INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI
DEPARTMENT OF MATHEMATICS AND STATISTICS

MA635P-Scientific Programming Laboratory

Lab Exercise-8 (30 Marks) Deadline: 12 February 2025, 5:00 PM

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1. Create an algorithm for Cholesky Decomposition. [2.5]
2. Create an algorithm for Gaussian Elimination. [2.5]
3. Create an algorithm for Gauss-Jordan Elimination. [2.5]
4. Write a Python code for the developed Gaussian Elimination and Solve the following linear system [5]

$$\begin{pmatrix} 6 & -2 & 2 & 4 \\ 12 & -8 & 6 & 10 \\ 3 & -13 & 9 & 3 \\ -6 & 4 & 1 & -18 \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix} = \begin{pmatrix} 16 \\ 26 \\ -19 \\ -34 \end{pmatrix}$$

5. Write a Python code for the developed Gauss-Jordan Elimination and Solve the above linear system [5]
6. Write a Python code to compute Doolittle decomposition using Gaussian-Elimination for the above problem. [5]
7. Write a Python code for the developed Cholesky Decomposition and solve the above linear system $A^TAx = A^Tb$ [5]
8. Compute total number operations for above algorithms and verify it is $O(n^3)$. [2.5]