M.Sc. 2nd Semester Examination, 2023

APPLIED MATHEMATICS

[Practical]

(*C Programming with Numerical Methods*)

PAPER – MTM-297

Full Marks : 25

Time : 2 hours

The figures in the right hand margin indicate marks

Candidates are required to give their answers in their own words as far as practicable

Answer **two** questions which are selected by **lottery** : 10×2

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

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

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

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

$$\begin{aligned} -3x_1 + x_2 - 5x_3 &= -12 \\ x_1 + 2x_2 + 4x_3 &= 11 \\ x_2 + 2x_3 &= 5 \end{aligned}$$

by LU decomposition method.

4. Write a program in C to find $y(0.4)$ by solving the differential equation.

$$\frac{dy}{dx} = x^2 - y^2, \quad y(0) = 1$$

by 4th order Runge-Kutta method using step length 0.1.

5. Write a program in C to arrange in descending order of a list of real numbers by insertion sort technique.

6. Write a program in C to find $f(2)$ by Lagrange Interpolation Technique given that $f(1) = 1.500$, $f(3) = 2.232$, $f(4) = 2.500$, $f(5) = 2.736$ and $f(6) = 2.949$.

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

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

8. Write a program in C to find y (0.4) by solving the differential equation

$$\frac{dy}{dx} = x - y, \quad y(0) = 1$$

by Milne's Predictor Corrector method using step length 0.05.

9. Write a program in C to arrange in ascending order of a list of real numbers by selection sort technique.

10. Write a program in C to find $y(1.2)$ by solving the differential equation

$$\frac{dy}{dx} = x - y, \quad y(0) = 1$$

by modified Euler method using step length 0.2.

11. Write a program in C to find the value of

$$\int_0^2 \frac{x}{1+x^2}\,dx$$

by using six point Gauss-Chebyshev quadrature formulae.

12. Write a program in C to compute $y(2.9)$ using Newton's backward interpolation formula given that

$y(2.0) = 0.3010, y(2.2) = 0.3424, y(2.4) = 0.3802,$
$y(2.6) = 0.4149,\ y(2.8) = 0.4471, y(3.0) = 0.4772.$

13. Write a program in C to find the value of

$$\int_0^2 \frac{x}{1+x^2}\,dx$$

by using six point Gauss-Legendre quadrature formulae.

14. Write a program in C to find the value of

$$\int_1^2 x^2 dx$$

by Monte Carlo method.

15. Write a program in C to compute $y(2.1)$ using Newton's forward interpolation formula given that
$y(2.0) = 0.3010, y(2.2) = 0.3424, y(2.4) = 0.3802,$
$y(2.6) = 0.4149, \ y(2.8) = 0.4471, y(3.0) = 0.4772.$

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 Gauss elimination method.

17. 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-Seidal method.

[Note book & Viva : 05]
