[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7031 **K**

Unique Paper Code : 2352204701

Name of the Paper : Numerical Methods, DSC

Name of the Course : **Bachelor of Arts / Bachelor of Science (Programme)**

Semester : VII

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. All the **six** questions are compulsory. Attempt any **two** parts from each question.
3. Each question carries equal marks.
4. Use of Non-Programmable Scientific Calculator is allowed.

1. (a) Round-off the number 665221 correct to four significant digits and then calculate the absolute, relative and percentage errors.

   (b) Determine the number of significant digits in the following numbers :

   (i) 9354

   (ii) 0.00456

   (iii) 5.34500

   (iv) 1.0026

   (v) 1.5×10^5

(c) Perform three iterations of Bisection Method to obtain a root of the equation $x^3 - 3x^2 + 1 = 0$ in $]0,1[$.

2. (a) Use Regula-Falsi method to find root of $x^3 - 5\sin x + 1 = 0 = 0$ in $]0,1[$. Perform three iterations.

(b) By performing three iterations of Secant method to find approximate root of the equation $x^2 - 3 = 0$ in $]1,2[$, by taking $x_0 = 1$ and $x_1 = 2$.

(c) Perform three iterations of Newton Raphson's Method to obtain the approximate value of $(17)^{\frac{1}{3}}$ taking initial approximation $x_0 = 2$.

3. (a) Using Gauss Elimination method solve the following system of linear equations:

$$2x + 6y + 10z = 0$$

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

$$3x + 14y + 28z = -8$$

(b) Find the Lagrange interpolating polynomial which fits into the given data and approximate the value of f(3).

x	0	1	2	5
f(x)	2	3	12	147

(c) Starting with initial vector (x,y,z) = (0,0,0), perform three iterations of Gauss Jacobi

Method to solve the following system of equations :

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

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

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

4. (a) Starting with initial vector (x,y,z) = (0,0,0), perform three iterations of Gauss Seidel Method to solve the following system of equations :

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

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

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

(b) Find the unique polynomial P(x) of degree 3 or less using Newton's interpolating Formula for the following data :

x	–3	0	1	3
f(x)	–28	2	4	32

(c) Show that : $[E^{1/2} + E^{-1/2}](1+\Delta)^{1/2} = 2+\Delta$ (Note: Symbols have their own meaning)

5. (a) Use the formula

$$f'(x_0) \approx \frac{f(x_0)-f(x_0-h)}{h}$$ to approximate the derivative of f(x) = sin x at $x_0 = \pi$ taking h = 1, 0.1, 0.01.

(b) Use Simpson's rule to compute $I = \int_0^1 \frac{dx}{1+x}$, correct to three-decimal places with step-size, h = 0.25.

(c) Evaluate $I = \int_0^1 \sin \pi x \, dx$ using the trapezoidal rule with step-size h = 0.25.

6. (a) Use the central difference formula to compute $y'(1)$, $y''(1)$ for the data points

x	−1	1	2	3
f(x)	0.5	2	4	4

(b) Solve the initial value problem $u' = -2tu^2$, $u(0) = 1$ using the Euler's method with step-size, $h = 0.5$ over the interval $[0,1]$,

(c) Use Simpson's rule with $n = 4$ to compute

$$I = \int_0^1 \frac{x}{x^3 + 10} dx .$$