Seat No.: _____ **Enrolment No._____**

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII (NEW) - EXAMINATION – SUMMER 2018

Subject Code: 2180503 Date: 07/05/2018

Subject Name: Process Modeling, Simulation & Optimization

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.**

			MARKS
Q.1	**(a)**	List the various professional simulators and equation solver software.	**03**
	(b)	Find out stationary points using Lagrange Multiplier method for following function : Minimize $f(x)= 4x_1^2 + 5x_2^2$ Subject to $h(x) = 2x_1 + 3x_2 – 6 =0$	**04**
	(c)	Discuss the six steps used to solve optimization problems.	**07**
Q.2	**(a)**	Write the various equations of motion for process modeling.	**03**
	(b)	Describe briefly the fundamental laws used in mathematical models of chemical engineering systems.	**04**
	(c)	Explain: partitioning, tearing, Sequential modular approach, simultaneous modular approach.	**07**
		OR	
	(c)	Explain the features of Basic Tearing Algorithm.	**07**
Q.3	**(a)**	Compare lumped parameter model and distributed parameter model.	**03**
	(b)	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.	**04**
	(c)	Define mathematical modeling and give detail classification of mathematical modeling.	**07**
		OR	
Q.3	**(a)**	Compare linear model and non linear model.	**03**
	(b)	A child's rectangular play yard is to be built next to the house. To make the three sides of the play yard, 24 feet of fencing are available. Formulate the problem to maximize the area of play yard.	**04**
	(c)	Explain: black-box model, white box model, gray model.	**07**
Q.4	**(a)**	Determine the Hessian matrix of the function $f(x) = 2x_1^2 – 3x_1x_2 + 2x_2^2$	**03**
	(b)	Explain the necessary and sufficient conditions for an extremum of an unconstrained function.	**04**
	(c)	Explain mathematical modeling of non-isothermal CSTR.	**07**
		OR	
Q.4	**(a)**	Define : feasible region, global minimum, convex region	**03**
	(b)	Construct the region given by the following inequality constraints and determine its convexity. $x_1 \leq 6$; $x_2 \leq 6$; $x_1+x_2 \leq 6$; $x_1 \geq 0$, $x_2 \geq 0$	**04**
	(c)	Explain mathematical modeling of ideal binary distillation column.	**07**

Q.5	**(a)**	Classify the methods for unconstrained multivariable optimization problems.	**03**
	(b)	List the applications of optimization in chemical engineering.	**04**
	(c)	Minimize $f(x) = x^4 - x + 1$ using Newton's method. Take any suitable initial guess. Show at least 4 iterations.	**07**

OR

Q.5	**(a)**	Explain the penalty methods for solving nonlinear programming with constraints.	**03**
	(b)	Explain Simplex algorithm for linear programming.	**04**
	(c)	Discuss the optimizing recovery of waster heat with suitable figure and equations.	**07**

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