Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - IV EXAMINATION - WINTER 2025

Subject Code: 3140510 **Date: 18-11-2025**

Subject Name: Numerical Methods in Chemical Engineering

Time: 02:30 PM TO 05:00 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)**	Differentiate between accuracy and precision with appropriate example.	**03**
	(b)	Describe different types of errors.	**04**
	(c)	Find the absolute error and relative error in $\sqrt{6}+\sqrt{7}+\sqrt{8}$ correct to 4 significant digits.	**07**
Q.2	**(a)**	Describe intermediate value properties.	**03**
	(b)	The area of cross-section of a rod is desired up to 0.2% error. How accurately should the diameter be measured?	**04**
	(c)	Use the method of false position, to find the fourth root of 32 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 Gauss elimination method with its pitfalls.	**03**
	(b)	Using Descartes rule of sign find maximum number of positive and negative roots of the following equation. $f(x) = 2x^7 - x^5 + 4x^3 - 5$	**04**
	(c)	Apply Gauss elimination method to solve the equations $x + 4y - z = -5$; $x + y - 6z = -12$; $3x - y - z = 4$.	**07**
		OR	
	(a)	Define Eigen values and Eigen vectors.	**03**
	(b)	Find the eigenvalues and eigenvectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$	**04**
	(c)	Solve, by Jacobi's iteration method, the equations $20x + y - 2z = 17$; $3x + 20y - z = -18$; $2x - 3y + 20z = 25$	**07**

Q.4 **(a)** Explain working procedure of method of least square. **03**

(b) Write normal equations to fit a straight line ($y=a_0+a_1x$) with the least square method. **04**

(c) Find the least squares fit of the form $y = a_0 + a_1x^2$ to the following data **07**

x	-1	0	1	2
y	2	5	3	0

OR

(a) Establish Newton's backward interpolation formula. **03**

(b) Fit a straight line to the following data: **04**

x	6	7	7	8	8	8	9	9	10
y	5	5	4	5	4	3	4	3	3

(c) Find the missing term in the following table using interpolation: **07**

x	0	1	2	3	4
y	1	3	9	...	81

Q.5 **(a)** State the formulas for Trapezoidal Rule, Simpsons $1/3^{rd}$ rule, Simpsons $3/8^{th}$ rule. **03**

(b) Find the cubic polynomial which takes the following values: **04**

x	0	1	2	3
f(x)	1	2	1	10

(c) Compute the value of $\int_{0.2}^{1.4}(sinx - logx + e^x)dx$ using Simpson's 3/8 rule. **07**

OR

(a) Find by Taylor's series method, the values of y at x = 0.1 and x = 0.2 to five places of decimals from $dy/dx = x^2y - 1$, $y(0) = 1$. **03**

(b) Using the modified Euler's method, find y(0.2) given $y' = y + e^x$, $y(0)=0$ **04**

(c) Apply the Runge-Kutta fourth order method to find an approximate value of y when x = 0.2 given that $dy/dx = x + y$ and $y = 1$ when $x = 0$. **07**

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