(c) Using Runge Kutta method of fourth order, find y(0.2) by taking h= 0.1 for the initial value problem $\frac{dy}{dx} = \frac{y-x}{y+x}$, given that y(0) = 1.

[This question paper contains 8 printed pages.]

Your Roll No...............

Sr. No. of Question Paper : 4307 **I**

Unique Paper Code : 2354000006

Name of the Paper : Numerical Methods (GE)

Name of the Course : **COMMON PROG GROUP**

Semester : V

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. Attempt all question by selecting two parts from each question.

3. Each question carry equal marks.

4. Use of non-programmable Scientific Calculator allowed.

1. (a) If X = 1.356, find the absolute error, relative error and percentage error when X is rounded-off to two decimal digits.

(b) Find the relative error and percentage error of the number 5.9, if both of its digits are correct.

(c) Determine the number of significant digits in the following numbers.

(i) 0.50694,

(ii) 4.00449,

(iii) 357900,

(iv) 0.0050430,

(v) 0.87×10^{-9}

x	1	1.5	2	2.5	3	3.5	4
$f(x)$	2	2.4	2.7	2.8	3	2.6	2.1

Using Trapezoidal's rule estimate the area bounded by the curve, *x-axis* and the lines $x = 1$, $x = 4$.

(c) Use Simpson's rule to prove that log 7 is approximately 1.9587 using $\int_1^7 \frac{1}{x}\, dx$.

6. (a) Using Euler's method, find an approximate value of y corresponding to $x = 1$ given that $\frac{dy}{dx} = x + y$ and $y = 1$ where $x = 0$.

(b) Using mid-point (Runge Kutta second order) method, solve the initial value problem $\frac{dy}{dx} = x^2 + y^2$ from x = 0 to x = 0.6 where y(0) = 1 by using $h = 0.2$.

(c) Starting with initial vector $(x, y, z) = (1, 1, 1)$ performs three iterations of Gauss Jacobi method to solve the following system of equations

5x-y + z = 10

2x+8y-z=11

-x+y+4z=3

5. (a) For the function $f(x) = logx$, approximate $f'(2)$ by using backward difference formula

$$f'(x_i) \approx \frac{3f(x_i) - 4f(x_i - h) + f(x_i - 2h)}{2h}$$

with h = 0.1 and 0.2

(b) A curve is drawn to pass through the points given by the following table:

2. (a) Perform five iterations of the Bisection method to obtain the smallest positive root of the equation $f(x) = x^3 + 2x - 2=0$, also write the order of convergence of Bisection Method.

(b) Using Regula-Falsi method compute the real root of the equation $x^2 = 6$, correct to four decimal places, also write the order of convergence of Regula-Falsi method.

(c) Using Newton-Raphson method, compute $\sqrt{13}$ correct to four decimal places, also write the order of convergence of Newton-Raphson method.

(d) Using Secant method find the smallest positive root of the equation $x^3 - 2x^2 = 2$ correct up to three decimal places, also write the order of convergence of Secant Method.

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

$2x+y+z=3$

$3x+2y+z=2$

$2x+y+2z=1$

(b) Show that

(i) $\mu=\sqrt{1+\frac{\delta^2}{4}}$

(ii) $\Delta=\frac{1}{2}\delta^2+\delta\sqrt{1+\frac{\delta^2}{4}}$.

(Note: Symbols have their own meaning)

(c) Given $f(0) = 1$, $f(1) = 3$, $f(3) = 55$. Find unique polynomial of degree 2 or less by using Lagrange interpolation to calculate approximate value of $f(2)$.

4. (a) Starting with initial vector (x, y, z) = (0.5, 0.5,0.5) perform three iterations of Gauss- Seidel method to solve the following system of equations

$4x+y+2z = 4$

$3x+4y+z = 7$

$x+2y+3z=3$

(b) Find the unique polynomial P(x) of degree 2 or less using Newton's interpolating formula for the following data

x	0	1	2	3
f(x)	0	1	0	-1

Also, estimate P(1.5).