GUJARAT TECHNOLOGICAL UNIVERSITY
BE SEMESTER–VIII(OLD) • EXAMINATION – WINTER 2017

Subject Code: 180506   Date:15/11/2017
Subject Name: Chemical System Modeling
Time:02.30 PM TO 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)	Derive concentration profile model for a fixed bed catalytic reactor. With usual notation enumerate all assumption clearly. Note: Develop concentration profile equation for non-isothermal System.	07
	(b)	Derive temperature profile model for a fixed bed catalytic reactor. With usual notation enumerate all assumption clearly. Note: Develop temperature profile for adiabatic operation.	07
Q.2	(a)	Derive the Continuity equation.	07
	(b)	Discuss about Model Development Procesure & Deterministic Versus Stochastic Process.	07
		OR	
	(b)	What are the various model formulation principles?	07
Q.3	(a)	What is modeling? Classify it based on different category and group of models.	07
	(b)	Calculate the fraction of solute that could be extracted in a single stage solvent extraction using numerical values of S=10R, m=1/8 and c=0.15kg/m3. Derive the relation used.	07
		OR	
Q.3	(a)	List Steps for formulation of a mathematical model. List types of Boundary conditions.	07
	(b)	For a continuous solvent extraction by 'N' Stages at steady state, derive Kremsor Brown equation.	07
Q.4	(a)	Derive model for Counter current Cooling of Tanks.	07
	(b)	Develop a model for temperature profile along a tabular gas pre-heater when gas of temperature of T_o ^0C is heated through a pipe held at temperature T_w ^0C. Assume feat velocity profile and heat transfer coefficient along the flux is given by $$h = c\sqrt{x}$$ When x is distance from tube inlet and c is a constant. Also solve model assuming axial condition to be negligible.	07

OR

Q.4 **(a)** Derive model for Temperature Distribution in a Transverse Cooling fin of Triangular Cross-Section. **07**

Q.4 **(b)** 1000 kg/hr of fluid having density 850 kg/m^3 and specific heat Cp=0.9 k-cal/kg ^{0}C is being cooled by two identical tanks through counter current cooling system. If the pump of cooling water trips at time θ=0. Find exit fluid temperature from tank No. 2 after 100 min. using following data: **07**
Tank volume =700 liters each.
Exit temperature of fluid tank No.1=115 ^{0}C
Exit temperature of fluid tank No.2=70 ^{0}C
Inlet temperature of hot fluid =205 ^{0}C

Q.5 **(a)** Pipes are joined by pair of flanges of thickness 't' neglecting heat loss through edges, formulate model for temperature profile over flange surface and solve the model. **07**
(b) Develop a model of Laminar flow in a narrow slit. **07**

OR

Q.5 **(a)** Discuss about Physical modeling and Mathematical Modeling. Discuss merits and demerits of both. **07**
(b) Define: independent variable, dependent variable, parameters. **07**

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