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BCS–054

BACHELOR OF COMPUTER APPLICATIONS

(BCA) (REVISED)

Term-End Examination

December, 2025

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. Attempt any* ***three*** *questions from question no.* ***2*** *to question no.* ***5****.*

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1. (a) Solve the following system of equations using Gauss Elimination method : 6

$$2x_1 + 8x_2 + 2x_3 = 14$$

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

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

(b) Use Secant method to perform three iterations for finding roots of the equation $x^3 + 4x^2 - 10 = 0$, near $x = 0$ and $x = 1$. (Compute upto two decimal places only.) 6

(c) Find Newton's forward difference interpolating polynomial which agrees with the following data : 8

x	$f(x)$
1	10

2	19
3	40
4	79
5	142
6	235

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

(d) Use Gauss-Seidel iterative method to solve the following system of linear equations (Perform 3 iterations) : 6

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

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

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

taking $x_1^{(0)} = x_2^{(0)} = x_3^{(0)} = 0$ as the initial values.

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

(f) Write Taylor's series for $(1-x)^{-1}$. Also, find the truncation error in approximating $(1-x)^{-1}$, say at $x = 0.1$ by taking first three terms. 6

(g) If $f(x) = \frac{1}{x}$, show that $f(a,b,c) = \frac{1}{abc}$ using divided difference table for $x = \{a, b, c\}$. 4

2. (a) List *one* method for interpolation with equal intervals and *one* method for interpolation with unequal intervals. Find the Lagrange's interpolating polynomial for the following data : 10

x	$f(x)$
1	4
3	18
7	70

Hence, evaluate $f(4)$ using the interpolating polynomial.

(b) Using Euler's method, solve the differential equation : 10

$$y' = x^3 + y^2$$

where $y(0) = 1$.

Find the solution on [0, 0.4] with $h = 0.1$.

3. (a) Write short notes on the following : 5+5

(i) Regula-Falsi method

(ii) Newton-Raphson method

(b) Find the Newton's backward difference interpolating polynomial which agrees with the table of values given ahead : 10

x	$f(x)$
4	19
6	40
8	79
10	142

Hence interpolate $f(9)$.

4. (a) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$, using : 10

(i) Trapezoidal rule

(ii) Simpson's rule

with 4 equal subintervals.

(b) Using Runge-Kutta method of order 4 to approximate y, when $x = 0.1$ and $x = 0.2$, given that $x = 0$ when $y = 1$ and $\frac{dy}{dx} = x + y$ (take $h = 0.1$). 10

5. Write short notes on the following : 4×5=20

   (i) Runge-Kutta method of order-2 and IVPs

   (ii) Stirling's formula and its application

   (iii) Accuracy and Precision

   (iv) Pivotal condensation method for solving linear algebraic equations

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