2025-2026**
Subject Code	**03019102BS01**	**Semester**	**II**

Chapter-1

Sr No	Question	COs	B.T
1.	Solve the following system of equation by Gauss elimination. $-2b+3c=1; 3a+6b-3c=-2; 6a+6b+3c=5.$	**1**	**3**
2.	Find the Eigen values and Eigen vector of the matrix A= $\begin{bmatrix} -3 & -7 & -5 \\ 2 & 4 & 3 \\ 1 & 2 & 2 \end{bmatrix}$.	**3**	**3**
3.	If $A=\begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$ find A^2 using Cayley Hamilton theorem.	**3**	**4**
4	Verify the cayley-Hamilton theorem by computing $B^2-3B-2I$ where $B=\begin{bmatrix} 3 & 1 \\ 2 & 0 \end{bmatrix}$.	**3**	**4**
5.	Perform LU-Decomposition for the matrix A and find the matrices L and U Where $A=\begin{bmatrix} 3 & 1 & 6 \\ -6 & 0 & -16 \\ 0 & 8 & -17 \end{bmatrix}$	**1**	**3**
6.	The matrix A can be factored as $A=PDP^{-1}$ where D $=\begin{bmatrix} -1 & 0 \\ 0 & -2 \end{bmatrix}$ and $D=\begin{bmatrix} -8 & -3 \\ 27 & 10 \end{bmatrix}$ then find A^5.	**3**	**4**

Chapter-2

7.	Which of the following sets of vectors in R^3 are linearly independent? (i)$v_1=(-3,0,4), v_2=(5,-1,2)$and $v_3=(1,1,3)$. (ii) $v_1=(-2,0,1), v_2=(3,2,5)$and $v_3=(6,-1,1), v_4=(7,0,-2)$. (iii)$(4,-1,2), (-4,10,2), (4,0,1)$.	**2**	**4**
8.	(a) Write standard basis for the space of polynomials P_2 (the space of polynomials of degree at most 2). (b) Verify whether the set of all matrices of the form $\begin{bmatrix} a & b \\ 0 & c \end{bmatrix}$ is a subspace of the vector space of all 2×2 matrices. (c) Define linearly dependent vectors.	**2**	**3**
9.	Find a basis for the eigen space of the matrix $A=\begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$ and determine its dimension.	**2**	**4**
10.	Check whether $V=R^2$ is a vector space with respect to	**2**	**3**

	$(x_1, y_1) + (x_2, y_2) = (x_1 + x_2 - 2, y_1 + y_2 - 3)$ and $k(x, y) = (kx + 2k - 2, ky - 3k + 3)$, k is a real number.		
11.	Define the span of a set of vectors.	**2**	**4**
12.	Determine the dimension of the subspace spanned by {(1, 0, 0), (0, 1, 0)}in $\mathbb{R}^3$.	**2**	**5**
13.	Find a basis for the subspace of $\mathbb{R}^4$ spanned by (1, 0, 0, 0), (0, 1, 0, 0), and (1, 1, 0, 0).	**2**	**3**
14.	Find the basis vectors for the eigenspace of a given matrix to determine its geometric multiplicity.	**2**	**1**
15.	Determine the dimension and a basis for the solution space $x_1 + x_2 - 2x_3 = 0, \ -2x_1 - 2x_2 + 4x_3 = 0, \ -x_1 - x_2 + 2x_3 = 0$	**2**	**4**
Chapter-3			
16.	Check the vector B is in the Column Space or not by solving AX=B where $A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$ $A = \begin{bmatrix} 3 \\ 7 \end{bmatrix}$.	**1**	**3**
17.	If the Rank of a 4×6 matrix is 3 , where $A = \begin{bmatrix} 1 & 2 & 0 & 3 & 4 & 5 \\ 3 & 6 & 0 & 9 & 12 & 15 \\ 2 & 4 & 0 & 6 & 8 & 10 \\ 1 & 2 & 0 & 3 & 4 & 5 \end{bmatrix}$. What is the dimension of the column space?	**1**	**2**
18.	Find domain and co-domain of $(T_2 \circ T_1)$ and find $(T_2 \circ T_1)(x, y)$ $T_1(x, y) = (2x, 3y); T_2(x, y) = (x - y, x + y)$.	**3**	**2**
19.	Find a basis for the Column Space of $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$.	**3**	**3**
20.	Let $T: R^3 \to R^3$ bethe linear Transformation defined by $T(x, y, z) = (x + 2y - z, y + z, x + y - 2z)$ (a) Find a basis and the dimension for the range of T. (b) Find a basis and dimension for the kernel of T. (c) Verify the dimension theorem.	**3**	**3**
Chapter-4			
21.	Given the vectors $v_1=(2,0,1)$ and $v_2=(1,1,0)$ in R^3 ,	**4**	**3**

	Apply the Gram-Schmidt process to find an orthonormal basis for the subspace they span. Verify orthogonality by computing the dot product.		
22.	Verify that the set {(1,0),(0,1)} is orthonormal in R^2 and compute the projection of (2,3) onto (1,0).	**4**	**4**
23.	Find an orthonormal basis for the plane $x+y+z=0$ in R^3 and compute angles between basis vectors.	**4**	**2**
24.	1) What is the difference between an orthogonal set and an orthonormal set of vectors? 2) Normalize the vector v=(3,4), to obtain a unit vector. 3)If $\vec{A}$=(3,4) and $\vec{B}$=(−4,3), determine the angle between them.	**4**	**3**
25.	Consider the matrix $B=\begin{bmatrix}1&2&3&4\\2&4&6&8\\1&3&2&5\end{bmatrix}$.Find the dimension of the column space and determine its colmns form a linearly independent set or not.	**1**	**3**