Seat No.: _____ Enrolment No. _____

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. **07**
Note: Develop concentration profile equation for non-isothermal System.

(b) Derive temperature profile model for a fixed bed catalytic reactor. With usual notation enumerate all assumption clearly. **07**
Note: Develop temperature profile for adiabatic operation.

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 ^{0}C is heated through a pipe held at temperature T_w ^{0}C. **07**
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.

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: 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	**07**
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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