

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. Sem. – IInd - Examination – June/July- 2011****Subject code: 1721606****Subject Name: Chemical System Modeling & Simulation****Date: 29/06/2011****Time: 10:30 am – 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.

- Q.1** (a) Develop a temperature profile model for fixed bed catalytic reactor. List all assumptions made. **07**
- (b) Pipes are joined by pair of flanges of thickness 't', neglecting heat loss through edges formulate model for temperature profile over flange surface and also solve the model. **07**

- Q.2** (a) For a laminar flow of Newtonian fluid in a narrow slit formed by two parallel walls at a distance 2B apart, derive equation for velocity profile **07**
- (b) Develop equation of continuity from eulerian point of view **07**

OR

- (b) Develop equation of continuity from Lagrangian point of view. **07**

- Q.3** A still is purifying benzene and toluene from a small amount of essentially non volatile impurity and is initially charged with 20 kg mole of feed stock of composition $X_F = 0.32$ mole fraction of benzene. Feed is supplied at the rate of 10 kg mole/hr and the heat input is adjusted so that the total moles of liquid in the still remains at 20. Estimate the time required for composition of over head product to fall to 0.4 mole fraction of benzene. No liquid stock is removed from the still during this period. Assume relative volatility $\alpha = 2.36$ **14**

OR

- Q.3** (a) Derive Kemser-Brown equation with usual notations for a continuous solvent extraction by 'N' stages at steady state. **07**
- (b) A tank contains 20 m³ of water. A stream of brine containing 2 kg/m³ of salt is fed into tank at a rate of 8.25×10^{-4} m³/sec. Liquid flows out from the tank at a rate of 5.5×10^{-4} m³/sec. If the tank is well agitated, what is concentration of salt in the tank when the tank contains 36 m³ of brine. **07**

- Q.4** (a) Discuss with steps Barkley and Motard algorithm. **07**
- (b) A chemical process is represented by the following set of equation **07**
- $$X_1 X_4 + (X_6^2 / X_4) - 4 = 0$$
- $$X_2 X_5 + 3X_6 = 0$$
- $$X_1 / X_2 + \ln (X_3 / X_4) - 2 = 0$$
- $$X_3^3 + (2X_3^2 / X_4) - 2X_3 = 0$$
- $$X_2 + X_4 - 3 = 0$$
- $$X_3(X_3 + X_6) - 7 = 0$$
- Precedence order these equations using SWS algorithm along with Steward and Rudd algorithm.

OR

- Q.4** (a) Compare Sequential approach and simultaneous approach used for process plant simulation **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

- Q.5** (a) Write a brief note on Professional simulation package HYSIS **07**
- (b) Discuss about Sources and Databanks related to Physical and thermodynamic properties. **07**

OR

- Q.5** (a) With the aid of Newton's method discuss convergence promotion. **07**
- (b) Write in brief about simulation software FLUENT **07**
