C180

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MAMT-08

Numerical Analysis

MAM.Sc. Mathematics (MAMT/MSCMT)

2nd Year, Examination, 2022 (June)

Time : 2 Hours] **Max. Marks : 80**

Note : This paper is of Eighty (80) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein.

SECTION–A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Twenty (20) marks each. Learners are required to answer any Two (02) questions only.

(2×20=40)

1. (a) Find the real root of the equation $x^3 - 2x - 5 = 0$ using Regula-Falsi method.

(b) Find the root of the equation $\sin x - x^3 = 1$ using Newton-Raphson method.

2. Find the eigenvalues and vectors of the following matrix

$$A = \begin{bmatrix} 5 & 0 & 1 \\ 0 & -2 & 0 \\ 1 & 0 & 5 \end{bmatrix}.$$

3. Fit a curve of the form $y = ax^b$ to the given data:

x	2	3	4	5	6
y	144	172.8	207.4	248.8	298.5

4. (a) Solve the boundary value problem

$$\frac{d^2y}{dx^2} + (1 + x^2)y + 1 = 0,\ x \in [0.1]$$

by a second order finite difference method with step size $h = \frac{1}{4}$.

(b) Solve the BVP by Numerov method

$$\frac{d^2y}{dx^2} = x + y$$

$$y(0) = 0,\ y(1) = 0$$

with step size $h = \frac{1}{4}$.

5. Define with example :

(a) Spectrum and spectral radius.

(b) Complex matrix and Hermitian matrix.

(c) Homogeneous boundary value problem.

(d) Minima property of Chebyshev polynomials.

(e) Eigenvalues and Eigenvectors.

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Ten (10) marks each. Learners are required to answer any Four (04) questions only. (4×10=40)

1. Find the root of the equation $x^3 - 2x - 5 = 0$ by Muller's method. Take 1, 2 and 3 as initial approximations.

2. Perform two iterations of Bristow-method to find two roots of the equation $x^4 - 3x^3 + 20x^3 + 44x + 54 = 0$ use (2,2) as initial approximation.

3. Solve the following linear equations

$2x_1 + 8x_2 + 2x_3 = 14$

$6x_1 + 6x_2 - x_3 = 13$

$2x_1 - x_2 + 2x_3 = 5$

using Gauss-Jordan method.

4. Find the eigenvalues of the following Hermitian matrix

$$A = \begin{bmatrix} 2 & -4i & 0 \\ 4i & 2 & 0 \\ 0 & 0 & 4 \end{bmatrix}$$

5. (a) Express $2 - x^2 + 3x^4$ as a sum of chebyshev polynomials.

(b) Express $2\,T_0(x) + T_1(x) + 2T_2(x)$ as a polynomial in x.

6. Use Picard's method to compute $y(0.5)$, where $y(t)$ is the solution to the given IVP $\frac{dy}{dt} = 1 + y$

$y(0) = 1$.

7. Solve the following IVP by Milne's method, given that

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

8. Solve the boundary value problem $\frac{d^2y}{dx^2} = y$

$y(0) = 0$, $y(1) = 1.2$ by employing shooting method, take $y'(0) = 0.85, 0.95$ as initial guesses.
