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MT-608

Numerical Analysis-II

MA/MSC Mathematics (MAMT/MSCMT)

4th Semester Examination, 2022 (Dec.)

Time : 2 Hours] **[Max. Marks : 35**

Note : This paper is of Thirty Five (35) 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 Nine and Half (9½) marks each. Learners are required to answer any Two (02) questions only. (2×9½=19)

1. Using the method of least-squares find a straight line that fits the following data :

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

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

2. Compute $y(0.4)$ by Adams-Moulton method, given that

$$\frac{dy}{dt} = ty,\ y(0) = 1$$

$y(0.1) = 1.01$, $y(0.2) = 1.022$, $y(0.2) = 1.023$.

3. Solve the boundary value problem by Numerov method

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

With step size $h = \frac{1}{2}$.

4. Use fourth order Runge-Kutta method to compute $y(0.4)$, given that

$$\frac{dy}{dt} = -2t - y,\ y(0) = -1$$ [Take step size $h = 0.1$]

5. Compute the constant α and γ^{β} such that $y = \alpha\gamma^{\beta x}$ fits the given data.

x	1	2	3	4	5	6
y	151	100	61	50	20	8

SECTION–B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. Express $1 - x^2 + 2x^4$ as a sum of Chebyshev Polynomial.

2. Find the best lower degree approximation polysomial to $2x^3 + 5x^2$.

3. Use Picard's method to compare $y(2.1)$, where $y(t)$ is the solution to the given IVP $\frac{dy}{dt} = 1 + ty$, $y(2) = 0$, Perform upto third approximation.

4. Using Taylor's series method, solve

$\frac{dy}{dt} = y \sin t + \cos t$, for some t, given that $y(0) = 1$.

5. Use fourth order Runge-Kutta method to compute $y(2.1)$, given that $\frac{dy}{dt} = -2t - y$, $y(0) = -1$ [Take step size $h = 0.1$]

6. Obtain the second-degree polynomial approximation to the function $f(x) = \frac{1}{1+x^2}$, $x \in [1,1.2]$ using Taylor series expansion about $x = 1$. Find a bound on the truncation error.

7. Solve the boundary value problem

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

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

8. Define the following :

(a) Orthogonal Polynomial.

(b) Chebyshev Polynomial.
