S.C.No.—21703205

M.Sc. EXAMINATION, 2023

(Main/Re-appear/Improvement)

(2021/2022)

(Second Semester)

MATHEMATICS

21MTH-205

Computational Techniques

Time : 3 *Hours* *Maximum Marks :* 80

Note : Attempt any *Five* questions. All questions carry equal marks.

1. (a) Define Newton-Gregory backward interpolation formula.

(b) Find the absolute error, if the number $x = 0.00545845$ is truncated to three decimal digits.

(c) Show that :

$$\Delta^3 y_2 = \nabla^3 y_5.$$

(d) Evaluate $\Delta^n(e^x)$ with interval of difference being taken as unity.

(e) Define Trapezoidal's rule.

(f) Define linear homogenous and non-homogeneous difference equations.

(g) Solve the difference equation :

$$y_{n+2} - 6y_{n+1} + 9y_n = 0.$$

(h) Using Power method, find largest eigen value of the matrix $A = \begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$.

Unit I

2. (a) Obtain a real positive root of the equation $x^3 - x - 1 = 0$ by Bisection method.

(b) Solve the following system of equations by Gauss elimination method :

$$2x + 3y - z = 5;$$
$$4x + 4y - 3z = 3;$$
$$2x - 3y + 2z = 2$$

3. (a) Discuss convergence of Regula-Falsi method.

(b) Using Muller's method, find a root of the equation $x^3 - 3x - 5 = 0$.

Unit II

4. (a) Estimate $y(2.3)$ using the following Newton-Gregory forward interpolation formula for the following data :

x	y
2	17
3	46
4	97
5	176
6	289

(b) Find the cubic splines and evaluate $y(1.5)$ using the data :

x	y
0	2
1	–6
2	–8
3	2

5. (a) Evaluate $f(8)$ using Newton's divided difference formula for the given data :

x	$f(x)$
4	48
5	100
7	294
10	900
11	1210
13	2028

(b) Construct a divided difference table using the data :

$y(0) = 8$, $y(1) = 68$ and $y(5) = 123$ and determine $y(2)$.

Unit III

6. Evaluate $\int_0^6 \frac{dx}{1+x^2}$ using Trapezoidal, Simpson's 1/3 and Simpson's 3/8 rule.

7. (a) Obtain 5-point central difference formula using Richardson extrapolation model.

(b) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Romberg's method.

Unit IV

8. (a) Solve the difference equation :

$$y_{n+2} - 4y_{n+1} + 4y_n = 2^n.$$

(b) Apply Runge-Kutta fourth order method to find an approximate value of y when $x = 0.2$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ when $x = 0$.

9. (a) Use Fadeev-Leverrier method to find characteristics polynomial of the matrix :

$$A = \begin{bmatrix} 2 & -1 & 1 \\ -1 & 2 & 1 \\ 1 & -1 & 2 \end{bmatrix}.$$

(b) Solve the differential equation :

$\frac{dy}{dx} = x^2 + y^2$, $y = 0$ at $x = 0$ using Euler's method for $y = 0.5$ using $h = 0.1$.