Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - III EXAMINATION - WINTER 2025

Subject Code: BE03005041 **Date: 22-12-2025**

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 following terms: 1) Significant figures, 2) Truncation Error.	**03**
	(b)	Explain sources of arising errors in numerical computation.	**04**
	(c)	Round off the numbers 865250 and 37.46235 to four significant figures and compute E_a, E_r, E_p in each case.	**07**
Q.2	**(a)**	Describe intermediate value properties theorem.	**03**
	(b)	Find a root of the equation $x^3 - x - 1 = 0$, using the bisection method correct to three decimal places.	**04**
	(c)	Find by Newton's method, the real root of the equation $3x = cosx + 1$,correct to four decimal places.	**07**
		OR	
	(c)	Find the root of the equation $xe^x = cosx$ using the secant method correct to four decimal places.	**07**
Q.3	**(a)**	Explain the Gauss Jordan method to solve the system of linear equations.	**03**
	(b)	Apply Gauss elimination method to solve the equations: $x + 4y - z = -5; x + y - 6z = -12; 3x - y - z = 4$	**04**
	(c)	Apply the Gauss-Seidal iteration method to solve the equations. $20x + y - 2z = 17; 3x + 20y - z = -18; 2x - 3y + 20z = 25$	**07**
		OR	
	(a)	Explain 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 correct to two decimal places. **07**
$10x + y - z = 11.19; x + 10y + z = 28.08; -x + y + 10z = 35.61$

Q.4 **(a)** Write down normal equations to fit the straight line y=a+bx. **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 is the table: **07**

x	2	3	4	5	6
y	45.0	49.2	54.1	....	67.4

OR

(a) Establish the following identities: **03**
(1) $\Delta = E - 1$
(2) $\Delta = 1 - E^{-1}$

(b) From the following table, estimate the number of students who obtained marks between 40 and 45: **04**

Marks:	30-40	40-50	50-60	60-70	70-80
No. of Students:	31	42	51	35	31

(c) Find the distance moved by a particle and its acceleration at the end of 4 seconds, if the time verses velocity data is as follows: **07**

t	0	1	3	4
v	21	15	12	10

Q.5 **(a)** Write the formula of Simpson's one-third rule. **03**

(b) Use the Trapezoidal rule to estimate the integral $\int_0^2 e^{x^2} dx$ taking 10 intervals **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**

OR

(a) Describe Milne's predictor-corrector method. **03**

(b) 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. **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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