Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY M. E. - SEMESTER - I • EXAMINATION - WINTER • 2014

Date: 06-01-2015 **Subject Code: 2711608** 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.
- Q.1 (a) For a jacketed kettle heated through surface by condensing steam, develop an 07equation for variation of temperature with usual notations
 - (b) Explain with examples: Boundary conditions, Initial conditions and Parameters 07
- Q.2 (a) W kg/h of fluid having density, specific heat C_p is being cooled in two stages 07 counter current cooler. Hot fluid at temperature T₀ is fed to tank No. 1 having cooling coil and stirrer. The continuous overflow from tank No. 1 at temperature T_{1S} is fed to tank No. 2 where it further cools to T₂₈ temperature. Cooling water flows counter currently. Both tanks are identical. If the cooling water is suddenly stopped due to failure of pump. Find the chronological temperature rise of exit fluid from tank No. 2 i. e T_2 with time hr.
 - (b) Develop temperature profile model on longitudinal triangular fin. List all 07 assumptions made and also suggest suitable method for solving the model

OR

- (b) For a laminar flow of Newtonian fluid in a narrow slit formed by two parallel 07 walls at a distance 2B apart, develop relation for momentum flux and velocity distribution with usual notations.
- Q.3 A still is purifying benzene and toluene from a small amount of essentially 14 nonvolatile 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 overhead product to fall to 0.4 mole fraction of benzene. No liquid stock is removed from the still during this period. Assume relative volatility = 2.4

OR

- A tank contains 30 m³ of water. A stream of brine containing 3 kg/m³ of salt 07 Q.3 (a) is fed into the tank at a rate of 9.25 x 10^{-4} m³/s. Liquid flows out from tank at a rate of 6.5 x 10^{-4} m³/s. If the tank is well agitated, what is concentration of salt in tank when the tank contains 40 m³ of brine?
 - **(b)** Formulate temperature profile model for a Fixed bed catalytic reactor. List all 07 assumption made for deriving the model.
- 07 **Q.4** Compare simultaneous modular approach with sequential modular approach. (a) 07
 - (b) With neat flow chart discuss Kehat and Shacham algorithm.

OR

Q.4 (a) In case of Murthy and HussainóII algorithm, discuss various innovation 07 applied for decomposition of networks also state under which circumstances, these innovations are applied.

1

(b) A chemical process is represented by the following set of equation X₁ X₄ + (X₆²/X₄) 6 4 = 0 X₂ X₅ + 3X₆ = 0 X₁/X₂ + 1n (X₃/X₄) 6 2 = 0 X₁/X₂ + ln (X₃/X₄) 6 2X₃ = 0 X₂ + X₄ - 3 = 0 X₃(X₃ + X₆) 6 7 = 0 Precedence order these equations using SWS algorithm along with Steward and Rudd algorithm.
Q.5 (a) Discuss and compare various tearing algorithms in detail
(b) Write briefly on Sparse system

	(b)	Write briefly on Sparse system	07
		OR	
Q.5	(a)	With the aid of Newtonøs method discuss convergence promotion.	07
	(b)	Write in brief about simulation software HYSIS	07

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