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.

(a) Define Newton-Gregory backward interpolation formula.

(3-123-24/19)H-21703205(PG94)

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- (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 nonhomogeneous 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.

H-21703205(PG94)

2

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

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

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

method?

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

Unit II

A. (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

(3-423-24/20)H-21703205(PG94) 3 P.T.O.

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

x	у
0	2
1	-6
2	-8
3	2

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

\boldsymbol{x}	f(x)
4	48
5	100
7	294
10	900
11	1210
13	2028

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

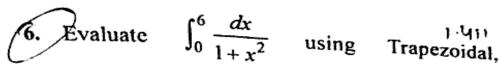
$$y(0) = 8$$
, $y(1) = 68$ and $y(5) = 123$ and determine $y(2)$.

H-21703205(PG94)

4

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Unit III



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:

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

(b) Solve the differential equation:

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

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6

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