ASSIGNMENT SHEET-01

Course: B.Tech. **Subject: Engineering Mathematics-I** **Code: TMA-101**

1. Find the rank of the following matrices:

(i) $A = \begin{bmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 9 \\ -1 & -3 & -4 & -3 \end{bmatrix}$ (ii) $X = \begin{bmatrix} 1 & 2 & 1 \\ -1 & 0 & 2 \\ 2 & 1 & -3 \end{bmatrix}$ (iii) $Z = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$

2. For which value of K the rank of matrix

$X = \begin{bmatrix} 1 & 5 & 4 \\ 0 & 3 & 2 \\ K & 13 & 10 \end{bmatrix}$ is 2.

3. Find non-singular matrices P and Q such that PAQ is normal form where

$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & 1 & 1 \end{bmatrix}$

4. Show that the vectors $X = [1, 2, -3, 4], Y = [3, -1, 2, 1], Z = [1, -5, 8, -7]$ are linearly dependent. Then find the relation between them.

5. Verify Cayley-Hamilton Theorem for the matrix $A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$ and find A^{-1}.

6. Find the Eigen values and Eigen vectors of the matrix $A = \begin{bmatrix} 3 & 1 & 1 \\ 1 & 5 & 1 \\ 1 & 1 & 3 \end{bmatrix}$.

7. Find the latent roots of the two rowed orthogonal matrix $\begin{pmatrix} \cos\theta & -\sin\theta \\ \sin\theta & \cos\theta \end{pmatrix}$ and verify that they are of unit modulus.

8. Test the consistency and solve the following system of equations: $2x - y + 3z = 8, -x + 2y + z = 4, 3x + y - 4z = 0.$

9. For what values of η the equations $x + y + z = 1$, $x + 2y + 4z = \eta$, $x + 4y + 10z = \eta^2$ have a solution and solve them completely for each value.

10. Examine the values of λ and μ so that the equations: $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ have

(i) No solution (ii) A unique solution (iii) An infinite number of solutions.