

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur (GIET University)



B. Tech (Sixth Semester – Regular/ Supplementary) Examinations, April 2025

21BCHPE36011/22BCHPE36011 –Process Modelling Simulation

(Chemical Engineering)

Time: 3 hrs

Maximum: 70 Marks

Answer ALL questions
(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. Differentiate between semi-batch and batch reactor. | CO1 | K2 |
| b. Define modularity. | CO4 | K1 |
| c. Differentiate between sequential and equation oriented modular approach. | CO4 | K2 |
| d. State the equation of motion. | CO2 | K1 |
| e. Briefly explain the importance of optimization of a model? | CO1 | K2 |

PART – B

(15 x 4 = 60 Marks)

Answer **all** the questions

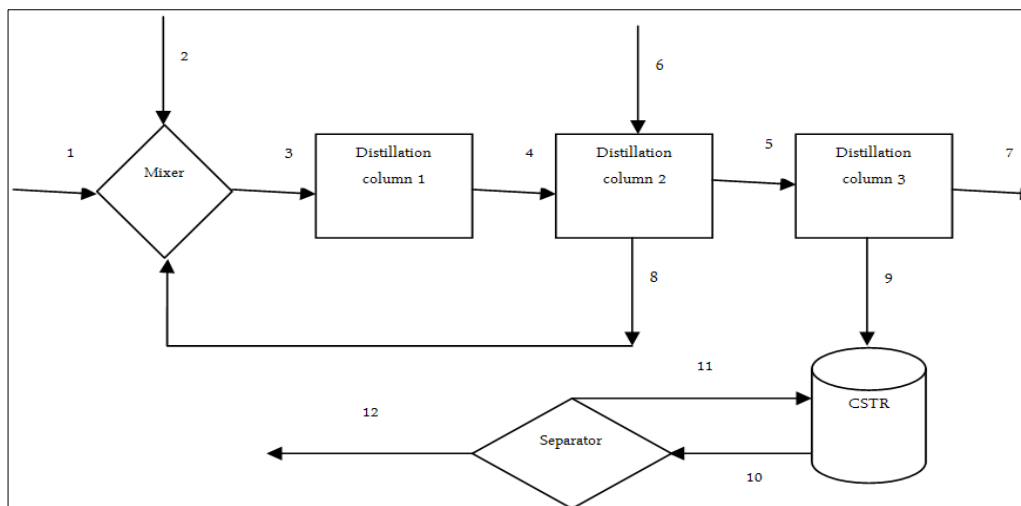
| | Marks | CO # | Blooms Level |
|---|-------|------|--------------|
| 2. a. Explain the mathematical model for energy equation for lumped and distributed model. | 10 | CO1 | K5 |
| b. Explain the mathematical model for continuity equation. | 5 | CO1 | K5 |
| (OR) | | | |
| c. Derive the mathematical model for energy equation. | 8 | CO2 | K1 |
| d. Explain the fundamental laws for creating mathematical model. | 7 | CO1 | K2 |
| 3.a. Explain the design equation for a CSTR with first-order non-isothermal consecutive, simultaneous & reversible reactions. | 10 | CO2 | K2 |
| b. Derive the mathematical model for variable hold up multi stage CSTR in isothermal condition. | 5 | CO1 | K3 |
| (OR) | | | |
| c. Develop the mathematical model of ideal binary distillation column | 10 | CO1 | K4 |
| d. Derive the mathematical model for variable hold up multi stage CSTR in isothermal condition. | 5 | CO2 | K3 |
| 4.a. Solve the following LPP using simplex method. Max $Z = X_1 + X_2 + 3X_3$ Subject to, $3X_1 + 2X_2 + X_3 \leq 3$ $2X_1 + X_2 + 2X_3 \leq 2$ $X_1, X_2, X_3 \geq 0$ | 8 | CO3 | K3 |
| b. Solve the following LPP using Graphical method Max $Z = 8X + 2Y$ Subject to, $X + Y \leq 7$, $X - 2Y \leq 3$ where $X, Y \geq 0$ | 7 | CO3 | K3 |
| (OR) | | | |

- c. Find the root of the equation $\sin x - \cosh x + 1 = 0$, correct to 4 decimal places, using Regula falsi method. The root lies between 1 & 2. 8 CO3 K3
- d. Solve by Fibonacci Method, $f(x)_{\min} = x^2 - 2x$, $0 < x < 1.5$, resolution: 0.25, $N=4$, $A=0$, $B=1.5$ 7 CO3 K3
- 5.a. Define Monte-Carlo simulation & write the steps for formulating problem. 6 CO4 K2
- b. A manufacturing company keeps stock of a special product. Previous experience indicates the daily demand as given below. Simulate the demand for next 10 days. Find the daily average demand for the product on the basis of simulated data. 9 CO3 K3

| | | | | | | |
|--------------|------|-----|------|-----|------|------|
| Daily demand | 5 | 10 | 15 | 20 | 25 | 30 |
| Probability | 0.01 | 0.2 | 0.15 | 0.5 | 0.12 | 0.02 |

(OR)

- c. Encode the following information flow diagram with the following matrices 15 CO4 K3
- Process matrix
 - Stream Connection matrix
 - Incidence matrix
 - Adjacency matrix
 - Recycle set



--- End of Paper ---