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BCS–054

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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