MATH/V/CC/05 **Student's Copy**

2 0 1 9

(CBCS)

(5th Semester)

MATHEMATICS

FIFTH PAPER

(Computer-Oriented Numerical Analysis)

Full Marks : 75

Time : 3 hours

(PART : A—OBJECTIVE)

(*Marks* : 25)

The figures in the margin indicate full marks for the questions

SECTION—A

(*Marks* : 10)

Tick ☑ the correct answer in the box provided : 1×10=10

1. By definition of backward difference operator $f(x)$ equals to

(a) $f(x \quad h) \quad f(x)$ ☐

(b) $f(x \quad h) \quad f(x)$ ☐

(c) $f(x) \quad f(x \quad h)$ ☐

(d) $f(x) \quad f(x \quad h)$ ☐

2. The Newton-Raphson formula to find the cube root of a positive number N is

(a) $x_{n \quad 1} \quad \frac{1}{3} \quad 2x_n \quad \frac{N}{x_n^2}$ ☐

(b) $x_{n \quad 1} \quad \frac{1}{3} \quad x_n \quad \frac{N}{x_n^2}$ ☐

(c) $x_{n \quad 1} \quad \frac{1}{3} \quad x_n \quad \frac{N}{2x_n^2}$ ☐

(d) $x_{n \quad 1} \quad \frac{1}{3} \quad x_n \quad \frac{2N}{x_n^2}$ ☐

3. If f (75) 246, f (80) 202, f (85) 118 and f (90) 40, then f (79) is

(a) 210·512 ☐ *(b)* 215·472 ☐

(c) 115·472 ☐ *(d)* 225·472 ☐

4. Given that f (1) 1, f (2) 9, f (2) 11, then f (0)

(a) 1 ☐ *(b)* 2 ☐

(c) 4 ☐ *(d)* 5 ☐

5. In Gauss elimination method, the given system of simultaneous equations transform to

(a) upper triangular matrix ☐ *(b)* lower triangular matrix ☐

(c) diagonal matrix ☐ *(d)* scalar matrix ☐

6. Given that

$$A \quad \begin{array}{ccc} 12 & 7 & 5 \\ 0 & 11 & 10 \\ 0 & 1 & 2 \end{array}$$

then

(a) A is upper triangular matrix ☐

(b) A is lower triangular matrix ☐

(c) A is diagonally dominant matrix ☐

(d) A is a diagonal matrix ☐

7. If f (1) 0, f (2) 1 and f (3) 4, then f (3) is equal to

(a) 3 ☐ *(b)* 5 ☐

(c) 2 ☐ *(d)* 4 ☐

8. From the table, the value of f (15) equals

x	15	17	19	21	23	25
$f(x)\quad \sqrt{x}$	3·873	4·123	4·359	4·583	4·796	5·000

(a) 0·129 ☐ *(b)* 0·131 ☐

(c) 0·135 ☐ *(d)* 0·141 ☐

9. The Euler's modified formula is given by

(a) $y_{n\ \ 1}\quad y_n\quad hf(x_n, y_n)$ ☐

(b) $y_{n\ \ 1}\quad y_n\quad \frac{h}{2}[f(x_n, y_n)\quad f(x_{n\ \ 1}, y_{n\ \ 1})]$ ☐

(c) $y_{n\ \ 1}\quad y_n\quad \frac{h}{3}[f(x_n, y_n)\quad f(x_{n\ \ 1}, y_{n\ \ 1})]$ ☐

(d) $y_{n\ \ 1}\quad y_n\quad h[f(x_n, y_n)\quad f(x_{n\ \ 1}, y_{n\ \ 1})]$ ☐

10. For solving ordinary differential equation numerically, which among the following is applied if successive derivatives can be obtained easily?

(a) Taylor's method ☐ *(b)* Runge-Kutta method ☐

(c) Euler's method ☐ *(d)* Picard's method ☐

SECTION—B

(*Marks* : 15)

Answer the following questions : 3×5=15

1. *(a)* Prove that $E \quad\quad E$.

OR

(b) Find the value of $^{n}(e^{x})$.

2. *(a)* Find the missing term in the given table :

x	100	101	102	103	104
y	2	2·0043	—	2·0128	2·0170

OR

(b) If $f(x)\quad \frac{1}{x^2}$, find the divided difference of $\quad (a, b)$.

3. *(a)* Solve by Gauss-Jordan method $x \quad y \quad 4$ and $2x \quad y \quad 2$.

OR

(b) Solve the given equation by Crout's method :

$$x \quad 2y \quad 3, \; 2x \quad 3y \quad\quad 1$$

4. *(a)* Find the value of $\log 2^{\frac{1}{3}}$ from $\,_{0}^{1} \frac{x^2}{1 \quad x^3} dx$, using Simpson's one-third rule with $h \quad 0 \; 25$.

OR

(b) Find $f \quad (2)$ from the following table :

x	1	2	3	4	5
y	0	3	8	15	24

5. *(a)* Using Runge-Kutta formula of order 2, find $y(1 \; 1)$, given that

$$\frac{dy}{dx} \quad 3x \quad y^2, \; y(1) \quad 1 \; 2$$

OR

(b) Write the algorithm of Euler's method for numerical solution of differential equation.

(PART : B—DESCRIPTIVE)

(*Marks* : 50)

The figures in the margin indicate full marks for the questions

Answer **one** question from each Unit

UNIT—I

1. *(a)* Find the function whose first difference is $x^3 \quad 3x^2 \quad 5x \quad 12$. 5

(b) Find the positive root of the equation $3x \quad \cos x \; 1 \quad 0$ by Newton-Raphson method correct to four decimal places. 5

2. *(a)* Solve the equation $xe^{x} \quad 2 \quad 0$ by Newton-Raphson method. 5

(b) Write the algorithm of regula falsi method for finding the root of the equation $f(x) \quad 0$. 5

UNIT—II

3. *(a)* Deduce Lagrange's interpolation formula for unequal interval. 5

(b) From the following table, evaluate $f(3 \quad 8)$ using Newton's backward interpolation formula : 5

x	0	1	2	3	4
y	1·00	1·50	2·20	3·10	4·60

4. *(a)* Obtain Newton's divided difference interpolation for non-equal intervals of the arguments. 5

(b) Using Newton's divided difference formula, evaluate $f(10)$, given that

x	0	2	5	9	11
y	1	5	116	712	1310

5

UNIT—III

5. *(a)* Solve the following system of equations by Gaussian elimination method : 5

$$6x \quad y \quad z \quad 19, \; 3x \quad 4y \quad z \quad 26, \; x \quad 2y \quad 6z \quad 22$$

(b) Solve the following system of equations by Crout's method : 5

$$x \quad y \quad z \quad 3, \; 2x \quad y \quad 3z \quad 16, \; 3x \quad y \quad z \quad 3$$

6. *(a)* Write an algorithm for Gauss-Seidel iteration method. 5

(b) Solve by using Gauss-Seidel method correct to three decimal places : 5

$$x \quad y \quad 54z \quad 110, \; 27x \quad 6y \quad z \quad 85, \; 6x \quad 15y \quad 2z \quad 72$$

UNIT—IV

7. *(a)* Find the first and second derivative of the following tabulated function at the point x 1 5 : 5

x	1·5	2	2·5	3	3·5	4
$f(x)$	3·375	7·0	13·625	24	38·875	59·0

(b) Compute by Simpson's rule the value of the integral

$$I \quad {}_{0}^{1} \frac{x^2}{1 \quad x^2} dx$$

by dividing into four equal parts. 5

8. *(a)* Deduce the formula for Simpson's one-third rule. 5

(b) Evaluate $I \quad {}_{0}^{\overline{3}} \frac{x}{\cos x} dx$ by using trapezoidal rule correct up to four decimal places. 5

UNIT—V

9. *(a)* Using Taylor series method, find $y(0 \; 1)$ correct to four decimal places, given that $\frac{dy}{dx} \quad x^2 \quad y^2, \; y(0) \quad 1.$ 5

(b) Find the approximate solution of the initial value problem $\frac{dy}{dx} \quad 1 \quad y^2, \; y(0) \quad 0$ by Picard's method and compare it with the exact solution. 5

10. *(a)* Apply Euler's modified method to solve $\frac{dy}{dx} \quad x \quad 3y$ subject to $y(0) \quad 1$ and hence find an approximate value of y when $x \quad 1.$ 5

(b) Using Milne's predictor-corrector method, find $y(0 \; 4)$ for the differential equation $\frac{dy}{dx} \quad 1 \quad xy, \; y(0) \quad 2.$ 5

★ ★ ★