2024

M.Sc. 2nd Semester Examination

APPLIED MATHEMATICS

PAPER : MTM-297

(Lab: C-Programming with Numerical Methods)

[*Practical*]

Full Marks : 25

Time : 2 hours

Answer **two** questions which are selected by lottery :

$10 \times 2 = 20$

1. Write a program in C to find a real root of an equation $x^3 - 8x - 4 = 0$ by fixed point iteration method.

2. Write a program in C to find the solutions of a Tri-diagonal system of equations

$$x_1 + x_2 = 3$$
$$x_1 + x_2 - 3x_3 = -3$$
$$-2x_2 + 3x_3 = 4$$

3. Write a program in C to find the value of integration $\int_1^2 (x^2 + 1)dx$ by Simpson's $\frac{1}{3}$ Rule.

4. Write a program in C to find the solutions of a system of linear equations

$$-3x_1 + x_2 - 5x_3 = -12$$
$$x_1 + 2x_2 + 4x_3 = 11$$
$$x_2 + 2x_3 = 5$$

by LU decomposition method.

5. Write a program in C to find $y(0{\cdot}4)$ by solving the differential equation $\frac{dy}{dx} = x^2 - y^2, \ y(0) = 1$ by 4th order Runge-Kutta method using step length $0{\cdot}1$.

6. Write a program in C to find $f(2)$ by Lagrange Interpolation Technique, given that $f(1) = 1{\cdot}500$, $f(3) = 2{\cdot}232$, $f(4) = 2{\cdot}500$, $f(5) = 2{\cdot}736$ and $f(6) = 2{\cdot}949$.

7. Write a program in C to find the approximate largest Eigenvalue (in magnitude) and the corresponding Eigenvector of the following matrix by Power method

$$\begin{pmatrix} 2 & 3 & 1 \\ 3 & 2 & 2 \\ 1 & 2 & 1 \end{pmatrix}$$

18. Write a C function to compute the LU decomposition of a square matrix.

19. Implement a C function to find the roots of a polynomial equation of degree n using Newton's method. Verify the output for the equation $f(x) = 3x^3 - 2x^2 + 5x - 7$.

[Notebook and Viva : 05]

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8. Write a program in C to find $y\,(0{\cdot}4)$ by solving the differential equation $\dfrac{dy}{dx} = x - y, \; y(0) = 1$ by Milne's Predictor Corrector method using step length $0{\cdot}05$.

9. Write a program in C to find $y(1{\cdot}2)$ by solving the differential equation $\dfrac{dy}{dx} = x - y, \; y(0) = 1$ by modified Euler method using step length $0{\cdot}2$.

10. Write a program in C to find the value of $\displaystyle\int_0^2 \dfrac{x}{1+x^2}\,dx$ by using six point Gauss-Chebyshev quadrature formulae.

11. Write a program in C to compute $y\,(2{\cdot}9)$ using Newton's backward interpolation formula, given that

$y(2{\cdot}0) = 0{\cdot}3010, \quad y(2{\cdot}2) = 0{\cdot}3424, \quad y(2{\cdot}4) = 0{\cdot}3802,$
$y(2{\cdot}6) = 0{\cdot}4149, \quad y(2{\cdot}8) = 0{\cdot}4471, \quad y(3{\cdot}0) = 0{\cdot}4772.$

12. Write a program in C to find the value of $\displaystyle\int_0^2 \dfrac{x}{1+x^2}\,dx$ by using six point Gauss-Legendre quadrature formulae.

13. Write a program in C to find the value of $\displaystyle\int_1^2 x^2\,dx$ by Monte Carlo method.

14. Write a program in C to compute $y\,(2{\cdot}1)$ using Newton's forward interpolation formula, given that

$y(2{\cdot}0) = 0{\cdot}3010, \quad y(2{\cdot}2) = 0{\cdot}3424, \quad y(2{\cdot}4) = 0{\cdot}3802,$
$y(2{\cdot}6) = 0{\cdot}4149, \; y(2{\cdot}8) = 0{\cdot}4471, \; y(3{\cdot}0) = 0{\cdot}4772.$

15. Write a program in C to find the solutions of a system of linear equations
$$-3x_1 + x_2 - 5x_3 = -12$$
$$x_1 + 2x_2 + 4x_3 = 11$$
$$x_2 + 2x_3 = 5$$
by Gauss elimination method.

16. Write a program in C to find the solutions of a system of linear equations
$$-3x_1 + x_2 - 5x_3 = -12$$
$$x_1 + 2x_2 + 4x_3 = 11$$
$$x_2 + 2x_3 = 5$$
by Guass-Seidel method.

17. Develop a C function to perform bubble sort on an array of structures sorted by a specific field.