

B. Tech Degree IV Semester Examination, April 2010

SE 402 CHEMICAL ENGINEERING II (2006 Scheme)

Time: 3 Hours

Maximum Marks: 100

PART A (Answer ALL questions)

(8 x 5 = 40)

- I. a. Write down the expressions for resistances to steady state heat conduction through a plane wall and a cylindrical wall.
- b. Distinguish single effect and multiple effect evaporation. What is the main advantage of multiple effect evaporation?
- c. What is the need for providing reflux in distillation? What is optimum reflux?
- d. What is flooding velocity? What is its significance in the operation of a packed column?
- e. Distinguish constant rate and falling rate drying periods. How does the rate remain constant in the former?
- f. Why is liquid-liquid extraction normally more difficult compared to absorption or distillation?
- g. Distinguish the collision and Transition theories of Rate Constant.
- h. What are the major disadvantages of the batch reactor?

PART B

(4 x 15 = 60)

- II. Describe with a neat sketch the working of a shell and tube heat exchanger.

OR

- III. A counter flow double pipe heat exchanger is used to cool a hot process fluid with water. The process fluid flows at 18kg/s and is cooled from 105°C to 45°C. The water flows counter currently to the process fluid, entering at 25°C and leaving at 50°C. Assuming no heat losses, calculate the required flow rate for the cooling water and the required area for the heat exchanger.

Data

The specific heat for water is $4.2 \frac{\text{kJ}}{\text{kg.K}}$ and that of the process fluid is $3.4 \frac{\text{kJ}}{\text{kg.K}}$. The process

fluid side film heat transfer coefficient is $2500 \frac{\text{W}}{\text{m}^2\text{k}}$ and the cooling water side heat transfer

coefficient is $1200 \frac{\text{W}}{\text{m}^2\text{k}}$. The tube wall thickness is 3mm and the thermal conductivity is

$220 \frac{\text{W}}{\text{m}^2\text{k}}$.

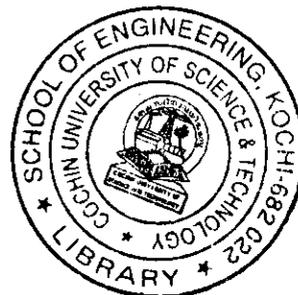
- IV. Compare the salient features of absorption in a plate and packed tower.

OR

- V. A liquid mixture of benzene-toluene is to be distilled in a fractionating tower at atmospheric pressure. The feed contains 45 mol % benzene and enters as liquid at the boiling point. A distillate containing 95 mol % benzene and a bottoms containing 10 mol% benzene are to be obtained. The reflux ratio is 4. Calculate the number of theoretical trays needed.

Equilibrium data

x	0	0.130	0.258	0.411	0.581	0.780	1.000
y	0	0.261	0.456	0.632	0.777	0.9000	1.000



(Turn over)

VI. Describe with the help of a process flow diagram the manufacture of dried milk powder by spray drying milk.

OR

VII. Distinguish fixed bed leaching and moving bed leaching. Describe with a neat sketch the working of a typical moving bed leaching equipment.

VIII. A homogenous liquid phase reaction



take place with 50% conversion in a well mixed reactor operating isothermally. What will be the conversion in a plug flow reactor of equal size if all other conditions remain the same.

OR

IX. The irreversible gas phase reaction $A \rightarrow 3B$ is carried out isothermally. The reaction is zero order and the initial concentration of A is 2 mol/litre and the system contains 40% inerts. The specific reaction constant is $0.1 \frac{\text{mol}}{\text{litre.min}}$. Calculate the time required to achieve 80% conversion in a constant pressure batch reactor.
