BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

04752

June, 2019

BCS-054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 hours   *Maximum Marks : 100*

Note :

- (i) *Use of calculator is allowed during examination.*
- (ii) *Question no.* **1** *is* **compulsory.** *Attempt any* **three** *questions from questions no.* **2** *to* **5.**

1. (a) Find the sum of two floating-point numbers

    $x = 0.6239 \times 10^6$ and $y = 0.5163 \times 10^4$.   **2**

    (b) Find the product of x and y where the value of x and y are given in part (a) of this question.   **2**

    (c) What is 'underflow' ? Give an example of multiplication due to which underflow occurs.   **3**

(d) Write the following system of linear equations in matrix form :   *2*

$$3x + 5y + 8z = 0$$
$$3y + 2z = 7$$
$$2x - 3z = -6$$

(e) Solve the following system of linear equations using the Gauss elimination method :   *4*

$$13x - 7y = 2$$
$$5x + 3y = 15$$

(f) Find an interval in which the following equation has a root :   *2*

$$2x^2 - 11x + 14 = 0$$

(g) Show two iterations of Newton-Raphson method for finding approximate root of the equation

$$x^2 + x - 6 = 0 \quad \text{starting with } x_0 = 1. \quad 3$$

(h) Write the notation and formula for the following operators :   *3*

(i) Central difference operator

(ii) Shift operator

(iii) Forward difference operator

(i) Write ∇ and δ in terms of E. *3*

(j) Define the term interpolation with the help of an example. State the Newton's backward difference formula for interpolation. *2+2=4*

(k) Construct a difference table for the following data : *2*

x	4	6	8	10
f(x)	9	15	29	31

(l) From the Newton's backward difference formula asked in part (j), derive a rule/formula for finding the derivative of a function f(x) at $x = x_0$. *3*

(m) State trapezoidal rule for finding the approximate value of integral

$$\int_{a}^{b} f(x)\, dx \,.$$

Also show it geometrically. *3*

(n) Define the following terms and give one example for each of the following in the context of differential equations : **4**

(i) Order

(ii) Degree

(iii) Initial conditions

(iv) Boundary conditions

2. (a) Assuming an 8-decimal digit floating point representation (with 4 digits for mantissa, two digits for exponent and one each for sign of mantissa and exponent), represent the following numbers in normalised floating point form (use chopping, if required). **3**

(i) 23563255

(ii) $- 63 \cdot 27832$

(iii) $- 0 \cdot 0000235$

(b) For each of the three numbers in Q.No. 2(a), find the relative error in its normalised floating point representation. **6**

(c) Obtain the approximate value of smallest positive root of the equation

$$x^3 + 4x - 12 = 0,$$

by using three iterations of bisection method. **6**

(d) Find the Maclaurin's series of $f(x) = e^x$, around $x = 0$. (Please note $\frac{d}{dx} e^x = e^x$)

Calculate the approximate value of e using first four terms of this series. 5

3. (a) Solve the following system of linear equations with pivotal condensation Gaussian elimination method : 10

$$2x + 3y - z = 11$$
$$x - 5y + 7z = \text{[?]}$$
$$3x - y - \text{[?]} = 4$$

(b) Solve the following system of linear equations using Gauss-Jacobi iterative method. Perform only three iterations.

$$5x - 7y + 3z = 15$$
$$x - 5x - 2z = 4$$
$$3x + 2y + z = 2$$

Take initial estimates as $x = 0$, $y = 0$ and $z = 0$. 6

(c) Define the following with the help of an example : 4

(i) Ill conditioned problem

(ii) Rounding off errors

(iii) Algebraic equations

(iv) Transcendental equations

4. **(a)** Find the Newton's forward-difference interpolating polynomial for the following data :

x	1	2	3	4	5	6
f(x)	12	22	44	84	148	242

Hence, obtain the value of f(x) at x = 1·5 and x = 2·5. *8*

(b) Estimate the missing term (represented by '?') in the following data, if it represents a valid interpolating polynomial of degree 3. *6*

x	1	2	3	4	5
f(x)	5	24	?	128	225

(c) Given the following data for interpolation :

x	0	1	5	15
f(x)	20	60	120	200

To find the value of f(x) at x = 2, which of the following methods will be used by you ?

- Bessel's interpolation formula
- Newton's FD formula
- Lagrange's interpolation method

Give reasons in support of your answer. *3*

(d) What is inverse interpolation ? Explain with the help of an example. 3

5. Attempt any *two* of the following parts : 2×10=20

(a) Find the approximate value of the integral

$$I = \int_{0.2}^{1.0} \frac{dx}{\sqrt{1 + x^2}}$$

by Simpson's $\frac{1}{3}$ rd rule dividing the interval [0.2, 1.0] to 4 equal sub-intervals. Compute up to four places of decimal only.

(b) Find the value of f′(x) or y′ and f″(x) or y″ at x = 1.25 for the values of y = $x^{2/3}$ given in the following table :

x	1·0	1·5	2·0	2·5	3·0
y = f(x) = $x^{2/3}$	1	1·310	1·587	1·842	2·080

(c) Solve the following differential equation using Euler's method :

y′ = 1 − 2 xy, assume that y(0) = 1.

Find the solution in the interval [0, 0·8] with h = 0·2.