Enrollment No./Seat No.:

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering - SEMESTER - VIII EXAMINATION - WINTER 2025

Subject Code: 2180503 **Date: 13-11-2025**

Subject Name: Process Modeling, Simulation & Optimization

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)**	Explain physical vs mathematical modeling.	**03**
	(b)	Write in brief on uses and scope of mathematical models.	**04**
	(c)	Find extreme points of $f(x_1,x_2) = x_1^3 + x_2^3 + 2x_1^2 + 4x_2^2 + 6$.	**07**
Q.2	**(a)**	Define deterministic and stochastic processes.	**03**
	(b)	Explain fundamental laws used in modeling.	**04**
	(c)	Derive model of batch reactor for first order series reaction $A \rightarrow B \rightarrow C$	**07**
		OR	
	(c)	Derive mathematical model of an isothermal CSTR with constant holdup	**07**
Q.3	**(a)**	Define feasible solution, feasible region, and optimum solution.	**03**
	(b)	Explain the geometry of linear programs.	**04**
	(c)	Fit the exponential curve the following data using Least Square method:	**07**

y	2	4	6	8
x	25	38	56	84

		OR	
	(a)	Explain partitioning with example.	**03**
	(b)	Explain the algorithm of steepest descent method for unconstrained multivariable optimization problem.	**04**
	(c)	Explain fitting of VLE data by non linear regression	**07**
Q.4	**(a)**	Distinguish between sequential & simultaneous modular approaches.	**03**
	(b)	Differentiate between Black box model, grey box model and white box model with proper example	**04**
	(c)	It is required to design a close-topped rectangular tank whose total area is to be 110 m^2 . If a maximum volume is required then formulate the problem.	**07**

OR

	(a)	Explain advantages of working with modern process simulators.	**03**
	(b)	Explain Simplex algorithm for linear programming.	**04**
	(c)	Minimize the quadratic function: $f(x) = x^2 - x$ using quasi-newton method with initial guess x=3	**07**
Q.5	**(a)**	Give essential features of optimization problems.	**03**
	(b)	Explain algorithm of Golden section method.	**04**
	(c)	Explain the steps for finding the optimum L/D ratio for a pressurized cylindrical storage vessel. List all the variables and the important assumptions.	**07**

OR

	(a)	Discuss general procedure for solving optimization problems.	**03**
	(b)	Differentiate steady state and dynamic simulators and give examples of each.	**04**
	(c)	What is Optimization? List the six general steps for the analysis and solution of optimization problems	**07**

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