GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – WINTER 2023

Subject Code:3140510   **Date:19-01-2024**

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)**	Enlist various methods for solving linear algebraic equations.	**03**
	(b)	Explain intermediate value property theorem.	**04**
	(c)	Round off the numbers 658740 and 67.36584 to four significant figures and compute Ea, Er, Ep in each case.	**07**
Q.2	**(a)**	Explain error propagation in addition and subtraction operation.	**03**
	(b)	Define Inherent, Rounding off and Truncation error.	**04**
	(c)	Find a root of the equation $x^3 - 2x - 5 = 0$, using the method of false position 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)	Explain iterative method to improve accuracy of an ill conditioned equation.	**04**
	(c)	Find the eigen-values and eigenvectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$.	**07**

OR

Q.3	**(a)**	Write short note on iterative methods.	**03**
	(b)	Define Eigen values and Eigen vectors.	**04**
	(c)	Using the Gauss elimination method, solve the equations: $x + 2y + 3z - u = 10; 2x + 3y - 3z - u = 1;$ $2x - y + 2z + 3u = 7; 3x + 2y - 4z + 3u = 2$	**07**
Q.4	**(a)**	Write an algorithm for Newton-Raphson method.	**03**
	(b)	Define curve fitting. What is meant by the curve of best fit?	**04**
	(c)	Solve, by Jacobi's iteration method, the equations $20x + y - 2z = 17; 3x + 20y - z = -18; 2x - 3y + 20z = 25$	**07**

OR

Q.4	**(a)**	Write an algorithm for Newton's forward interpolation formula.	**03**
	(b)	Find the missing term is the table:	**04**

x:	2	3	4	5	6
y:	45.0	49.2	54.1	?	67.4

	(c)	Find the polynomial f (x) by using Lagrange's formula and hence find f(3) for	**07**

x	0	1	2	5
f(x)	2	3	12	147

Q.5 **(a)** Write an algorithm for trapezoidal rule. **03**

(b) Use Simpson's 1/3rd rule to find $\int_0^{0.6} e^{-x^2} \, dx$ by taking seven ordinates. **04**

(c) Find the least squares fit of the form $y = a_0 + a_1 x^2$ to the following data **07**

x:	-1	0	1	2
y:	2	5	3	0

OR

Q.5 **(a)** Write an algorithm of Simpson's 3/8 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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