Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–IV EXAMINATION – SUMMER 2025

Subject Code:3140510 Date:15-05-2025

Subject Name:Numerical Methods in Chemical Engineering

Time:10:30 AM TO 01:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Explain False position method.	**03**
	(b)	Explain intermediate value property theorem.	**04**
	(c)	Find the relative error if the number X = 0.004997 is (i) truncated to three decimal digits (ii) rounded off to three decimal digits.	**07**
Q.2	**(a)**	Enlist various methods for solving linear algebraic equations.	**03**
	(b)	Explain various types of errors in computations.	**04**
	(c)	Find a root of the equation $x^3 - 4x - 9 = 0$, using the bisection method correct to three decimal places.	**07**
		OR	
	(c)	Find the root of the equation $xe^x = \cos x$, using the secant method correct to four decimal places.	**07**
Q.3	**(a)**	Explain Descarte's rule of sign with example.	**03**
	(b)	Find x_2 of $x^4 - x = 10$, correct to three decimal places, using the Newton-Raphson method, where $x_0 = 2$.	**04**
	(c)	Solve the following equations using Gauss-Jacobi's method. $27x + 6y - z = 85; x + y + 54z = 110; 6x + 15y + 2z = 72$	**07**
		OR	
Q.3	**(a)**	Enlist Limitations of Newton-Raphson's Method.	**03**
	(b)	Solve the following equations by the Gauss elimination method: $x + y + z = 9; 2x - 3y + 4z = 13; 3x + 4y + 5z = 40$	**04**
	(c)	Fit a curve of the form $y = ae^{bx}$, to the following data:	**07**

x:	0	1	2	3
y:	1.05	2.10	3.85	8.30

Q.4	**(a)**	Find the iterative formula for finding $\sqrt{N}$ where is N is real number, using Newton Raphson formula.			**03**
	(b)	Explain working procedure of method of least square.			**04**
	(c)	Find the missing values in the following data:			**07**

x:	45	50	55	60	65
y:	3.0	……	2.0	…..	-2.4

OR

Q.4	**(a)**	Write down normal equations to fit the straight line $y = a + bx$.			**03**
	(b)	Evaluate (i) $\Delta \tan^{-1} x$, (ii) $\Delta(e^x log 2x)$			**04**
	(c)	Find the cubic polynomial which takes the following values:			**07**

x:	0	1	2	3

y:	1	2	1	10

Hence evaluate $f(4)$.

Q.5 **(a)** Write an algorithm for Newton's Forward interpolation method. **03**

(b) Use the Trapezoidal rule to estimate the integral $\int_0^2 ex^2 dx$ taking the number 10 intervals. **04**

(c) Solve $y' = x + y,\ y(0) = 1$ by Taylor's series method. Hence find the values of y at $x = 0.1\ and\ x = 0.2$. **07**

OR

Q.5 **(a)** Write an algorithm for Trapezoidal Rule. **03**

(b) Discuss in brief about boundary problems. **04**

(c) Using Euler's method, find an approximate value of y corresponding to $x = 1$, given that $dy/dx = x + y\ and\ y = 1\ when\ x = 0$. **07**

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