KONERU LAKSHMAIAH EDUCATION FOUNDATION
(Deemed to be University, Estd. u/s. 3 of UGC Act 1956)

I B. Tech., EVEN Semester, A. Y. 2024-25

Linear Algebra & Calculus for Engineers (23MT1001)

Home Assignment-1 (CO1)

1. Calculate the rank of the matrix by reducing into Echelon form.

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

2. In a cricket match, Chennai Super Kings needed just 6 runs to win with 1 ball left to go in the last over. The last ball was bowled and the batsman at the crease hit it high up. The ball traversed along a path in a vertical plane and the equation of the path is $y=px^2+qx+r$ with respect to a xy-coordinate system in the vertical plane and the ball traversed through the points (10,8), (20,16), (30,18) , can you conclude that Chennai Super Kings won the match? (Use Gauss elimination method).
3. A youth group is selling snacks to raise money to attend their convention. Amy sold 2 pounds of candy, 3 boxes of cookies and 1 can of popcorn for a total sale of $65. Brian sold 4 pounds of candy, 6 boxes of cookies and 3 cans of popcorn for a total sale of $140. Paulina sold 8 pounds of candy, 8 boxes of cookies and 5 cans of popcorn for a total sale of $250. Determine the cost of each item using Gauss elimination method. (Ans: 20, 5, 10)
4. Solve the following by using LU-decomposition method:

(i) $x+y+z=1,\ 3x+y-3z=5,\ x-2y-5z=10$ (Ans: (6, -7, 2))

(ii) $x+y-z=4,\ x-2y+3z=-6,\ 2x+3y+z=7$ (Ans: 1, 2, -1)

5. Determine the Eigen values and Eigen vectors of the matrix $A=\begin{bmatrix}6 & -2 & 2\\ -2 & 3 & -1\\ 2 & -1 & 3\end{bmatrix}$
6. Verify the system dX/dt=AX is stable or not where $A=\begin{bmatrix}1 & 0 & -1\\ 1 & 2 & 1\\ 2 & 2 & 3\end{bmatrix}$

7. Check whether the matrix A is diagonalizable or not, where $A=\begin{bmatrix}5 & 0 & 0\\ 0 & 5 & 0\\ 1 & 4 & -3\end{bmatrix}$.

8. Determine the eigen values of the matrix $A=\begin{pmatrix}1 & 0 & 0\\ -2 & 3 & 0\\ 1 & 2 & -4\end{pmatrix}$ and hence determine Eigen values of A^3 , A^T and A^{-1} also verify the sum and product of eigen values is same as trace and determinant of matrix A.

9. Reduce the given Quadratic form $Q \equiv x_1^2 + 5x_2^2 + x_3^2 + 2x_1x_2 + 2x_2x_3 + 6x_3x_1$ into canonical form and hence determine the rank, index, signature and nature of the quadratic form.

10. Reduce the quadratic form $x^2 + y^2 + z^2 + 2xy + 4yz - 6zx$ into sum of squares. Also specific the nature of the quadratic form.