UNIT-III

1 Find the singular value decompositions of the following matrices

(i) $\begin{bmatrix}1 & 1\\ 6 & 2\end{bmatrix}$. (ii) $\begin{bmatrix}2 & 2 & 0\\ 2 & 5 & 0\\ 0 & 0 & 3\end{bmatrix}$. (iii) $A = \begin{bmatrix}1 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$

2 Find the singular value decompositions of the following matrices

(iii) $\begin{bmatrix}1 & 1\\ 1 & 1\\ 1 & 1\end{bmatrix}$. (iv) $\begin{bmatrix}1 & 1 & 1\\ 1 & 1 & 1\end{bmatrix}$. (v) $\begin{bmatrix}5 & -2 & 0\\ -2 & 6 & 2\\ 0 & 2 & 7\end{bmatrix}$.

3 Find the singular value decomposition for the matrix

(a) $A = \begin{bmatrix}1 & 1\\ 1 & 0\\ 0 & 1\end{bmatrix}$ (b) $A = \begin{bmatrix}3 & 1 & 1\\ -1 & 3 & 1\end{bmatrix}$

4 QR factorization of $A = \begin{bmatrix}1 & 1 & 1\\ 1 & -1 & 2\\ -1 & 1 & 0\\ 1 & 5 & 1\end{bmatrix}$ by the Gram Schmidt process

5 QR factorization of $A = \begin{bmatrix}1 & 2 & 2\\ -1 & 1 & 2\\ -1 & 0 & 1\\ 1 & 1 & 2\end{bmatrix}$ by the Gram Schmidt process

6 Find the QR factorization for A = $\begin{bmatrix}1 & -1 & 4\\ 1 & 4 & -2\\ 1 & 4 & 2\\ 1 & -1 & 0\end{bmatrix}$

7 Find the QR-factorization of $A = \begin{bmatrix}1 & -1 & 2\\ 0 & 1 & 3\\ 3 & -3 & 4\end{bmatrix}$

8 Find the Moore-Penrose pseudo-inverse of the matrix $A = \begin{bmatrix}1 & 2\\ 2 & 1\\ 1 & -1\end{bmatrix}$

9 *Find the pseudo inverse of* $A = \begin{bmatrix}1 & 2 & 1 & 3\\ 4 & 3 & 2 & 1\end{bmatrix}$

10 Find the least squares approximate solution of the over determined system $\begin{bmatrix}1 & 2\\ 2 & 1\\ 1 & -1\end{bmatrix}\begin{bmatrix}x\\ y\\ z\end{bmatrix} = \begin{bmatrix}5\\ 4\\ -1\end{bmatrix}$

11 Find the least squares approximate solution of the over determined system x+y=1, x+2y=2, x+3z=2

12 Solve using LU decomposition method

$10x + 7y + 8z + 7w = 32; 7x + 5y + 6z + 5w = 23; 8x + 6y + 10z + 9w = 33$ & $7x + 5y + 9z + 10w = 31$.

13 Using Choleski method solve $16x + 4y + 4z - 4w = 32; 4x + 10y + 4z + 2w = 26; 4x +$

$4y + 6z - 2w = 20;\ -4x + 2y - 2z + 4w = -6.$

14 Using the Choleski method, solve the system of equations. $4x - y - z = 3;\ -x + 4y - 3z = -0.5\ ;\ -x - 3y + 5z = 0$

15 Solve using LU decomposition method $x_1 + x_2 + x_3 = 1,\ \ 4x_1 + 3x_2 - x_3 = 6\ \&3x_1 + 5x_2 + 3x_3 = 4$

16 Solve by LU decomposition method x + 2y + 3z = 1, 2x + 3y + 8z = 2, x + y + z = 3.

17 Find the spectral decomposition of the matrix $\begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$

18 Find the spectral decomposition of the matrix $\begin{pmatrix} -3 & -1 & -1 \\ -1 & 3 & -1 \\ -1 & -1 & -3 \end{pmatrix}$

19 If $A = \begin{bmatrix} 0 & 1 & 1 \\ \sqrt{2} & 2 & 0 \\ 0 & 1 & 1 \end{bmatrix}$ and find the SVD of A

20 Find QR decomposition of the matrix $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 1 & 2 \\ 0 & 0 & 3 \end{bmatrix}$