SHAHEED BHAGAT SINGH STATE TECHNICAL CAMPUS, FEROZEPUR

ROLL No: | | | | | | | | | | | | | **Total number of pages:[2]**

Total number of questions:06

B.Tech. || CHE || 8th Sem | 7th sem

Chemical process simulation (RC/RP)

Subject Code BTCH-801

Paper ID: M/18

Time allowed: 3 Hrs (2011 batch onwards) **Max Marks: 60**

Important Instructions:

- **All questions are compulsory**
- **Assume any missing data**

PART A (2×10)

Q. 1. Short-Answer Questions: All COs

a) What do you understand by manipulated variables?

b) What do you mean by Mathematical consistency of a model?

c) What are the various uses of mathematical modeling in Research & Development?

d) Give the iterative procedure steps for bubble-point calculation.

e) Write steady state Model in reference to a Single Component Vaporizer.

f) Write down general component continuity for j-th component & total energy equation for any system.

g) What is equilibrium constant model for pH measurement?

h) Write mathematical form of law of Mass action.

i) What is deterministic model?

j) What is lumped Parameter model?

PART B (8×5)

Q. 2. Define the following terms related to Mathematical Modeling: CO1

(a) Distributed parameter model.

(b) Thermal Equilibrium model.

(c) Significant Metal wall capacitance.

(d) Slop

OR

Discuss principles of formulation of mathematical modeling CO1

Q. 3. Write the Component continuity & energy equations for a semi-batch reactor in which B is added to A. CO2

(i). Consecutive reaction occurring with exothermic heat of reaction λ_1 & λ_2

$$A \xrightarrow{k_1} B \xrightarrow{k_2} C$$

(ii). Reversible with forward reaction exothermic heat of reaction λ_1 and λ_2 is taking place, k_1 and k_2 are rate constants for forward and backward reactions.

$$A \rightleftharpoons B$$

OR

The liquid in a jacked, non isothermal CSTR is stirred by an agitator whose mass is significant as compared to reaction mass. The mass of reactor wall and the mass of jacket wall are also significant. Write the energy equations for the system. Neglect the radial temperature gradient in agitator, reactor and jacket wall. CO2

Q. 4. Develop the equations describing an "inverted" batch distillation column. This system has a large reflux drum into which the feed is charged. The material is fed to the top of the column. Vapor is generated in a re-boiler in the base. Heavy material is withdrawn from the bottom of column. Derive a mathematical model for the case when tray hold up cannot be neglected CO3

OR

In ideal binary distillation column, derive the modeling equations for CO3

a) Condenser and reflux drum.

b) Reboiler and column base.

c) n^{th} tray.

Q. 5. Develop a Mathematical Model for heat conduction through a solid sphere of radius R the center temperature in this sphere is maintained constant at T_{amb}. CO4

OR

Rigorously model multicomponent flash drum. CO4

Q. 6. Derive the Mathematical Model for a Lumped Parameter Gas Absorber. List all the assumptions used in deriving the model. CO5

OR

Assuming equilibrium state and uniform mixing develop model for continuous extraction process. CO5