

Government Engineering College, Bhuj

Subject: NMEE (BE03000191)

Assignment-1

CO-2: Numerical Solution of Linear Equations

Question-1.

1. Use forward elimination and back substitution to compute (x, y, z) or Solve the system using Gauss Elimination:

$$\begin{cases} 4x - 6y = -2, \\ -2x + 7y + 2z = 9, \\ 2x + y - z = 3 \end{cases}$$

2. By Gauss Elimination, determine the solution vector:

$$\begin{cases} x + y + z = 6, \\ 2x + 3y + z = 11, \\ x - y + 2z = 5 \end{cases}$$

3. Execute Gauss Elimination with clear row operations:

$$\begin{cases} 3x - y + z = 8, \\ x + 2y + 3z = 3, \\ 2x + y - z = 2 \end{cases}$$

Question-2

1. Solve the system by Gauss-Jordan Elimination:

$$\begin{cases} x + y + z = 6, \\ 2x + 3y + 5z = 22, \\ 4x + 7y + z = 18 \end{cases}$$

2. Transform the augmented matrix to Reduced Row Echelon Form and extract solution or Apply Gauss Jordan method to the following system.

$$\begin{cases} -x + \frac{1}{2}y - z = 0, \\ 3x + 2y - z = 1, \\ 2x - 2y + 4z = -2 \end{cases}$$

3. Perform Gauss–Jordan elimination and validate each pivot:

$$\begin{cases} 3x - y - z = 1, \\ x - 2y + z = 0, \\ 2x + y + 3z = 6 \end{cases}$$

Question-3.(LU- decomposition Mehtod)

1. Factorize $A = LU$ and solve $Ax = b$:

$$\begin{cases} 4x + 6y + 8z = 6, \\ x + y + z = 3, \\ 2x + 3y + 5z = 4 \end{cases}$$

2. Compute L and U and determine (x, y, z) :

$$\begin{cases} 6x + 5y + 2z = 22, \\ 2x + y + z = 7, \\ 4x + y - z = 3 \end{cases}$$

3. Construct LU decomposition and solve:

$$\begin{cases} 3x + y - z = 6, \\ x + 2y + 3z = 7, \\ 2x + 3y + z = 8 \end{cases}$$

Question-4

1. Find the inverse of the matrix. Use Gauss Jordan method

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

2. Apply Gauss Jordan method to find inverse of the matrix

$$B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 4 \\ 5 & 6 & 0 \end{bmatrix}.$$

3. Determine Inverse using Gauss Jordan method

$$C = \begin{bmatrix} 3 & 0 & 2 \\ 2 & 0 & -2 \\ 0 & 1 & 1 \end{bmatrix}.$$

Question-5

1. Use Jacobi iterations method to solve system of equations:

$$\begin{cases} 10x - 2y - 2z = 6, \\ -x - 10y - 2z = 7, \\ -x - y + 10z = 8 \end{cases}$$

2. Apply Gauss Jacobi to investigate the values of (x, y, z)

$$\begin{cases} 10x - 2y + z = 12, \\ x + 9y - z = 10, \\ 2x - y + 11z = 20 \end{cases}$$

3. Balance the system and apply Gauss Jacobi Iterative method

$$\begin{cases} 2x + 4y + z = 4, \\ x + 3y + 5z = 5, \\ 8x + y + z = 8 \end{cases}$$

Question-6

1. Using Gauss–Seidel and compute (x, y, z) correct the answer up to 3 decimal places:

$$\begin{cases} 5x + 2y + z = 12, \\ x + 4y + 2z = 15, \\ x + 2y + 5z = 20 \end{cases}$$

2. Perform Gauss–Seidel iteration over the given system of linear equation:

$$\begin{cases} x + 10y + 4z = 6, \\ 2x - 4y + 10z = -15, \\ 9x + 2y + 4z = 20 \end{cases}$$

Answer Key (Exact Solutions)

- Gauss Elimination:

$$\text{GE-1: } \left(\frac{3}{2}, \frac{4}{3}, \frac{4}{3}\right), \quad \text{GE-2: } (1, 2, 3), \quad \text{GE-3: } (2, -1, 1)$$

- Gauss–Jordan:

$$\text{GJ-1: } (2, 1, 3), \quad \text{GJ-2: } (1, -2, -2), \quad \text{GJ-3: } (1, 1, 1)$$

- LU Decomposition:

$$\text{LU-1: } (7, -5, 1), \quad \text{LU-2: } (1, 2, 3), \quad \text{LU-3: } (2, 1, 1)$$

- Gauss Jacobi

$$\text{JACO-1: } (1, 1, 1), \quad \text{JACO-2: } (1.31, 1.31, 1.7023), \quad \text{JACO-3: } (0.876, 0.919, 0.574)$$

- Gauss Seidel

$$\text{GS-1: } (0.996, 1.95, 3.16), \quad \text{GS-2: } (2.733, 0.986, -1.652)$$