No. of Printed Pages : 7 **BCS–054**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (REVISED)

Term-End Examination

December, 2023

BCS–054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 Hours *Maximum Marks : 100*

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

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

(*iii*) *Attempt any* ***three*** *more from the next* ***four*** *questions.*

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1. (a) Use Gauss Elimination method to solve the system of linear equations given below : 6

$$x_1 + 4x_2 + x_3 = 7$$

$$x_1 + 6x_2 - x_3 = 13$$

$$2x_1 - x_2 + 2x_3 = 5$$

(b) Use Gauss-Seidel method to solve the system of linear equations given below (results should be correct upto two decimal places only) : 6

$$-4x_1 + x_2 + 10x_3 = 21$$

$$5x_1 - x_2 + x_3 = 14$$

$$2x_1 + 8x_2 - x_3 = -7$$

(c) Use Regula-Falsi method to find positive root of the equation $x^3 + 4x^2 - 10 = 0$, correct upto two places of decimal. 6

(d) Perform the following : 6

(i) Express operator Δ in terms of operator δ

(ii) Express operator Δ in terms of operator ∇

(e) Determine the Newton's forward difference interpolating polynomial that satisfies the data tabulated below : 6

x	$f(x)$
1	10
2	19
3	40
4	79
5	142
6	235

Also, find the value of $f(x)$, at $x = 1.5$.

(f) Use Newton's Forward Difference (FD) formula to compute $f'(x)$ and $f''(x)$ at $x = 2.0$, for the data given below : 5

x	$f(x)$
1.5	1.2247
2.0	1.4142
2.5	1.5811
3.0	1.7320
3.5	1.8708

(g) Calculate the value of the integral $\int_{4}^{5.2} \log x \, dx$, using Simpson's 1/3 rule. (Assume $h = 0.2$). 5

2. (a) Using Euler's method tabulate the solution of IVP (Initial Value Problem) $y' = -2ty^2$, $y(0) = 1$ in the interval [0,0.8], taking $h = 0.2$. 8

(b) Find the Taylor's series for $(1-x)^{-1}$ at $x = 0$. 4

(c) Perform four iterations of Secant method for finding the root of the equation $x^3 + 4x^2 - 10 = 0$ near $x = 0$ and $x = 1$. Compute upto two decimal places only. 8

3. (a) Write Newton-Raphson scheme for finding qth root of a positive number N. Hence

find cube root of 10 correct up to 3 places of decimal taking initial estimate as 2.0. 8

(b) Write expression for E, Δ, δ, μ operators in terms of ∇ operator. 4

(c) Use Lagrange's method of interpolation to find the value of y when $x = 2.5$ from the following data : 8

x	y
0	– 6
0.5	–1.875
1.5	0.375
3.0	0

Compute upto four places of decimal only.

4\. (a) Use divided difference table to find the value of $f(a, b, c)$, for $f(x) = x^2$. 4

(b) Determine first and second derivatives of $y = f(x)$ at $x = 1.1$ from the data tabulated below : 10

x	$y = f(x)$
1.0	0.0000
1.2	0.1280
1.4	0.5440
1.6	1.2960
1.8	2.4320
2.0	4.0000

(c) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule, subdivide the interval (0, 1) into 6 equal parts. 6

5\. (a) Use modified Euler's method to find the value of y for x = 0.1 and 0.2 from the differential equation $\frac{dy}{dx} = x^2 + y^2 - 2$; $y(0) = 1$. Compute upto 3 places of decimal only. 10

(b) Use fourth order classical Runge-Kutta method to solve the initial value problem $u' = -2tu^2$ with $u(0) = 1$ and $h = 0.2$ on the interval [0,1]. 10