No. of Printed Pages : 7 **BCS-054**

BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

01734

December, 2014

BCS-054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 hours *Maximum Marks : 100*

Note : *Simple (but not scientific) calculator is allowed. Question number 1 is* ***compulsory****. Attempt any* ***three*** *from the next four questions.*

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1. (a) Using 8-decimal digit floating-point representation (with four digits for mantissa, two for exponent and one each for sign of exponent and mantissa), represent the following numbers in normalized floating point form (use rounding, if required) : *3*

(i) 9561

(ii) – 74·794

(iii) – 0·00726

(b) What is an overflow ? Give an example involving addition of numbers in which overflow occurs. *3*

(c) Find the sum of two floating-point numbers : *2*

$$x_1 = 0{\cdot}4507 \times 10^3 \text{ and } x_2 = 0{\cdot}5671 \times 10^5$$

(d) Find the product of the two numbers given in question. no. 1(c) above. *2*

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

$$-8x + 6y = 13$$
$$9x - 5y = 7$$

(f) Solve the following system of linear equations using Gauss Elimination method : *3*

$$4x + 3y = 1$$

$$7x - 2y = -20$$

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

$$x^2 - 8x + 11 = 0$$

(h) Write the formula used in Regula-Falsi method for finding the roots of an equation. *3*

(i) Write the expressions which are obtained by applying each of the operators to f(x), for some h : *3*

(i) Δ

(ii) δ

(iii) D

(j) Write each of ∇ and μ in terms of E. *2*

(k) State the following two formulae for interpolation : *3*

(i) Newton's Backward difference formula

(ii) Stirling's formula

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

x	1	2	3	4
f(x)	2	9	28	65

(m) From the Newton's Backward difference formula asked in part k(i) above, derive the formula for finding derivative of a function f(x) at x_0. *3*

(n) State Simpson's (1/3) rule for finding the value of the integral $\int_a^b f(x)\,dx$. *3*

(o) Explain each of the following concepts with a suitable example for each : *4*

(i) Degree and order of a differential equation

(ii) Boundary Value Problem

2. (a) Can the number zero (0) be represented as a normalized floating point number ? Why or why not ? Further, under representation of question no. 1(a), how many floating point representations (including all un-normalized representations) are possible for the number zero ? *4*

(b) For each of the following numbers, find the floating point representation, if possible normalized, using rounding if required. The format is 8-digit as is mentioned in question no. 1(a) : *6*

(i) 2/7

(ii) 896786

Further, find absolute error, if any, in each case.

(c) Find the product of the two numbers : *6*

$a = -0{\cdot}5203 \times 10^4$ and $b = -0{\cdot}6251 \times 10^{-5}$.

(d) Find the approximate value of $e = e^1$, by taking first four terms of Maclaurin's series, and also find truncation error. *4*

3. (a) Solve the following system of equations, using partial pivoting Gaussian elimination method (compute upto two places of decimal only) : *12*

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

$$3x_1 + 5x_2 - 2x_3 = 6$$

$$x_1 - 2x_2 - x_3 = -2$$

(b) Give formula for next approximations of values of x_1, x_2 and x_3 using Gauss-Seidel method for solving a system of linear equations of the form *4*

$$a_{11}\, x_1 + a_{12}\, x_2 + a_{13}\, x_3 = b_1;$$

$$a_{21}\, x_1 + a_{22}\, x_2 + a_{23}\, x_3 = b_2 \text{ and}$$

$$a_{31}\, x_1 + a_{32}\, x_2 + a_{33}\, x_3 = b_3.$$

(c) What are the advantages of Direct methods over Iterative methods for solving a system of linear equations ? *4*

4. (a) For $f(x) = 8x^3 - 5x^2 + 12$, find $\Delta^4 f(x)$. *6*

(b) Construct a difference table and mark the backward differences for the following data : *8*

x	1	2	3	4	5	6
f(x)	5	13	18	24	33	40

(c) Estimate the missing term 'A' in the following data, where it represents a polynomial of degree three : *6*

x :	1	2	3	4	5
f(x) :	3	7	A	21	31

5. Attempt any ***two*** parts of (a), (b) and (c).

(a) Given the following values of $f(x) = ln\ (x)$, find the approximate value of $f'(2 \cdot 0)$. *10*

x	2·0	2·2	2·6
f(x)	0.69315	0.78846	0.95551

(b) Find the approximate value of $I = \int_0^1 \frac{dx}{1 + x}$ using Simpson's (1/3) rule (three points). *10*

(c) Solve the following IVP using Euler's method : *10*

$$y' = 1 - 2xy, \quad y(0 \cdot 2) = 0 \cdot 1948$$

Find $y(0 \cdot 4)$ with $h = 0 \cdot 2$.