Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2711608 **Date: 31/12/2015**

Subject Name: Chemical System Modeling & Simulation

Time:2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Discuss classification of modeling. Enlist steps of formulation of a Chemical Engg. Model.	**07**
	(b)	Develop equation of continuity from Lagrangian point of view.	**07**
Q.2	**(a)**	Develop a mathematical model for temperature profile on a rectangular fin with usual notations.	**07**
	(b)	Formulate a model for temperature profile along tubular gas preheater. Assume flat velocity profile and heat transfer coefficient along the tube is given by $h=cx^{0.5}$ where 'x' is distance from tube inlet and 'c' is a constant. Also solve the model with appropriate method.	**07**
		OR	
	(b)	Develop temperature profile model for a Fixed bed catalytic reactor enlisting all assumption made for deriving the model.	**07**
Q.3	**(a)**	For consecutive reversible reactions in series $A \leftrightarrow B$ and $B \leftrightarrow C$ Derive relation for rate of disappearance of A, Number of moles of A and various rate constants	**07**
	(b)	Derive Kremser-Brown equation with usual notations for a continuous solvent extraction by 'N' stages at steady state.	**07**
		OR	
Q.3	**(a)**	For an unsteady state single stage solvent extraction, derive relation for fraction extracted with usual notations.	**07**
	(b)	Develop relation for momentum flux and velocity distribution for a laminar flow of Newtonian fluid in a narrow slit.	**07**
Q.4	**(a)**	Define & Explain: Signal flow graph, Successor digit	**07**
	(b)	With a neat flow chart explain Murthy & Hussain –I algorithm	**07**
		OR	
Q.4	**(a)**	Discuss sequential modular approach. List general purpose sequential modular program structured components	**07**
	(b)	A chemical process is represented by following set of equations $f_1(x_3, x_4) = 0$; $f_2(x_5, x_2) = 0$; $f_3(x_6) = 0$; $f_4(x_6, x_1) = 0$; $f_5(x_3, x_2) = 0$; $f_6(x_4, x_5, x_1) = 0$ Determine Associated incidence matrix, digraph of the process and associated adjacency matrix	**07**

Q.5 **(a)** Discuss about databanks related to Physical and thermodynamic properties. **07**

(b) Write in brief about features of Basic tearing algorithm. **07**

OR

Q.5 **(a)** Write in brief about simulation software FLUENT **07**

(b) Using Kehat and Shacham algorithm for decomposition of network, find out the streams that are to be teared (i.e. cut- set) for a process having following details. **07**

Nodes	**Input**	**Output**
(1)	2	1, 3
(2)	6, 8	7
(3)	1, 5	4
(4)	7	5, 8
(5)	4, 3	2, 6

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