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MT-608

M.A./M.Sc. MATHEMATICS (MAMT/MSCMT)

(Numerical Analysis–II)

4th Semester Examination, 2024 (June)

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) $2\times19=38$

***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. Given the differential equation $y'' - xy' - y = 0$ with the condition $y(0) = 1$ and $y(0) = 0$, use Taylor's series method to determine the value of $y(0.1)$.

2. Use Picard's method to approximate y when $x = 0.2$, given that $y = 1$ when $x = 0$ and $\frac{dy}{dx} = x - y$.

3. Find the value of $y(1.1)$, using RungeKutta method fourth order given that $\frac{dy}{dx} = y^2 + xy, y(1.0)$ take $h = 0.05$.

4. A boundary-value problem is defined by $y'' + y + 1 = 0$, $0 \le x \le 1$ 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. Compute $y(1)$ by Adams-Moulton method, given that :

$$\frac{dy}{dt} = y - t^2, \quad y(0) = 1,\ y(0.2) = 1.2859,$$

$$y(0.4) = 1.46813,\ y(0.6) = 1.73779$$

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. Using the method of least squares fit a curve of the form $y = \frac{x}{a+bx}$ to the following data (3, 7.148), (5, 10.231), (8, 13.509), (12, 16.434).

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

3. Find the values of a_0, a_1 and a_2 so that the function $z = a_0 + a_1x + a_2y$ is fitted to the data x, y, z given below :

   (0, 0, 2), (1, 1, 4), (2, 3, 3), (4, 2, 16) and (6, 8, 8)

4. Given that differential equation $\frac{dy}{dx} = \frac{x^2}{y^2+1}$ with the initial condition $y = 0$ when $x = 0$, use Picard's method to obtain y for $x = 0.25$, 0.5 and 1.0 correct to three decimal places.

5. Given $\frac{dy}{dx} = xy^{1/3}$, where $y(1) = 1$. Find $y(1.1)$ using Runge-Kutta method.

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 ex correct to six decimal places at $x = 1$.

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

8. The difference equation $y' = x^2 + y^2 - 2$ statisfies 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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