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BCS-054

BACHELOR OF COMPUTER APPLICATIONS (BCA) (REVISED)

Term-End Examination

June, 2021

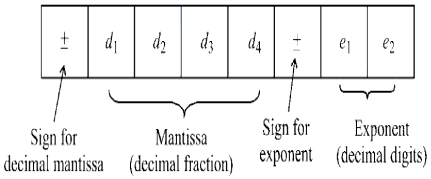
BCS-054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

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.*

1. (a) Consider the following decimal floating point representation for a number having base 10 : 3



Which of the following numbers are not in normalised form ? Convert all the numbers to normalised form :

(i)

+	0	1	2	3	−	1	5

(ii)

−	1	2	3	4	+	0	0

(iii)

−	0	0	0	1	+	0	2

(b) Solve the following system of equations using Gauss-elimination method. Does this method produce a solution for this system ? 5

$$6x + 2y + 4z = 6$$

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

$$2x + y + z = 0$$

(c) Find the smallest positive root for the equation using bi-section method : 7

$$x^3 + 3x^2 - 6 = 0$$

Show three iterations.

(d) Construct the difference table for the data : 3

x	$f(x)$
1	6
2	12
3	18
4	25

List the forward differences for $f(1)$ and backward differences for $f(4)$.

(e) Write the notation and the formula in terms of $f(x)$ and h for the following : 2

(i) Central difference

(ii) Shift operator

(f) Find the Newton's forward-difference interpolating polynomial which agrees with the table of values given below : 7

x	$f(x)$
1	5
2	14
3	27
4	44
5	65
6	90

Using this polynomial, find the value of $f(1.25)$.

(g) Evaluate the integral $I = \int_0^{0.4} \frac{dx}{(1+2x)^2}$ by using Simpson's 1/3rd rule, by dividing the interval into four equal sub-intervals. 7

(h) Find the order and degree of the following differential equation : 2

$$5\left(\frac{d^3y}{dx^3}\right)^3 + 12\left(\frac{dy}{dx}\right) - 3x\left(\frac{d^2y}{dx^2}\right)^4 = 0$$

(i) Write the formula for finding the numerical differentiation $\left(\frac{dy}{dx} \text{ and } \frac{d^2y}{dx^2}\right)$ using backward difference formula. 4

2. (a) Perform the following floating point operations (assume the maximum mantissa size to be of 4 decimal digits). Use chopping wherever required (answer should be in normalised form) : 6

(i) add 0.2345×10^5 and -0.2205×10^5

(ii) subtract 0.6101×10^2 from 0.2016×10^5

(iii) multiply 0.28×10^{-3} and 0.221×10^4

(b) Using the Gauss-Seidel iterative method, solve the following system of linear equations : 6

$$2x + y = 7$$

$$x + 4y = 14$$

Use the initial values $x_0 = y_0 = 1$. Perform only two iterations.

(c) Using Newton-Raphson method, find the cube root of 10 with initial value as 2. Perform 3 iterations. 8

3. (a) Derive the relationship between E and the following operators : 6

(i) ∇

(ii) δ

(iii) μ

(b) Find the value of α in the following data, if $f(x)$ represents a polynomial of degree 3 : 6

x	$f(x)$
1	7
2	15
3	α
4	73
5	135

(c) Find the Lagrange's interpolating polynomial for the following data : 8

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

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

4. (a) The values of $y = x^{1.5}$ are given below for $x = 1(1)5$. Find the value of y' and y'' at $x = 1.5$ using F-D formula : 10

x	$f(x) : y = x^{1.5}$
1	1
2	2.8284
3	5.1962
4	8

(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 $h = 0.1$.

5. (a) Assuming the decimal floating point representation given in Q. 1 (c), identify what problems will be encountered, if you perform the following operations. Explain the problem and propose solution, if any : 6

(i) Adding 0.6005×10^{99} with

0.4150×10^{99}

(ii) Adding 0.6705×10^{12}, 0.6685×10^{5} and -0.6705×10^{12}

(iii) Dividing 0.2003×10^{-53} by

-0.5000×10^{49}

(b) How is truncation error related to Taylor series ? Explain with the help of an example. 4

(c) For a given value of h, find the values of Δ, Δ^2 and Δ^3, if $f(x) = x^2$. 5

(d) Derive the formula of Trapezoidal rule using a diagram. 5