No. of Printed Pages : 7

BCS-054

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

04473

Term-End Examination

December, 2018

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

Represent :

(i) -235

(ii) -2576

(iii) $+0{\cdot}007567$ *3*

(b) What are the advantages of representing floating point numbers in normalised form ? 2

(c) If $x_1 = 2{\cdot}98 \times 10^2$ and $x_2 = 1{\cdot}97 \times 10^1$ are two floating point numbers, then find the value of $x_1 - x_2$. You must show all the steps. 2

(d) If $x_3 = 2{\cdot}71 \times 10^4$ and $x_4 = -\,1{\cdot}53 \times 10^{-5}$ are two floating point numbers, find the value of $x_3 \times x_4$. Show all the steps. 2

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

$$2x + y + z = 5$$

$$x + 3z = 9$$

$$2y + 5z = 11$$

(f) Show one iteration of solving the following system of linear equations using Gauss – Jacobi iterative method. You may assume x = 1 and y = 1 as initial estimate. 3

$$2x + 3y = 8$$

$$3x + 5y = 13$$

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

$$4x^2 + 4x - 35 = 0$$

(h) Explain how calculation of next estimate differs in Newton – Raphson method and Bisection method of solving non-linear equations. *3*

(i) Write the symbol and formula with respect to f(x) and some value of h for the following operators : *3*

(i) Forward difference

(ii) Central difference

(iii) Shift operator

(j) Express forward difference and backward difference operators in terms of shift operator. *2*

(k) State the Newton's forward difference formula for interpolation. *2*

(l) Given the following data :

x	0	2	10	30
y	5	10	40	70

To find the value of y at x = 5, which of the methods will you choose from the Lagrange's method or Newton's backward difference formula ? Give reason in support of your answer. *3*

(m) From the forward difference formula for interpolation asked in question 1(k), derive the formula for finding derivative of a function $f(x)$ at $x = x_0$. *3*

(n) State and explain the Trapezoidal rule geometrically. *4*

(o) Define the following terms in the context of differential equations : *4*

(i) Order

(ii) Degree

(iii) Initial condition

(iv) Boundary condition

2. (a) Explain the following terms with the help of an example : *8*

(i) Truncation error

(ii) Absolute error

(iii) Overflow

(iv) Unstable problem

(b) Obtain the smallest positive root of the equation

$$x^3 - x - 3 = 0,$$

by using three iterations of Bisection method. *6*

(c) What is Maclaurin series ? Find the Maclaurin series of $f(x) = e^x$ around $x = 0$. *6*

3. (a) Solve the following system of linear equations using Gaussian elimination method with partial pivoting condensation : *10*

$$x - 2y + z = 1$$

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

$$2x + 3y - 5z = 2$$

(b) Using Gauss – Seidel iterative method, show two iterations of solving the following system of linear equations : *6*

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

$$2x_1 + 3x_2 - x_3 = 4$$

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

Take initial estimate as $x_1 = x_2 = x_3 = 0$.

(c) Which of the two methods – direct or iterative, will you choose for the following types of problems. Give reasons in support of your answer. *2+2=4*

(i) When the matrix is dense and order of matrix is less than 50.

(ii) When you want small rounding off errors.

4. (a) Estimate the missing term (shown by "?") in the following data, if it represents a valid interpolating polynomial of degree 3 :

x	2	3	4	5	6
f(x)	3	7	?	21	31

Also find the interpolating polynomial using Newton's forward difference formula and find the value of f(x) at x = 2·5. *10*

(b) Find the Newton's backward difference form of interpolating polynomial for the following data :

x	2	4	6	8
f(x)	21	41	80	140

Hence, evaluate f(7). *6*

(c) Find the $\Delta^2 f(x)$ and $\Delta^3 f(x)$ for the square function $f(x) = x^2$. *2+2=4*

5. Attempt any two parts of (a), (b) and (c) given below. Each part is of 10 marks. *10+10=20*

(a) The value of $y = x^{3/2}$ are given for $x = 1{\cdot}0\ (0{\cdot}5)\ 3{\cdot}0$.

x	1·0	1·5	2·0	2·5	3·0
$y = x^{3/2}$	1·00	1·84	2·83	3·95	5·20

Find y' and y'' at $x = 1{\cdot}25$ using FD formula.

(b) Evaluate :

$$\int_{1}^{6} (2 + x^2)\, dx$$

using Simpson's $\frac{1}{3}$ rule with 11 points.

(c) Using Euler's method, find the solution of the differential equation

$$y' = t^2 + y, \text{ given } y(0) = 1.$$

Find the solution on the interval [0, 0·8] with h = 0·2 (Please note t is an independent variable).