Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2014

Subject code: 1721606 Date: 23-06-2014

Subject Name: Chemical System Modeling and Simulation

Time: 02:30 pm - 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. **All notations have conventional meaning.**

Q.1 **(a)** Define a Model. Give classification of modeling. Enlist steps of formulation of Chemical Engineering Model. **07**

(b) For an unsteady state single stage solvent extraction, derive relation for fraction extracted with usual notations. **07**

Q.2 **(a)** N_0 gm of solid material was placed in W gm of water at time t_0. The liquid was continuously stirred and maintained at constant temperature. At the end of very long period of time N_f gm of solid remains undissolved which can assumed as zero. The original solid consisted of S spheres each of initial diameter D_0. Obtain variation of diameter of solid as function of time. **07**

(b) Using method of least squares find a straight line that fits the following data **07**

x	1	2	3	4	5
y	14	27	40	55	68

OR

(b) Formulate a model for concentration profile for fixed bed catalytic reactor with usual notations. **07**

Q.3 **(a)** For a jacketed kettle heated through surface by condensing steam, develop a model for variation of temperature with time. **07**

(b) Formulate a model for temperature profile on a rectangular fin with usual notations listing all assumptions made. **07**

OR

Q.3 **(a)** For consecutive reversible reactions in series **07**

$A \acute{z} B$ and $B \acute{z} C$

Derive relation for rate of disappearance of A, Number of moles of A and various rate constants

(b) Compute the fraction of solute that can be extracted in counter current solvent extraction at steady state with N stages (for values of N from 1 to 30) using the same numerical values of S=12R, m=1/8 and c=0.1 kg/m^3, which are used for single stage extraction, compare and comment the results **07**

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 $f_1(x_1, x_4) = 0$; $f_2(x_2, x_3) = 0$; $f_3(x_5) = 0$; $f_4(x_5, x_6) = 0$; $f_5(x_1, x_2) = 0$; $f_6(x_3, x_4, x_6) = 0$ Determine Associated incidence matrix, digraph of the process and associated adjacency matrix	**07**
		OR	
Q.4	**(a)**	Write briefly about Path tracing method (PTM).	**07**
	(b)	Compare various tearing algorithms in tabular form	**07**
Q.5	**(a)**	Describe Barkley and Motard algorithm in detail.	**07**
	(b)	Write a brief note of Professional simulation package ñChemcadò.	**07**
		OR	
Q.5	**(a)**	Discuss modularity and routing for prediction of VLE data	**07**
	(b)	With neat flow chart discuss Kehat and Shacham algorithm	**07**

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