VII SEMESTER B.TECH (CHEMICAL ENGG.)
END SEMESTER EXAMINATIONS, NOV/DEC 2015
SUBJECT: PROCESS MODELLING AND SIMULATION (CHE -403)
REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 100

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitably assumed.
- Draw IFD wherever necessary.

1A.	The fluid is flowing along the inclined flat plate which is at angle β from the vertical. The film thickness over the plate is δ and the fluid is moving with velocity V. Develop an equation for velocity distribution. State all the assumptions.	**10**
1B.	An agitated $2m^3$ tank is initially filled with water at 25 ^oC. A steam coil with an area of 0.5 m^2 heats the water using steam condensing at 120^oC. The heat transfer coefficient for heating is 1140 J/s.m^2.K. The tank losses heat to the surrounding through the walls which have an area of 9 m^2. The heat transfer coefficient for heat losses is 10 J/s.m^2.K and the surrounding temperature is 25^oC .How long will it take to heat the water to boiling point. Neglect the heat capacity of the tank walls. (Take water Cp=4187J/Kg.K)	**10**
2A.	Derive the center difference technique and develop the mathematical model or the dynamics response of an unsteady state counter current plug flow heat exchanger. Give briefly the solution procedure.	**15**
2B.	List out the characteristics of model.(Any 5 only)	**05**
3A.	Develop steady state tray composition for a 6 plate absorption column. A linear equilibrium relation holds between liquid x_m and vapor y_m on each plate and is given by $y_m = ax_m + b$. The inlet compositions to the column along with liquid and gas flow rate are known. Briefly give the solution procedure.	**07**
3B.	Write a short notes on degree of freedom?	**05**
3C.	Consider a set of reversible reaction: $A \underset{K_2}{\overset{K_1}{\Longleftrightarrow}} B$ and $B \underset{K_4}{\overset{K_3}{\Longleftrightarrow}} C$ Where N_A,N_B, N_C be the moles of A, B,C respectively present at any time t. Since the reaction is constant volume, N_A,N_B, N_C are proportional to concentration. Derive $\frac{d^2N_A}{dt^2} + (K_1 + K_2 + K_3 + K_4)\frac{dN_A}{dt} + \left((K_1 * K_3) + (K_2 * K_4) + (K_1 * K_4)\right)N_A - (K_2 * K_4) = 0$	**08**

4A.	Write the step by step procedure for modeling of any process.	**10**
4B.	Define the following (i) Model (ii) simulation (iii) grey box model (iv) white box model (v) black box model	**5**
4C.	Differentiate between lumped and Distributed parameter model with examples	**5**
5	Write the general modeling equations for a ternary equilibrium column of five stages including condenser and reboiler for a multi-component distillation column. Draw a neat information flow diagram for feed tray , reboiler and Condensor.	**20**
6	Develop the design equations for multi component pipe line flasher. Discuss the model for establishing temperature.	**20**
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