Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2711608 **Date: 16/05/2016**

Subject Name: Chemical System Modeling & Simulation

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.**
4. **All notations have conventional meaning**

Q.1 **(a)** Derive Kemser-Brown equation with usual notations for a continuous solvent extraction by 'N' stages at steady state. **07**

(b) Explain with examples: Boundary conditions, Initial conditions and Parameters **07**

Q.2 **(a)** Develop concentration profile model for a Fixed bed catalytic reactor enlisting all assumption made for deriving the model. **07**

(b) N_0 gm of solid material was placed in W gm of water at time t_0. The liquid was continuously stirred and maintained at constant temperature. At the end of very long period of time N_f gm of solid remains undissolved which can assumed as zero. The original solid consisted of S spheres each of initial diameter D_0. Obtain variation of diameter of solid as function of time. **07**

OR

(b) In some determination of the value 'v' of carbon dioxide dissolved in a given volume of water at different temperature 'θ' the following pairs of values are obtained **07**

θ	0	5	10	15
v	1.8	1.45	1.18	1.00

Obtain by method of least squares a relation of the form $v = a + b\,\theta$ which best fits to these observations

Q.3 **(a)** W kg/h of fluid having density ρ, specific heat C_p is being cooled in two stages counter current cooler. Hot fluid at temperature T_0 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 T_{2S} 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 θ hr. **07**

(b) Develop relation for momentum flux and velocity distribution for a laminar flow of Newtonian fluid in a narrow slit. **07**

OR

Q.3 **(a)** Formulate a model for temperature profile on a rectangular fin with usual notations listing all assumptions made. **07**

(b) A tank contains 30 m^3 of water. A stream of brine containing 3 kg/ m^3 of salt is fed into the tank at a rate of 9.25 x 10^{-4} m^3/s. Liquid flows out from tank at a rate of 6.5 x 10^{-4} m^3/s. If the tank is well agitated, what is concentration of salt in tank when the tank contains 40 m^3 of brine? **07**

Q.4 **(a)** With neat flow chart discuss Kehat and Shacham algorithm **07**

(b) Write briefly about Path tracing method (PTM). **07**

OR

Q.4 **(a)** Compare simultaneous modular approach with sequential modular approach. **07**

	(b)	In case of Murthy and Hussain–II algorithm, discuss various innovation applied for decomposition of networks also state under which circumstances, these innovations are applied.	**07**
Q.5	**(a)**	Compare various tearing algorithms in tabular form	**07**
	(b)	Using Newton's method, solve equation $x^3 - 4x^2 + 6x - 5 = 0$, with an initial guess of x =4.	**07**

OR

Q.5	**(a)**	Write briefly on Sparse system	**07**
	(b)	Discuss features, applications and limitations for any one professional simulation package.	**07**

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