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BCS-054

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

February, 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** questions from questions no. **2** to **5**.*

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1. (a) Define the terms 'accuracy' and 'precision'. If 0·333 is the approximate value of $\frac{1}{3}$, find absolute and relative errors. *4*

(b) Solve the following system of equations, using Gauss Elimination method. *6*

$x + y + z = 3$; $3x + 2y + 3z = 18$;

$x + 4y + 9z = 16$

(c) Find the root of the equation $x^3 + 2 = 0$, by using Newton-Raphson method, taking initial approximation as –1. Perform only two iterations. *5*

(d) Express the operators (i) Δ (ii) ∇ (iii) δ in terms of operator E. *4*

(e) Find the Lagrange interpolating polynomial that fits the following data : *6*

x :	0	1	2
f(x) :	2	3	12

(f) Evaluate the integral $\int_0^6 (x^2 + x + 2)\, dx$ using Trapezoidal rule, with h = 1·0. *5*

(g) Find the smallest positive root of the equation $x^2 - x - 1 = 0$ by Bisection method. Perform only three iterations. *5*

(h) Assume that a floating point representation is of eight decimal digits with four digits for normalised mantissa, two digits for exponent and one digit each for sign of exponent and mantissa. Answer the following, using this representation. (Use chopping if required)

1+1+1+2=5

(i) 0·035119

(ii) 42·169

(iii) Addition of numbers given in (i) and (ii) above.

(iv) Multiplication of numbers given in (i) and (ii) above.

2. (a) Find the interpolating polynomial fitting the following data using Newton's backward difference interpolating method. *7*

x :	0	1	2	3	4
f(x) :	10	9	6	1	– 6

Hence, evaluate f(3·5).

(b) Construct the forward difference table and determine the term missing in the following data. You may assume $\Delta^4 y_0 = 0$. *8*

x :	100	101	102	103	104
f(x) :	2·000	2·0043	?	2·0128	2·0170

(c) Using Divided Difference table verify that for $f(x) = x^3$; f[a, b, c] = a + b + c. *5*

3. (a) Evaluate $\int_1^3 \sqrt{x}\, dx$ using Simpson's $\frac{1}{3}$ rule, with $h = 0{\cdot}5$. *5*

(b) Solve the following system of equations by using Gauss-Jacobi method. Perform only two iterations, assuming $x_1 = x_2 = x_3 = 0$ as the initial approximation. *6*

$$2x_1 - x_2 + x_3 = -1$$
$$x_1 + 2x_2 - x_3 = 6$$
$$x_1 - x_2 + 2x_3 = -3$$

(c) Solve the following system of linear equations using Gaussian elimination method using pivotal condensation. *9*

$$x + y + 10z = 14$$
$$5x - y + z = 9$$
$$x - 4y + z = -5$$

4. (a) Use Secant method to find the smallest positive root of the equation $f(x) = 2^x - 5x + 2$. Perform only two iterations. *7*

(b) What are the pitfalls of Gauss elimination method ? Discuss with the help of an example for each. *5*

(c) Given that $y' = xy$ and $y(0) = 1$, determine the value of y when $x = 0{\cdot}4$, using Euler's method with $h = 0{\cdot}1$. *8*

5. (a) Solve the following system of equations by using Gauss-Seidel method. Perform only two iterations, assuming $x_1 = x_2 = x_3 = 0$ as the initial approximation. *7*

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

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

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

(b) Write the formula for the following operations for function f(x) and step size h. *6*

(i) Δ

(ii) ∇

(iii) δ

(iv) μ

(v) E

(vi) D

(c) State the following formulae : *4*

(i) Stirling formula for Interpolation

(ii) Bessel's formula for Interpolation

(d) Explain the concept of Boundary Value Problem with suitable example. *3*