BACHELOR OF COMPUTER APPLICATIONS (BCA) (Revised)

Term-End Examination

December, 2015

05869

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.*

1. (a) Explain, with suitable examples, the advantages of using Normalized form for representing numbers. 3

(b) 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 chopping, if required) : 3

(i) 8975

(ii) -897.87

(iii) -0.0078456

(c) For two floating point numbers $x_1 = 0.6187 \times 10^4$ and $x_2 = 0.5306 \times 10^3$, find $x_1 - x_2$ in floating point representation. 2

(d) Find the product of the two numbers given in question number 1(c) above. 2

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

$$7x - 5y = 9$$

$$-8x - 4y = -13$$

(f) Show one iteration of solving the following system of linear equations using any iterative method. You may assume $x = y = 0$ as initial estimate. 3

$$-8x + 7y = 15$$

$$5x - 2y = -7$$

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

$$x^2 - 5x + 6 = 0$$

(h) Write the formula used in Newton-Raphson method for finding root of an equation. 3

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

(i) ∇ (ii) E (iii) D

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

(k) State the following two formulae for interpolation. 3

(i) Newton's Forward difference formula

(ii) Stirling's formula

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

x	1	2	3	4
$f(x)$	2	5	10	17

(m) From the Newton's Forward 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 Trapezoidal rule for finding the value of integral $\int_a^b f(x)\,dx$. 3

(o) Explain each of the following concepts with a suitable example. 4

(i) Boundary Value Problem.

(ii) Order of a differential equation.

2. (a) For each of the three numbers of question number 1(b), find relative error in its normalized floating point representation. 6

(b) Find approximate value of e by taking first three terms of Maclausin's series and also find the truncation error. 4

(c) Solve the following system of linear equations using Gaussian elimination method and comment on the nature of solution. 5

$$12x_1 + 18x_2 - 5x_3 = 25$$
$$3x_1 - 5x_2 + 7x_3 = 05$$
$$9x_1 + 23x_2 - 12x_3 = 20$$

(d) Obtain the smallest positive root of the equation $x^3 - 5x + 1 = 0$, by using three iterations of bisection method. 5

3. (a) Solve the following system of linear equations with partial pivoting condensation. Gaussian elimination method. 12

$$x_1 - x_2 + 3x_3 = 3$$
$$2x_1 + x_2 + 4x_3 = 7$$
$$3x_1 + 5x_2 - 2x_3 = 6$$

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

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

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

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

(c) Describe relative merits of each of direct methods and iterative methods of solving system of linear equations, over each other. 4

4. (a) The population of a city in a census taken once in 10 years is given below in thousands. Estimate the value in 1965. 8

Year	1961	1971	1981	1991	2001	2011
Population	35	42	58	84	120	165

(b) Derive the operators E and Δ in terms of δ. 5

(c) Find Newton's backward difference form of interpolating polynomial for the data : 7

x	4	6	8	10
$f(x)$	19	40	83	155

Hence evaluate $f(9)$.

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

(a) Find approximate value of $I = \int_1^3 \frac{dx}{4 + 3^x}$ **10**

using Simpson's $\left(\frac{1}{3}\right)$ rule (three points).

(b) The values of $y = \sqrt{x}$ are given below for $x = 1.5(0.5)3.5$ **10**

x	1.5	2.0	2.5	3.0	3.5
$f(x)$	1.2247	1.4142	1.5811	1.7320	1.8708

Find y' and y'' at $x = 3.25$ using BD formula.

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

$y' = 1 - 2xy$, $y(0.2) = 0.1948$, Find $y(0.4)$ with $h = 0.2$.