Code No: RR410805 **RR** **Set No. 2**

IV B.Tech I Semester Examinations,November 2010
PROCESS MODELLING AND SIMULATION
Chemical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the Mass Transfer phenomena in a Reactor with a case study. [16]
2. Draw an analog computer simulation circuit diagram for three CSTRs in series (isothermal, first order, irreversible, constant volume, and constant throughput). [16]
3. Discuss the general "Newton - Raphson" algorithm to determine the bubble point temperature for a binary system of components 1 and 2. Assume the system is ideal, Raoult's and Dalton's laws are applicable. [16]
4. A first order irreversible exothermic reaction A → B occurs in a series of three perfectly mixed CSTRs. Feed enters the first reactor and product leaves the third reactor. Derive the mass balance and component continuity equations considering isothermal and constant holdups. Assume constant density for the system, which is a binary mixture of A and B. [16]
5. Derive the Model equations to describe the Batch distillation of a multicomponent mixture. [16]
6. Write the energy equation for the CSTR (continuous stirred-tank reactor) in which consecutive first order reactions occur with exothermic heats of reaction λ_1 and λ_2.

$$\mathbf{A} \xrightarrow[\lambda_1]{k_1} \mathbf{B} \xrightarrow[\lambda_2]{k_2} \mathbf{C}$$

   State the assumptions made and explain the nomenclature used. [16]
7. Explain the convergence procedure to find the bubble point temperature of a binary vapour-liquid mixture. [16]
8. Define the equations and notations for Dalton's law, Raoult's law and relative volatility of an ideal vapour-liquid equilibrium system. [16]

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Code No: RR410805 **RR** **Set No. 4**

IV B.Tech I Semester Examinations,November 2010
PROCESS MODELLING AND SIMULATION
Chemical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the convergence procedure to find the bubble point temperature of a binary vapour-liquid mixture. [16]
2. Explain the Mass Transfer phenomena in a Reactor with a case study. [16]
3. A first order irreversible exothermic reaction A → B occurs in a series of three perfectly mixed CSTRs. Feed enters the first reactor and product leaves the third reactor. Derive the mass balance and component continuity equations considering isothermal and constant holdups. Assume constant density for the system, which is a binary mixture of A and B. [16]
4. Define the equations and notations for Dalton's law, Raoult's law and relative volatility of an ideal vapour-liquid equilibrium system. [16]
5. Draw an analog computer simulation circuit diagram for three CSTRs in series (isothermal, first order, irreversible, constant volume, and constant throughput). [16]
6. Derive the Model equations to describe the Batch distillation of a multicomponent mixture. [16]
7. Discuss the general "Newton - Rapshon" algorithm to determine the bubble point temperature for a binary system of components 1 and 2. Assume the system is ideal, Raoult's and Dalton's laws are applicable. [16]
8. Write the energy equation for the CSTR (continuous stirred-tank reactor) in which consecutive first order reactions occur with exothermic heats of reaction λ_1 and λ_2.

$$\mathbf{A} \xrightarrow[\lambda_1]{k_1} \mathbf{B} \xrightarrow[\lambda_2]{k_2} \mathbf{C}$$

State the assumptions made and explain the nomenclature used. [16]

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Code No: RR410805 **RR** **Set No. 1**

IV B.Tech I Semester Examinations,November 2010
PROCESS MODELLING AND SIMULATION
Chemical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Write the energy equation for the CSTR (continuous stirred-tank reactor) in which consecutive first order reactions occur with exothermic heats of reaction λ_1 and λ_2.

$$\mathbf{A} \xrightarrow[\lambda_1]{k_1} \mathbf{B} \xrightarrow[\lambda_2]{k_2} \mathbf{C}$$

State the assumptions made and explain the nomenclature used. [16]

2. Derive the Model equations to describe the Batch distillation of a multicomponent mixture. [16]

3. Explain the Mass Transfer phenomena in a Reactor with a case study. [16]

4. A first order irreversible exothermic reaction A → B occurs in a series of three perfectly mixed CSTRs. Feed enters the first reactor and product leaves the third reactor. Derive the mass balance and component continuity equations considering isothermal and constant holdups. Assume constant density for the system, which is a binary mixture of A and B. [16]

5. Explain the convergence procedure to find the bubble point temperature of a binary vapour-liquid mixture. [16]

6. Define the equations and notations for Dalton's law, Raoult's law and relative volatility of an ideal vapour-liquid equilibrium system. [16]

7. Draw an analog computer simulation circuit diagram for three CSTRs in series (isothermal, first order, irreversible, constant volume, and constant throughput). [16]

8. Discuss the general "Newton - Rapshon" algorithm to determine the bubble point temperature for a binary system of components 1 and 2. Assume the system is ideal, Raoult's and Dalton's laws are applicable. [16]

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Code No: RR410805 **RR** **Set No. 3**

IV B.Tech I Semester Examinations,November 2010
PROCESS MODELLING AND SIMULATION
Chemical Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the Mass Transfer phenomena in a Reactor with a case study. [16]
2. Define the equations and notations for Dalton's law, Raoult's law and relative volatility of an ideal vapour-liquid equilibrium system. [16]
3. A first order irreversible exothermic reaction A → B occurs in a series of three perfectly mixed CSTRs. Feed enters the first reactor and product leaves the third reactor. Derive the mass balance and component continuity equations considering isothermal and constant holdups. Assume constant density for the system, which is a binary mixture of A and B. [16]
4. Draw an analog computer simulation circuit diagram for three CSTRs in series (isothermal, first order, irreversible, constant volume, and constant throughput). [16]
5. Write the energy equation for the CSTR (continuous stirred-tank reactor) in which consecutive first order reactions occur with exothermic heats of reaction λ_1 and λ_2.

$$\mathbf{A} \underset{\lambda_1}{\overset{k_1}{\rightarrow}} \mathbf{B} \underset{\lambda_2}{\overset{k_2}{\rightarrow}} \mathbf{C}$$

   State the assumptions made and explain the nomenclature used. [16]
6. Discuss the general "Newton - Rapshon" algorithm to determine the bubble point temperature for a binary system of components 1 and 2. Assume the system is ideal, Raoult's and Dalton's laws are applicable. [16]
7. Derive the Model equations to describe the Batch distillation of a multicomponent mixture. [16]
8. Explain the convergence procedure to find the bubble point temperature of a binary vapour-liquid mixture. [16]

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