

**BACHELOR OF COMPUTER
APPLICATIONS (BCA) (REVISED)**

Term-End Examination

December, 2024

**BCS-054 : COMPUTER ORIENTED
NUMERICAL TECHNIQUES**

Time : 3 Hours

Maximum Marks : 100

Note : (i) *Any type of calculator is allowed during examination.*

(ii) *Question No. 1 is compulsory.*

(iii) *Attempt any **three** more from the question no. 2 to question no. 5.*

1. (a) (i) Explain accuracy and precision with the help of suitable examples. 2
- (ii) Find the significant digits of the following numbers : 2
- 40.05; 0.00500; 6×10^3 ; 470,000

(iii) What is overflow ? Give an example of multiplication due to which overflow occurs. 1

(b) Solve the following system of linear equations using Gauss elimination method : 5

$$x + y + z = 6$$

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

$$5x + 2y + z = 12$$

(c) Solve the following system of linear equations using Gauss-Jacobi's iteration method : 5

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

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

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

Perform two iterations.

(d) Find an approximate root of the equation :

$$3x^3 - 4x^2 + 3x - 4 = 0$$

using secant method, starting with initial approximation $x_0 = 0$ and $x_1 = 1$. Perform three iterations. 5

- (e) By using the Bisection method, find an approximate root of the equation : 5

$$x^3 - x - 11 = 0$$

that lies between 2 and 3 correct to three decimal places.

- (f) Prove that : 5

$$\Delta = \frac{1}{2}\delta^2 + \delta\sqrt{1 + \frac{\delta^2}{4}}$$

where symbols carry their usual notations.

- (g) Construct Newton's forward difference table for the following data : 5

| x | y |
|-----|-----|
| 0 | 3 |
| 1 | 6 |
| 2 | 11 |
| 3 | 18 |
| 4 | 27 |

Hence approximate $f(2.5)$ from Newton's forward difference interpolating polynomial.

(h) Evaluate : 5

$$\int_0^6 \frac{1}{1+x^2} dx$$

by using Trapezoidal rule.

2. (a) Solve the following system of linear equations by Gauss-Seidel iteration method : 6

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Perform two iterations.

(b) From the following table, evaluate $f(3.8)$ using Newton's backward interpolation : 7

| x | $f(x)$ |
|-----|--------|
| 0 | 1.00 |
| 1 | 1.50 |
| 2 | 2.20 |
| 3 | 3.10 |
| 4 | 4.60 |

- (c) The velocity of a train which starts from rest is given by the following table; the time being given in minutes from the start and speed in kilometres per hour :

| Time (in minutes) | Speed (in km/hr) |
|------------------------------|-----------------------------|
| 2 | 10 |
| 4 | 18 |
| 6 | 25 |
| 8 | 29 |
| 10 | 32 |
| 12 | 20 |
| 14 | 11 |
| 16 | 5 |
| 18 | 2 |
| 20 | 0 |

Estimate approximately by Simpson's one-third rule, the total distance covered in 20 minutes.

7

3. (a) Find a real root of the following equation correct to three decimal places by the method of Regula-Falsi : 6

$$x^3 - 4x - 9 = 0$$

- (b) Find a real root of the equation :

$$x^3 - 6x + 4 = 0$$

by using Newton-Raphson method, correct to three decimal places. 7

- (c) Find the cubic polynomial which takes the following value : 7

| x | $f(x)$ |
|-----|--------|
| 0 | 1 |
| 1 | 2 |
| 2 | 1 |
| 3 | 10 |

Hence evaluate $f(4)$.

4. (a) Find Newton's forward difference interpolating polynomial for the following data : 6

| x | $f(x)$ |
|-----|--------|
| 0 | 1 |
| 1 | 3 |
| 2 | 7 |
| 3 | 13 |

- (b) For certain values of x the values of a function $f(x)$ are given below :

| x | $f(x)$ |
|-----|--------|
| 0 | -4 |
| 2 | 2 |
| 3 | 14 |
| 6 | 158 |

Use Lagrange's formula for interpolation to find the value of $f(4)$. 7

- (c) Using Newton's divided difference formula on the table given below, evaluate $f(8)$ and $f(15)$: 7

| x | $f(x)$ |
|-----|--------|
| 4 | 48 |
| 5 | 100 |
| 7 | 294 |
| 10 | 900 |
| 11 | 1210 |
| 13 | 2028 |

5. (a) Use the Runge-Kutta method of fourth order with $h = 0.1$ to obtain an approximate value of y (1.2) for the solution of $\frac{dy}{dx} = 2xy$; $y(1) = 1$. 10
- (b) Use the Euler's method to obtain approximate value of y (0.5) for the solution of the initial-value problem $y' = (x - y)^2$, $y(0) = 0.5$, take $h = 0.1$. 10

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