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BCS–054

BACHELOR OF COMPUTER APPLICATIONS (BCA) (REVISED)

Term-End Examination

June, 2024

BCS-054 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

Time : 3 Hours *Maximum Marks : 100*

Note : (*i*) *Any calculator is allowed during examination hall.*

(*ii*) *Question No.* ***1*** *is compulsory.*

(*iii*) *Attempt any* ***three*** *more from the rest four questions.*

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1. (a) Solve the following system of linear equations using Gauss Elimination method : 5

$$4x - 5y + z = 2$$

$$2x + y - 2z = 7$$

$$x + 4y + z = 5$$

(b) Construct a difference table for the data : 5

x	$f(x)$
1	8
2	14
3	20
4	27
5	30

(c) (i) Express the following numbers in floating point representation, if possible normalised, in the four digit mantissa, two digit exponent etc. if necessary, approximate, using chopping : 3

(1) 29.43

(2) – 0.0023946, and

(3) – 8976925

(ii) Find the product of the two numbers :

$$x_1 = -0.9089 \times 10^{19}$$

and $x_2 = -0.5492 \times 10^{-10}$

Show the mantissa and exponent of the product in normalized form. 2

(d) Differentiate between direct methods and iterative methods for the solutions of linear algebraic equation with the help of suitable examples. 5

(e) Find a real root of the following equation using Bisection method correct to two decimal places : 5

$$x^3 - 5x + 1 = 0$$

(f) Prove that :

$$\mu^2 = 1 + \frac{\delta^2}{4}$$

where symbols carry their usual meaning. 5

(g) Solve by Gauss-Jacobi's iteration method, the following system of linear equations :

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x - 3y + 20z = 25$$

Perform two iterations. 5

(h) The velocities of a car running on a straight road at intervals of 2 minutes are given below : 5

Time, in minutes (*t*)	**Velocity, in km/hr (*v*)**
0	0
2	22
4	30
6	27
8	18
10	7
12	0

Apply, Simpson's one-third rule to find the distance covered by the car in 12 minutes.

2. (a) Solve the following system of linear equations by Gauss-Seidel method : 6

$$5x + 2y + z = 12$$

$$x + 4y + 2z = 15$$

$$x + 2y + 5z = 20$$

Perform two iterations.

(b) From the following table, estimate $f(7.5)$ using Newton's backward interpolation formula : 7

x	$f(x)$
1	1
2	8
3	27
4	64
5	125
6	216
7	343
8	512

(c) For the tabulated function : 7

x	y
0	3
1	6
2	11
3	18
4	27

find $\int_0^4 y\,dx$ by using Trapezoidal rule.

3. (a) Find a real root of the following equation correct to three decimal places by using Regula-Falsi method : 6

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

(b) Find the smallest positive root of : 7

$$x^3 - 5x + 3 = 0$$

by using Newton-Raphson method.

(c) From the following table, estimate the number of students who obtained marks between 40 and 45 by using Newton's forward interpolation formula : 7

Marks	**No. of Students**
30—40	31
40—50	42
50—60	51
60—70	35
70—80	31

4. (a) The following table gives corresponding values of x and y. Construct the difference table and then express y as a function of x : 6

x	y
0	176
1	185
2	194
3	203
4	212
5	220
6	229

Also compute $f(0.2)$.

(b) The value of a function $f(x)$ are given below for certain values of x : 7

x	$f(x)$
0	5
1	6
3	50
4	105

Find the value of $f(2)$ using Lagrange's interpolation formula.

(c) Determine $f(x)$ as a polynomial of x for the following data, using Newton's divided difference formula : 7

x	$f(x)$
– 4	1245
– 1	33
0	5
2	9
5	1335

5. (a) Using Runge-Kutta method of fourth order solve : 10

$$\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2} \quad \text{with } y(0) = 1,$$

at $x = 0.2, 0.4$.

(b) Use the Euler's method to obtain the approximate value of $y(0.5)$ for the solution of the initial value problem $y' = 1 + y^2$, $y(0) = 0$. Take $h = 0.1$. 10