BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH. **SEMESTER : I**
BRANCH: CIVIL ENGINEERING **SESSION : MO/2024**

SUBJECT: CE581 NUMERICAL METHODS AND COMPUTATIONAL TECHNIQUES

TIME: 3 Hours **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
***4*. Before attempting the question paper, be sure that you have got the correct question paper.**
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	Solve the following system of linear equations by Gauss Jacobi Method. $27x + 6y - z = 85$ $6x + 15y + 2z = 72$ $x + y + 54z = 110$	[5]	CO1	K3
Q.1(b)	Find the real root of the following equation by using Fixed Point Iteration Method. $x^3 + x - 1 = 0$	[5]	CO1	K3
Q.2(a)	Fit a second-degree parabola, $y = a + bx + cx^2$ for the following data by using the Method of Least Squares.	[5]	CO2	K3

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

Q.2(b)	Find the value of y, when x = 10 by using the Lagrange Interpolation Formula.	[5]	CO2	K3

x	5	6	9	11
y	12	13	14	16

Q.3(a)	What do you understand by Finite Difference Method? Discuss the concept of mesh and mesh points in Finite Difference Method.	[5]	CO3	K2
Q.3(b)	Compute the time taken to empty a cylindrical tank. The initial depth $h_0 = 5$ m. Assume $A : A_0$ as 987 : 1, where A = cross sectional area of the cylindrical tank and A_0 = cross sectional area of the orifice provided at the bottom of the tank Use the following Torricelli's formula to find the discharge through the orifice. $$Q = \sqrt{2gh}A_0$$ The discharge is also given by $$Q = -A\frac{dh}{dt}$$	[5]	CO3	K3
Q.4(a)	How do you find the finite difference scheme of a second order derivative?	[5]	CO4	K2
Q.4(b)	Differentiate between Explicit Method and Implicit Method of Finite Difference Scheme. Also comment on the stability of these two methods.	[5]	CO4	K2
Q.5(a)	Evaluate the following integral by using (i) Trapezoidal Rule, (ii) Simpson's 1/3 Rule, (iii) Simpson's 3/8th Rule. $$\int_0^6 \frac{dx}{1+x^2}$$	[5]	CO5	K3
Q.5(b)	Evaluate the following integral by using Gauss Legendre 2 Point and 3 Point Formula. $$\int_2^4 (x^2 + 2x)dx$$	[5]	CO5	K3

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