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MT-608

Numerical Analysis-II

MA/MSC Mathematics (MAMT/MSCMT)

4th Semester Examination, 2023 (June)

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	71	68	73	69	67	65	66	67
y	69	72	70	70	68	67	68	64

Also find the value of y at $x = 68.5$

2. Compute $y(1)$ by Adams-Moulton method, given that

$$\frac{dy}{dt} = y - t^2, \; y(0) = 1$$

$y(0.2) = 1.2859$, $y(0.4) = 1.46813$, $y(0.6) = 1.73779$.

3. Solve the boundary value problem $\frac{d^2y}{dx^2} = y$, $y(0) = 0$, $y(0.6) = 0.7$ by shooting method.

4. Fit the curve $pV^r = k$ to the data given in the table.

p	0.5	1	1.5	2	2.5	3
V	1.62	1	0.75	0.62	0.52	0.46

5. Determine the best minimax approximation to the function $f(x) = x^2$ on $[0, 1]$ with a straight line.

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 $T_0(x) + 2T_1(x) + T_2(x)$ as a polynomial in x.

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

3. Use Picard's method to compare $y(0.5)$, where $y(t)$ is the solution to the given IVP $\frac{dy}{dt} = 1 + y$, $y(0) = 1$, Perform upto third approximation.

4. Compute $y(0.2)$ by Taylor's series, where $y(t)$ is the solution of the IVP, $\frac{dy}{dt} = t + y$, $y(0) = 1$.

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. Obtain Taylor series expansion of the function $f(x) = e^x$, about $x = 0$. Find the number of terms of the exponential series such that their sum gives the value of e^x correct to six decimal places at $x = 1$.

7. Solve the boundary value problem

$$\frac{d^2y}{dx^2} = xy,\ y(0) + y\ (0) = 1,\ y(1) = 1, \text{ with step size } h = \frac{1}{3}.$$

8. Define the following :

(a) Runge-Kutta method of fourth order.

(b) Orthogonal property of Chebyshev Polynomial.