Lab Details

Programming with C/C++:

SL. NO.	LIST OF LAB PRACTICAL	Expected no. of lab hours
1	Numerical Solution of tri-diagonal system using Thomas algorithm	**2**
2	Solution of simultaneous non-linear equations using Newton Raphson method	**3**
3	Solution of simultaneous non-linear equations using Newton Raphson Method(Two variables)	**2**
4	Numerical solution of central difference interpolation by using Lagrange interpolation method	**2**
5	Numerical solution of integrals using Trapezoidal method	**2**
6	Numerical evaluation of integrals using Simpson's method	**2**
7	Numerical solution of characteristic value problem by Power method.	**2**
8	Numerical Solution of initial value problem using Euler's method	**2**
9	Numerical Solution of initial value problem using Runga Kutta method	**2**
10	Numerical Solution for heat equation by suitable method	**2**
11	Numerical Solution of wave equation by suitable method	**2**
12	Numerical Solution of Laplace equation in two variables by suitable method	**2**
13	Practical Exam	**2**
	Total	**24**

Scheme: Out of total 13 weeks, there will be 12 Lab classes based on above specified topics/problems. Last week will be reserved for practical exam.

Lab 1

Aim: Numerical Solution of tri-diagonal system by using Thomas algorithm

Brief Theory: A *tridiagonal matrix* has nonzero elements only on the main diagonal, the diagonal upon the main diagonal, and the diagonal below the main diagonal. We use Thomas algorithm to get the solution of tridiagonal matrix.

Thomas' algorithm, also called Tridiagonal Matrix Algorithm (TDMA) is essentially the result of applying Gaussian elimination to the tridiagonal system of equations. It gives the values of variables in reverse order upon back substitutions.

Numerical Procedure:

1. Start of the program
2. To solve AX=D, enter the size of array
3. Enter the values of diagonal (b_i), sub diagonal (a_i) and super diagonal (c_i) elements in matrix A
4. Enter the values (d_i) of matrix D
5. Set $\alpha_1 = b_1$
6. Apply the formula $\alpha_i = b_i - \frac{a_i c_{i-1}}{\alpha_{i-1}}, i = 2,3,.....,n$
7. Set $\beta_1 = \frac{d_1}{b_1}$
8. Apply the formula $\beta_i = \frac{d_i - a_i \beta_{i-1}}{\alpha_i}, i = 2,3,....,n$
9. Set $x_n = \beta_n$
10. Apply the formula $x_i = \beta_i - \frac{c_i x_{i+1}}{\alpha_i}, \; i = n-1, n-2,....$
11. Stop

Example:

1. Find the solution of the following tridiagonal linear system

$$3x_1 - x_2 = -5$$
$$-x_1 + 3x_2 - x_3 = 7$$
$$-x_2 + 3x_3 = 7$$