# BACHELOR OF COMPUTER APPLICATIONS (BCA) (Pre-Revised)

## Term-End Examination

## December, 2021

## CS-71 : COMPUTER ORIENTED NUMERICAL TECHNIQUES

*Time : 3 hours* *Maximum Marks : 75*

***Note :*** *Question number **1** is **compulsory**. Attempt any **three** questions from question numbers 2 to 5. Use of scientific calculator is permitted.*

**1.** (a) Differentiate between Propagated error and Generated error. Prove that Total relative error is equal to the sum of relative propagated error and relative generated error. *6*

(b) A polynomial passes through the following set of points :

| x | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| y | – 1 | – 1 | 1 | 5 |

Find the polynomial using Newton's forward interpolation. *6*

(c) Evaluate the integral $I = \int_0^1 \frac{dx}{1+x}$ by using Simpson's $\frac{1}{3}$ rule with h = 0·25 and h = 0·5. *6*

(d) What are the two pitfalls of Gauss elimination method ? *6*

(e) Find the approximate value of the root of the equation $x^3 + x - 1 = 0$, near x = 1, using Bisection method (two iterations only). *6*

**2.** (a) Use Runge-Kutta method to solve the initial value problem $y' = (t - y)/2$ on [0, 0·2] with y(0) = 1. Compare the solution with h = 0·2 and h = 0·1. *10*

(b) Use Lagrange's interpolation formula to find the value of sin (π/6) from the data given below : *5*

| X | 0 | π/4 | π/2 |
|---|---|---|---|
| Y = sin (x) | 0 | 0·70711 | 1·0 |

**3.** (a) Calculate the value of the integral $\int_{4}^{5\cdot2} \log x \, dx$ by using (i) Simpson's $\frac{1}{3}$ rule, and (ii) Simpson's $\frac{3}{8}$ rule. (Take h = 0·2) *8*

(b) Solve the following system of linear equations by using Gauss elimination method : *7*

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

$$2x + 3y + 3z = 10$$

$$3x - y + 2z = 13$$

**4.** (a) Solve the following system of equations using Jacobi's iteration method, perform two iterations : *8*

$$8x + y + z = 8$$

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

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

(b) Solve the following system of equations by using Gauss-Seidel method, perform two iterations : *7*

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110$$

**5.** (a) Prove the following relations between $\Delta$, $\nabla$, E, $\delta$ and $\mu$ operators : *8*

(i) $\Delta = E - 1$

(ii) $\nabla = 1 - E^{-1}$

(iii) $\delta = E^{1/2} - E^{-1/2}$

(iv) $\mu = \frac{1}{2}[E^{1/2} + E^{-1/2}]$

(b) Given $\frac{dy}{dx} = x^3 + y$, $y(0) = 1$. Find $y(0{\cdot}3)$ by using Euler's method using $h = 0{\cdot}1$. *7*