53 (MA 401) NMCP

2017

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)* Using Bisection Method find a real root of $x^3 - 3x + 1{\cdot}06 = 0$ to correct upto three decimal places. 4

(b) Prove that $\frac{E-1}{E} = \Delta$, where E is shift operator and Δ is forward difference operator. 4

(c) Using Runge-Kutta Method of fourth order, solve $\frac{dy}{dx} = xy + y^2$ with $y(0) = 1$ at $x = 0{\cdot}1, 0{\cdot}2, 0{\cdot}3$. 12

2. *(a)* Using Regula-Falsi Method find a real root of $x^3 - 4x - 9 = 0$ correct to three decimal places. 5

(b) Apply Lagrange's formula to find $f(5)$ from the following data : 7

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

(c) Using Modified Euler Method, find y at $x = 0{\cdot}1$ and $x = 0{\cdot}2$ given that

$$\frac{dy}{dx} = y - \frac{2x}{y}, \quad y(0) = 1$$ with correct result upto four places of decimals. 8

3. *(a)* Using Newton-Raphson Method find a real root of $3\tan 3x = 3x + 1$ correct to fourth decimal places. 4

(b) Using Gauss-elimination method solve— 6

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

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

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

(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. 10

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

(b) Compute $f(3{\cdot}8)$ from the following data : 8

x	:	0	1	2	3	4
$f(x)$	:	1	1·5	2·2	3·1	4·3

(c) Compute $f'(0{\cdot}1)$ from the following data : 8

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

5. (a) Using Gauss-Seidel Method, solve — 8

$$5x + 2y + z = 12$$
$$x + 4y + 2z = 15$$
$$x + 2y + 5z = 20$$

(b) Given the values 6

x	:	5	7	11	13	17
$f(x)$	:	150	392	1452	2366	5202

Evaluate $f(9)$

(c) Derive Newton's divided difference formula. 6

6. (a) Write the principle of least square method. Fit a second degree parabola $y = a + bx + cx^2$ to the following data : 1+9=10

x :	1	2	3	4	5	6	7
y :	1·8	1·3	2·1	1·2	1·5	2·5	6·3

(b) Solve $\frac{dy}{dx} = \frac{1}{2}(1+x)y^2$ with $y(0) = 1$ at $x = 0{\cdot}2, 0{\cdot}4, 0{\cdot}6$ by Euler Method and hence find $y(0{\cdot}8)$ by Milne's Method. 10
