

Total number of printed pages-4

53 (MA 401) NMCP

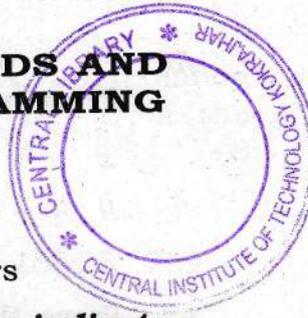
2019

**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) Write an algorithm to implement Euler's method. Solve the differential equation $\frac{d^2y}{dx^2} = x^2 + y^2$ with $y(0) = 1$ using Euler's method by choosing a step size of $h = 0.2$ to obtain solution for $0 \leq x \leq 1$.

4+8=12

- (b) Using Gauss-Seidel method solve the following equations : 8

$$2x + y + 6z = 9$$

$$8x + 3y + 2z = 13$$

$$x + 5y + z = 7$$

Contd.

2. (a) Solve $e^x - 4x - 1 = 0$, correct to 4 places of decimal using the method of successive approximation. 5

(b) Fit a parabola $y = a + bx + cx^2$ to the following data : 10

x :	1	2	3	4	5	6	7	8	9
y :	2	6	7	8	10	11	11	10	9

(c) Prove that $\frac{E^{-1}}{E} = \Delta$, where E is shift operator and Δ is forward difference operator. 5

3. (a) Using Newton's backward interpolation formula evaluate $f(3.8)$ from the following data : 8

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

(b) Using Gauss-elimination method solve the following equations : 7

$$\begin{aligned} 2x + 2y + z &= 12 \\ 3x + 2y + 2z &= 8 \\ 5x + 10y - 8z &= 10 \end{aligned}$$

(c) Using Newton-Raphson method, find a real root of $x^2 - x = 10$, correct to 4 decimal places. 5

4. (a) State Newton's forward interpolation formula. Compute $f(1.2)$ from the following data : 8

x :	1	1.5	2	2.5	3
f(x) :	9	32.75	79	155.25	269

(b) 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

(a) 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 decimal. 8

(b) Using Bisection method, find a real root of the equation $x^3 - 4x - 9 = 0$, correct to 3 decimal places. 6



- (c) Use Trapezoidal rule with $n=4$ to estimate $\int_1^2 x^2 dx$ and compare this estimation with exact value. 6
6. (a) Using Regula-Falsi method, solve $x^3 - 5x + 2 = 0$, correct to 3 decimal places. 5
- (b) Solve $\frac{dy}{dx} = \frac{1}{2}(x+y)y^2$ 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. 8
- (c) Compute first derivative of the function $f(x)$ at the point 0.1 from the following data : 7

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

