

K-456

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Roll No.

MAMT-08

Numerical Analysis

MA/M.Sc. Mathematics (MAMT/MSCMT)

2nd Year Examination, 2023 (Dec.)

Time : 2 Hours]

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)

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.

(2×19=38)

1. Using the Rutishauser method to compute all the eigenvalues of the matrix

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 1 \end{bmatrix}$$

2. Perform two iterations of Bristow-method to find two roots of the equation $x^4 - 3x^3 + 20x^2 + 44x + 54 = 0$, use (2, 2) as initial approximation.
3. Define the following root finding methods with their mathematical expression
- (a) Bisection method.
 - (b) Secant method.
 - (c) Regula-Falsi method.
 - (d) Newton-Raphson method.
4. Obtain a second degree polynomial approximation to the function $f(x) = x^3$, on the interval $[0, 1]$, using least-squares principle. Take weight function $w(x) = 1$.
5. Solve the following IVP by Milne's method, given that

$$\frac{dy}{dt} = t + y, t \in [0, 0.4] \text{ at } t_0 = 0, y_0 = 1.$$

SECTION-B
(Short Answer Type Questions)

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. (4×8=32)

1. Find the rate of convergence of Secant method and also discuss which of the method is faster between Regula-Falsi and Secant method.
2. Find the root of the equation $x^2 - 5x + 2 = 0$ up to fourth iteration by Newton-Raphson method.
3. Find a real root of the equation $x^4 + 7x^3 + 24x^2 - 15 = 0$, using Birge-Vieta method. Perform two iterations.
4. Using Gauss Jordan method solve the following system of equations

$$3x + y + z = 6$$

$$x + 2y + 3z = 8$$

$$2x + y + 4z = 8.$$

5. Compute $y(1.2)$ by using Runge-Kutta fourth order method, where $y(t)$ is the solution of the IVP

$$\frac{dy}{dt} = ty, y(1) = 2$$

6. Solve the BVP

$$\frac{d^2y}{dx^2} = \frac{3}{2}y^2, y(0) = 4, y(1) = 1$$

with step size $h = \frac{1}{3}$, using second order method.

7. Express $2 - x^2 + 3x^4 = 0$ as sum of the Chebyshev polynomials.

8. Fit a straight line to the given data.

x	1	2	3	4	5	6
y	2.6	2.7	2.9	3.025	3.2	3.367

Also find value of y at $x = 5.5$.
