Indian Institute of Information Technology Ranchi

Department of Mathematics

B. Tech End Semester Examination - Spring Semester 2022-23

Course Instructor: Prof. Tarni Mandal

Semester: 4th **Branch : CSE & CSE (DS&AI)**

Course Code: CS2004/CD-2008 **Course Name: Numerical Methods and Scientific Computing**

Duration: 3 Hrs. **QUESTION PAPER** **Maximum Marks: 100**

Instructions:

(1) Answer all the questions.
(2) Number in [ ] indicates marks.
(3) Scientific calculator is allowed in the examination.
(4) Any missing data can be assumed suitably.

1. (a) The following table gives the population of a town during the last six census. Estimate, using Newton's Interpolation formula, the increase in the population during the period 1946 to 1948. [10]

Year:	1911	1921	1931	1941	1951	1961
Population: (in thousand)	12	13	20	27	39	52

b) Given $\log_{10} 654 = 2.8156$, $\log_{10} 658 = 2.8182$, $\log_{10} 659 = 2.8189$, $\log_{10} 661 = 2.8202$, Find $\log_{10} 656$. [6]

2. (a) Using Gauss's Interpolation formula, obtain f (3.5) from the following table. [10]

x :	2	3	4	5
f(x) :	2.626	3.454	4.784	6.986

b) The Velocity V of a particle at a distance 's' from a point on its path is table: [6]
The speed of the train (V) in meters per second after t seconds is given by

t :	0	10	20	30	40	50	60
V :	47	58	64	65	61	52	38

Estimate the time taken to travel 60 feet by using Simpson's one-third rule.
Compare the result with Simpson's $\frac{3}{8}$ rule.

3 a) By applying the fourth order Runge- Kutta Method, find (0.2) from [10]
$\frac{dy}{dx} = y - x$ and $y = 2$, $x = 0$ taking $h = 0.1$

b) Find the root of the equation $\sin x = 1 + x^3$ between (-2,-1) to 3 decimal places by Newton's Raphson method. [10]

4 a) Using Improved Euler's method find y at $x = 0.1$ and $x = 0.2$ given $\frac{dy}{dx} = y - 2\frac{x}{y}$, $y(0) = 1$ [10]

b) Find the root between (2, 3) of $x^3 - 2x - 5 = 0$ by Regula Falsi Method. [6]

5. a) The system of equations are [10]
$2x + y - z = 6$, $x + y + 2z = 8$, $-x + 3y + 2z = 4$ using Iterative method improve the result $x = 2.8$, $y = 1$, $z = 1.8$

b) Solve the equations [6]
$2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$
by using Gauss Elimination Method.

6. a) Solve the following equation using Gauss- Jordan Method [10]
$2x_1 + 2x_2 - x_3 + x_4 = 4$, $4x_1 + 3x_2 - x_3 + 2x_4 = 6$,
$8x_1 + 5x_2 - 3x_3 + 4x_4 = 12$, $3x_1 + 3x_2 - 2x_3 + 2x_4 = 6$

b) Solve the following equation by Jacobi's iteration Method [6]
$20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$