A–0722

Total Pages : 5 **Roll No. ....**

MT-608

MA/MSC Mathematics (MAMT/MSCMT)

(Numerical Analysis-II)

Examination, June 2025

Time : 2:00 Hrs. Max. Marks : 70

Note :– This paper is of Seventy (70) marks divided into Two (02) Sections 'A' and 'B'. Attempt the questions contained in these sections according to the detailed instructions given therein. ***Candidates should limit their answers to the questions on the given answer sheet. No additional (B) answer sheet will be issued.***

Section–A

(Long Answer Type Questions) 2×19=38

Note :– Section 'A' contains Five (05) Long-answer type questions of Nineteen (19) marks each. Learners are required to answer any *two* (02) questions only.

1. Calculate $y(0.1)$ of the initial value problem :

$$y' = -2ty^2, y(0) = 1 \text{ with } h = 0.1$$

using Runge-Kutta method of forth order.

2. Use Milne's predictor and corrector Method to obtain the solution of the equation :

$$\frac{dy}{dx} = x - y^2 \text{ at } x = 0.8$$

Given that :

$$y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762$$

3. Use the Adams-Bashforth methods to approximate the solutions to the following initial-value problems. In each case use exact starting values, and compare the results to the actual values :

$$\frac{dy}{dt} = 1 + (t - y)^2, \ 2 \le t \le 3 : y(2) = 1, \text{ with } h = 0.2$$

4. Use Taylor's method of order two to approximate the solutions for each of the following initial-value problems :

$$\frac{dy}{dt} = te^{3t} - 2y, \ 0 \le t \le 1 : y(0) = 0, \text{ with } h = 0.5$$

5. Compute $y(0.25)$ and $y(0.5)$ correct to three decimal places by solving the following initial value problem by Picard's method :

$$\frac{dy}{dx} = \frac{x^2}{1+y^2}; y(0) = 0$$

Section–B

(Short Answer Type Questions) 4×8=32

***Note* :–** Section 'B' contains Eight (08) Short-answer type questions of Eight (08) marks each. Learners are required to answer any *four* (04) questions only.

1. Find four successive approximate solutions for the following initial value problem :

$$\frac{dy}{dx} = x + y, \text{ with } y(0) = 1$$

by Picard's method. Hence compute $y(0.1)$ and $y(0.2)$ correct to five significant digits.

2. Compute values of $y(1.1)$ and $y(1.2)$ on solving the following initial value problem, using Runge-Kutta methods of order :

$$4 : y'' + \frac{y'}{x} + y = 0, \text{ with } y(1) = 0.77 \text{ and } y'(1) = -0.44$$

3. By the method of least square, find the straight line that best fits the following data :

x	y
1	14
2	27
3	40
4	55
5	68

4. A boundary value problem is defined by $y'' + y + 1 = 0$, $0 \leq x \leq 1$ where $y(0) = 0$ and $y(1) = 0$, with $h = 0.5$, use the finite difference method to determine the value of $y(0.5)$.

5. Fit a curve of the best fit of the type, $y = ab^x$ to the following data :

x	y
1	1
2	1.2
3	1.8
4	2.5
5	3.6
6	4.7
7	6.6
8	9.1

6. Define the following :

   (a) Orthogonal Polynomial

   (b) Chebyshev Polynomial

7. Explain Least Square Principle for Continuous functions.

8. The difference equation $y' - x^2 + y - 2$, satisfy the following data :

X	Y
–0.1	1.0900
0	1.0000
0.1	0.8900
0.2	0.7605

Use Milne's method to obtain the value of $y(0.3)$.

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