

# Indian Institute of Technology Patna

## MA-102

### Tutorial sheet-1

1. Solve the following systems by Gauss elimination method:

(i)

$$\begin{aligned}x + y + z &= 4 \\2x + 5y - 2z &= 3 \\x + 7y - 7z &= 5.\end{aligned}$$

(ii)

$$\begin{aligned}x - 2y + 3z &= 9 \\-x + 3y &= -4 \\2x - 5y + 5z &= 17.\end{aligned}$$

(iii)

$$\begin{aligned}2x + 3y + z &= 25 \\-x - 2y + 4z &= -25 \\3x - y + 2z &= -2.\end{aligned}$$

(iv)

$$\begin{aligned}2x - y + 2z &= 5 \\x + 3y - z &= 2 \\4x + 4y + z &= -2.\end{aligned}$$

(v)

$$\begin{aligned}x + 4y - z &= 4 \\x + y - 6z &= -4 \\3x - y - z &= 1.\end{aligned}$$

2. Use Gauss elimination method to show that following system has no solution:

$$\begin{aligned}2 \sin x - \cos y + 3 \tan z &= 3 \\4 \sin x + 2 \cos y - 2 \tan z &= 10 \\6 \sin x - 3 \cos y + \tan z &= 9\end{aligned}$$

3. Show that every elementary matrix is invertible.

4. Find LU or PLU for following matrices and hence find solution for  $Ax = b$  for given vector  $b$  :

$$\begin{aligned}\bullet A &= \begin{bmatrix} 1 & 0 & 1 \\ 2 & 2 & 2 \\ 3 & 4 & 5 \end{bmatrix}, b = \begin{bmatrix} 1 \\ 4 \\ 7 \end{bmatrix} \\ \bullet A &= \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}, b = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}\end{aligned}$$

- $A = \begin{bmatrix} 1 & 4 & 2 \\ -2 & -8 & 3 \\ 0 & 1 & 1 \end{bmatrix}, b = \begin{bmatrix} -2 \\ 32 \\ 1 \end{bmatrix}$

5. Use Gauss-Jordan method to find the solution of following system:

$$\begin{aligned} 2x + y + z &= 1 \\ 4x - 6y &= 1 \\ -2x + 7y + 2z &= 1 \end{aligned}$$

6. Find the inverse of the following matrices using Gauss-Jordan method.

- $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 2 \\ 2 & 4 & 7 \end{bmatrix}$

- $A = \begin{bmatrix} 1 & 3 & 3 \\ 2 & 3 & 2 \\ 2 & 4 & 7 \end{bmatrix}$

- $A = \begin{bmatrix} 2 & -1 & 3 \\ -1 & 3 & -2 \\ 2 & 4 & 1 \end{bmatrix}$