Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VIII • EXAMINATION – SUMMER 2013

Subject Code: 180506 **Date: 09/05/2013**

Subject Name: Chemical System Modeling (Department Elective-II)

Time: 10:30 am TO 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)**	Derive the equation of continuity.	**07**
	(b)	Explain & Define: Independent variables, Dependent variables, Parameters, boundary conditions.	**07**
Q.2	**(a)**	Define modeling. Explain the procedure for model development.	**07**
	(b)	Discuss in detail Classification of mathematical modeling.	**07**
		OR	
	(b)	Discuss with block diagram stages in development of a complete mathematical model for a chemical process.	**07**
Q.3	**(a)**	For continuous solvent extraction by óNô stages at steady state, derive equation for fraction extracted.	**07**
	(b)	Derive concentration profile model equation for a fixed bed catalytic reactor for non isothermal system. List all assumption made.	**07**
		OR	
Q.3	**(a)**	Calculate the fraction of solute that could be extracted in a single stage solvent extraction using numerical. Values of S=10R, m=1/8 & c=0.15 kg/m^3. Derive the relation used.	**07**
	(b)	Derive temperature profile model equation for a fixed bed catalytic reactor for adiabatic operation. List all assumption made.	**07**
Q.4	**(a)**	Derive dimensionless temperature profile for a Transverse Cooling fin of Triangular Cross Section.	**07**
	(b)	Derive model for counter current cooling of tanks.	**07**
		OR	
Q.4	**(a)**	Explain : Physical Modeling & Mathematical Modeling.	**07**
	(b)	500 kg/hr of fluid having density 0.9 kg/lit & Cp= 1 kcal/ kg ^{o}c is being cooled by 2 identical tanks through counter current cooling water. If the pump of cooling water trips at time 0 mints find exit temp form tank no. 2 after 90 mints. The other relevant data is listed below: V= 800 lit T_{1s}= exit temp. of tank 1= 120 ^{o}c T_{2s}= exit temp. of tank 2= 70 ^{o}c T_o= inlet temp = 200 ^{o}c	**07**
Q.5	**(a)**	Derive model for Unsteady-state heat Transfer in a Tubular Gas Pre heater.	**07**
	(b)	Estimate the temp. at radious 50 mm for the following data. Outside diameter of pipe:=80 mm Outside radious of flange= 200 mm Thickness of flange= 30 mm Thermal conductivity= 85 kcal/hr m ^{0}c H.T.C. of air= 30 kcal/ hr m^2 ^{0}c Air temp.= 35 ^{0}c	**07**

Pipe temp= 225 ^{0}c

Also estimate heat loss over the flange.

OR

Q.5	**(a)**	For a laminar flow of Newtonian fluid in a narrow slit formed by two parallel walls at a distance 2B apart. Obtain following: (i) Momentum flux and velocity distribution equation. (ii) ratio of average velocity to maximum velocity for the flow.	**07**
	(b)	Derive model for heat loss through pipe flanges.	**07**

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