No. of Printed Pages : 6 **BCS-054**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (REVISED)

Term-End Examination

June, 2022

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** more from the next four questions.*

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

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

$$2x + 3y + 3z = 10$$

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

(b) Perform two iterations, using Gauss-Seidel iteration method to solve the following system of equations : 6

$$10x - 2y - z - w = 3$$
$$-2x + 10y - z - w = 15$$
$$-x - y + 10z - 2w = 27$$
$$-x - y - 2z + 10w = -9$$

(c) Find the root of the equation $x^3 - x - 1 = 0$, lying between 1 and 2, by using Bisection method (perform three iterations). 6

(d) Verify the relation $\Delta - \nabla = \Delta\nabla$, where Δ and ∇ are forward and backward differencing operations, respectively. 6

(e) Write Stirling's formula of numerical differentiation. Briefly discuss its application with suitable example. 6

(f) Find $f(5)$ by Lagrange's interpolation method, for the following data : 5

x	$f(x)$
1	0
3	18
4	48
6	180
10	900

(g) Compute the integral of function $f(x)$ using Trapezoidal rule, the value of $f(x)$ for values of x between 0 and 1.0 are tabulated below : 5

x	$f(x)$
0	1
0.1	1.2
0.2	1.4
0.3	1.6
0.4	1.8
0.5	2.0
0.6	2.2
0.7	2.4
0.8	2.6
0.9	2.8
1.0	3.0

2. (a) Perform the following conversions : 6

(i) $(-349)_{10}$ to its binary equivalent

(ii) $(-0.3125)_{10}$ to its binary equivalent

(b) Compare direct methods and iterative methods of solving linear algebraic equations. Give merits and demerits of each. Give *one* name of the methods for each category i.e. direct and indirect methods. 6

(c) Explain Newton-Raphson's iterative method for finding the qth root of a positive number N. Also find the cube root of 10 correct upto 3 places of decimal, taking initial estimate as 2.0. 8

3. (a) Verify the following : 6

(i) $\Delta f(x) = 0$ when $f(x) = c$, a constant

(ii) $\Delta^2 f(x) = 0$ when $f(x) = x$, an identity function.

(iii) $E^2 x^2 = x^2 + 8x + 16$, when the value of x varies by a constant increment of 2.

(b) Construct a difference table for data given below :

x	$f(x)$
1	7
2	13
3	18
4	25

Now perform the following : 7

(i) Highlight the forward differences for $f(1)$ by drawing circle around the values.

(ii) Highlight the backward differences for f (4) by drawing square around the values.

(iii) Find the highest degree of polynomial that can be generated.

(c) Write short notes on the following in the context of floating point representation :

(i) Precision

(ii) Accuracy

(iii) Significant digit

Give suitable example of each. 3+3+1

4. (a) If $f(x) = x^3$, find the first and second divided difference of f for $x = \{a, b, c\}$. 5

(b) Evaluate the integral $\mathrm{I} = \int_0^{0.8} \frac{dx}{\sqrt{1+x}}$ by Simpson's 1/3 rule, divide the interval 0 to 0.8 to 4 equal subintervals. (Compute upto 5 decimal places only). 5

(c) 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 5 places of decimal only). 10

5. (a) Using Runge-Kutta method of order 4, obtain y when $x = 1.1$, given that $y = 1.2$ when $x = 1$, y satisfies the equation $\frac{dy}{dx} = 3x + y^2$. 10

(b) Write formula for Euler's method and use it to find the solution of equation $y' = f(t, y) = t + y$ given $y(0) = 1$. Find the solution on [0, 0.8] interval with step size $h = 0.2$. 10