

**GUJARAT TECHNOLOGICAL UNIVERSITY****M.E Sem-II Examination July 2010****Subject code: 721606****Subject Name: Chemical System Modeling & Simulation****Date: 08 /07 /2010****Time: 11.00am – 1.30pm****Total Marks: 60****Instructions:**

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

- Q.1** (a) Derive continuity equation from eulerian point of view **06**  
(b) Define: Independent variable, Dependent variables, Parameters **06**

- Q.2** (a) For continuous solvent extraction by 'N' stages at steady state, derive **06**  
equation for fraction extracted  
(b) Develop temperature profile on longitudinal triangular fin with usual **06**  
notations. Suggest suitable solution for the derived model

**OR**

- (b) Derive concentration profile model equation for a fixed bed catalytic **06**  
reactor for non isothermal system. List all assumptions made.

- Q.3** (a) A tank contains certain volume of fresh water, a stream of brine containing **06**  
2 gm/lit of salt is fed into the tank at a rate of 3 lit/min. Liquid flows out  
from tank at a rate of 2 lit/min. If the tank is well agitated and salt  
concentration in tank attains a value which is half of inlet brine  
concentration in 10 minutes. Find out initial volume of fresh water in the  
tank  
(b) For a consecutive reversible reaction at constant volume **06**  
 $A \rightleftharpoons B$   
 $B \rightleftharpoons C$

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

**OR**

- Q.3** (a) Discuss with block diagram stages in development of a complete **06**  
mathematical model for a chemical process  
(b)  $N_o$  gm of a solid material was placed in W gm of water at time  $t=0$ . The **06**  
liquid was continuously stirred and maintained at constant temperature. At  
the end of very long time  $N_f$  gm of solid remains undissolved which can be  
taken as zero for practical purpose. The solid consisted of S sphere each of  
initial diameter  $D_o$  mt. Obtain variation of diameter of solid as function of  
time.

- Q.4** (a) For modular approach to process simulation, discuss sequential modular **06**  
approach in detail.

- (b) A chemical process is represented by following set of equations **06**

$$f_1(x_3, x_4) = 0; f_2(x_5, x_2) = 0; f_3(x_6) = 0;$$

$$f_4(x_6, x_1) = 0; f_5(x_3, x_2) = 0; f_6(x_4, x_5, x_1) = 0$$

Determine Associated incidence matrix, digraph of the process and associated adjacency matrix

**OR**

- Q.4 (a)** Write briefly on Sparse system **06**

- (b) Using method of least squares fit a parabola of the form of  $Y = a + bX + cX^2$  to the following data **06**

X	1.0	1.5	2.0	2.5	3.0	3.5	4.0
Y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

- Q.5 (a)** With a neat flow chart explain Kehat and Shacham algorithm **06**

- (b) Define & Explain: Signal flow graph, Successor digit **06**

**OR**

- Q.5 (a)** With a neat flow chart explain Murthy & Hussain –I algorithm **06**

- (b) List various professional simulation packages available and explain features of any one briefly **06**

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