QP Code: RM21BTECH489 | Reg. No | | | | | | | | | | | AY 21

# GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Sixth Semester Regular) Examinations, May – 2024

## 21BCHPE36001 - Process Modeling and Simulation

(Chemical)

Time: 3 hrs | Maximum: 70 Marks

**(The figures in the right hand margin indicate marks)**

**PART – A** **(2 x 5 = 10 Marks)**

| Q.1. Answer ***ALL*** questions | CO # | Blooms Level |
|---|---|---|
| a. Write the component continuity equation for an endothermic chemical reaction carried in a batch reactor. | CO2 | K1 |
| b. Write the limitation for Fibonacci search method. | CO3 | K1 |
| c. Write the objective of synthesis simulation problem. | CO4 | K1 |
| d. Differentiate between discrete & continuous model. | CO1 | K3 |
| e. What are the basic assumptions required for design of multi- component vaporizer? | CO2 | K2 |

**PART – B** **(15 x 4 = 60 Marks)**

| Answer ***ALL*** questions | Marks | CO # | Blooms Level |
|---|---|---|---|
| 2. a. Develop the mathematical model of bubble cap distillation column. | 10 | CO2 | K4 |
| b. Explain the mathematical model for continuity equation for distributed model. | 5 | CO1 | K3 |
| (OR) | | | |
| c. Explain the design equation of a batch reactor with neat sketch. | 10 | CO2 | K3 |
| d. Explain the mathematical model for energy equation for lumped model. | 5 | CO1 | K3 |
| 3.a. Explain the design equation for an isothermal CSTR with following first-order chemical reactions.<br>(i) Consecutive<br>(ii) Simultaneous<br>(iii) Reversible | 10 | CO2 | K3 |
| b. Explain the design equation of a single component vaporizer with neat sketch. | 5 | CO2 | K3 |
| (OR) | | | |
| c. Develop the mathematical model of a double pipe heat exchanger where the resistance to heat transfer from a condensing fluid to inner fluid can be represented by convective heat transfer co-efficient on both sides of the heat transfer wall. Assume that resistance of wall is negligible but the wall has finite heat capacity. | 10 | CO2 | K4 |
| d. Design the heating & cooling phase model of a semi-batch reactor. | 5 | CO2 | K4 |
| 4.a. Find the minimum of $f(x) = X^2-2X$ using Golden section method. Take the interval as 0 to 1.5, value of difference between two decision variables = 0.1. | 8 | CO3 | K2 |
| b. Find the root of the equation $x/(x+1) = 0$, correct to 4 decimal places using Regula falsi method. The root lies between 1 & 2. | 7 | CO3 | K2 |
| (OR) | | | |
| c. Solve the following LPP using simplex method. | 10 | CO3 | K2 |

Max Z = $15X_1+6X_2+9X_3+2X_4$

Subject to:

$2X_1+X_2+5X_3+6X_4 \leq 20$

$3X_1+X_2+3X_3+25X_4 \leq 24$

$7X_1+ X_4 \leq 70$

Where $X_1, X_2, X_3, X_4 \geq 0$

d. Solve the following LPP using dual simplex method. 5 CO3 K2

Max Z = $3X_1-X_2$

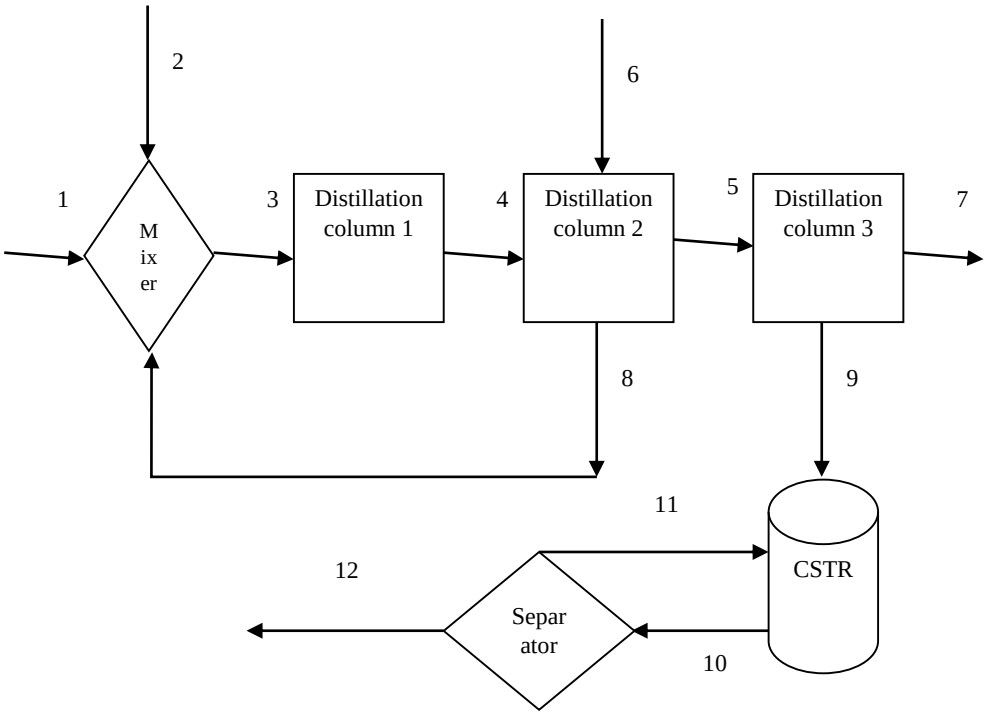
Subject to:

$X_1+X_2 \geq 1$

$2X_1+3X_2 \geq 2$

Where $X_1, X_2 \geq 0$

5.a. Encode the following information flow diagram using different types of matrices. 10 CO4 K4




b. Explain in details about dynamic simulation. 5 CO4 K2

(OR)

c. A tourist car operator finds that during the past few months, the car's use has varied so much that the cost of maintaining the car varied considerably. During the past 200 days, the demand for the car fluctuated as below. Using random numbers, simulate the demand for a 10-week period. 10 CO4 K4

| Trips per week | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Probability | 0.08 | 0.12 | 0.15 | 0.3 | 0.2 | 0.15 |

d. Write the steps for structure of simulation. 5 CO4 K2

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