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53 (MA 401) NMCP

2018

**NUMERICAL METHODS AND
COMPUTER PROGRAMMING**

Paper : MA 401

Full Marks : 100

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

Answer any five questions.

1. (a) Find a real root of $x^4 - x = 10$, correct to five decimal places by using Newton-Raphson method. 5
- (b) Prove that $\frac{E-1}{E} = \Delta$, where E is shift operator and Δ is forward difference operator. 4

Contd.

- (c) Using improve Euler method, find a solution of the equation $\frac{dy}{dx} = y + x^2$, with initial condition $y = 1$ at $x = 0$ for the range $0 \leq x \leq 1$ in steps of 0.2.

11

2. (a) Using Bisection method, find a real root of $x^3 - 3x + 1.06 = 0$ to correct upto three decimal places.

7

- (b) For a given function $f(x) = x^3$ and $\delta x = 0.2$ taking five decimal places obtain the absolute errors in $f'(x)$ and $f''(x)$ at $x = 3$.

5

- (c) Using modified Euler method, find y at $x = 0.1$ and $x = 0.2$ given that $\frac{dy}{dx} = y - \frac{2x}{y}$, $y(0) = 1$ with correct result upto four places of decimals.

8

3. (a) Using Regula-Falsi method, find the real root of $xe^x - 2x + 1 = 0$ correct to three decimal places.

5

- (b) Using three points Gaussian quadrature formula, evaluate $\int_0^1 \frac{dx}{1+x}$.

5

- (c) By using Least Square method, fit a second degree parabola $y = a + bx + cx^2$ to the following data :

10

x :	1	2	3	4	5	6	7
y :	1.8	1.3	2.1	1.2	1.5	2.5	6.3

4. (a) Using Iteration method, find a real root of $3x - \log_{10}(x) - 16 = 0$ correct to fourth decimal places.

5

- (b) Integrate $\int_1^2 \frac{dx}{x}$ by calculus and by Simpson's formula taking eight division and compute $\log 2$.

6

- (c) Solve the following equations by Gauss Seidel equation method correct upto four decimal places :

$$7x_1 + 52x_2 + 13x_3 = 104;$$

$$8x_1 + 11x_2 - 4x_3 = 95;$$

$$3x_1 + 8x_2 + 29x_3 = 71.$$

9

5. (a) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = xy + y^2$ with $y(0) = 1$ at $x = 0.1, 0.2, 0.3$.

12

- (b) Compute $f'(0.1)$ from the following data :

8

x :	0	1	2	3	4
$f(x)$:	1	0	1	10	33

6. (a) Solve $\frac{dy}{dx} = \frac{1}{2}(1+x)y^2$ with $y(0) = 1$ at $x = 0.2, 0.4, 0.6$ by Euler method and hence find $y(0.8)$ by Milne's method.

10

- (b) Using Gauss elimination method solve —

$$2x + y + 4z = 12$$

$$8x - 3y + 2z = 20$$

$$4x + 11y - z = 33$$

4

- (c) Apply Lagrange's formula to find $f(5)$ from the following data :

6

x :	1	2	3	4	7
$f(x)$:	2	4	8	16	128

7. (a) What do you mean by error ? Find the absolute error and relative error if the number $x = 0.004997$ is round off to three decimal places.

4

- (b) Using Newton's Interpolation formula evaluate $f(3.8)$ from the following data :

6

x :	0	1	2	3	4
$f(x)$:	1	1.5	2.2	3.1	4.3

- (c) The pressure and the volume of a gas are related by the equation $pV^\gamma = k$; γ and k being constants. Fit the equation to the following set of observations :

10

p (kg / cm^2) :	0.5	1.0	1.5	2.0	2.5	3.0
V (litres) :	1.62	1.00	0.75	0.62	0.52	0.46