



**Parul University**

**Faculty of Engineering & Technology**

**Department of Applied Sciences and Humanities**

**1<sup>st</sup> Year B. Tech Programme (Mathematics and Computing)**

**Linear Algebra - 03161151**

**Tutorial-3 Linear Transformation**

Q-1	Find the matrix representation of the linear transformation T and verify whether it is invertible. Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear transformation defined by $T(x,y,z)=(x+2y-z, 2x+y+3z, -x+4y+2z)$
Q-2	Let $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear transformation defined by $T(x,y,z)=(x+y, y-z, 2x+3z)$ . Find the matrix representation of T.
Q-3	Find the Rank and Nullity of the matrix $A = \begin{bmatrix} 1 & 4 & 2 \\ 2 & 8 & 4 \\ 3 & 12 & 6 \end{bmatrix}$ .
Q-4	Find a nonzero vector in the Null Space of $A = \begin{bmatrix} 2 & -4 \\ -1 & 2 \end{bmatrix}$ .
Q-5	Find the matrix of the rotation transformation in $\mathbb{R}^2$ by an angle $\theta$ counterclockwise.
Q-6	Consider the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 0 & 0 & 0 \end{bmatrix}$ Find its rank and nullity.
Q-7	Find the rank and nullity of the given linear transformation Given $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ , $T(x, y, z) = (x+y, y+z, x-z)$
Q-8	Find the dimension of the Null Space and Column Space for the matrix $D = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 3 & 1 \\ 0 & 0 & 0 \end{bmatrix}$ .
Q-9	Check whether vector B is in the Column Space by solving $AX=B$ , $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$ , $B = \begin{bmatrix} 5 \\ 11 \end{bmatrix}$
Q-10	Let $A = \begin{bmatrix} 1 & 1 & 1 & 0 & 2 \\ 0 & 1 & 2 & 3 & 1 \\ 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$ be a $4 \times 5$ matrix. What is the dimension of the null space?