Registration No : | | | | | | | | | | |

Total number of pages : 03 **B.Tech**

PCE5J002

5th Semester Regular / Back Examination 2018–19

PROCESS SIMULATION & MODELING

BRANCH : CHEM

Time : 3 Hours

Max Marks : 100

Q CODE : E088

Answer Question No.1 (Part-I) which is compulsory, any EIGHT from Part-II, and any TWO from Part-III.

The figures in the right-hand margin indicate marks.

Assume suitable notations and any missing data wherever necessary.

Answer all parts of a question at a place.

Part – I

Short Answer Type Questions (Answer All TEN)

Q1 **Answer the following questions :** **(10x2)**

a) Write the transport equation.

b) Differentiate between lumped and distributed model.

c) What is phase equilibrium?

d) Define global optima.

e) Write the disadvantages of Golden section search method.

f) Define activity coefficient.

g) Write the assumptions for energy equation.

h) Define process simulator.

i) Define the components of an information diagram.

j) What are the softwares used for simulation?

Part – II

Focused-Short Answer Type Questions(Answer Any EIGHT out of TWELVE)

Q2 **Answer the following questions :** **(8x6)**

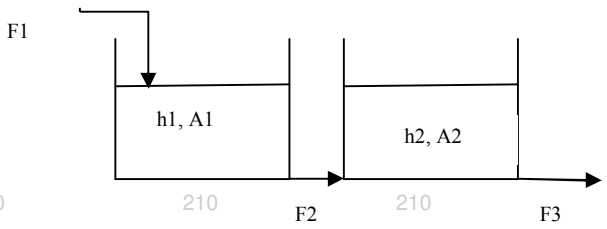
a) Write the different steps for the formulation of a model.

b) Explain the component continuity equation of a plug-flow reactor with a neat sketch.

c) Write the component continuity equation of a perfectly mixed batch reactor with consecutive first order isothermal reaction :

$$A \xrightarrow{k1} B \xrightarrow{k2} C$$

d) Consider a system having two tanks so that the liquid level in tank 2 affects the flow rate of tank 1. Develop a mathematical model for the system, assuming the flow rate of an influent stream of a tank is hydrostatic liquid pressure.



e) Write the stepwise procedure for Golden section search method.

f) Write the design equation of flash drum with proper assumptions.

g) Determine the square root of 28 for the correction of 4 decimal places of the root using Newton Raphson method.

h) Write the mathematical model for bubble column distillation column.

i) Solve the following LPP using simplex method.

Max $Z=X_1+X_2+3X_3$

subject to,

$3X_1+2X_2+X_3 \leq 3$

$2X_1+X_2+2X_3 \leq 2$

$X_1, X_2, X_3 \geq 0$

j) Explain different types of simulation.

k) Explain Wegstein's method.

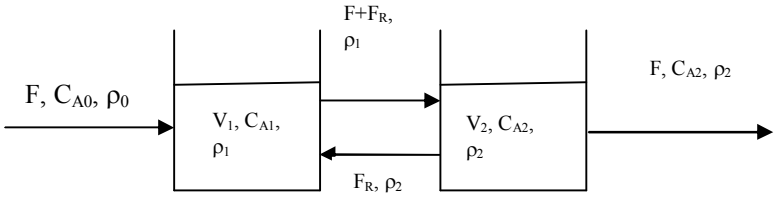
l) A manufacturing company keeps stock of a special product. Previous experience indicates the daily demand as given below. Simulate the demand for next 10 days. Find the daily average demand for the product on the basis of simulated data.

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

Part – III

Long Answer Type Questions (Answer Any TWO out of FOUR) **(2x16)**

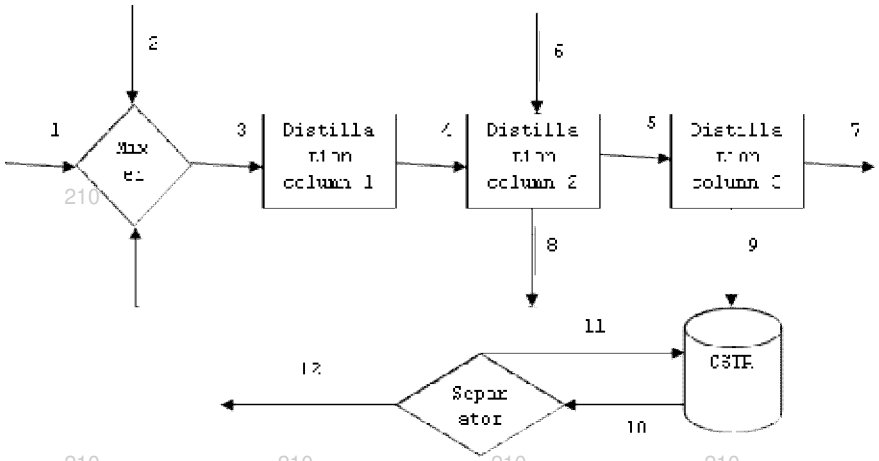
Q3 An isothermal irreversible reaction $A \xrightarrow{k1} B$ takes in a liquid phase in a constant volume reactor. The mixing is not perfect. Observation of flow patterns indicates that a two tank system with back mixing, as shown in figure should approximate the imperfect mixing. Assuming F & F_R are constant, write the equations describing the system.



Q4 Design the mathematical model of a non-isothermal CSTR with proper assumptions and design equations.

Q5 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 coefficient on both sides of the heat transfer wall. Assume that resistance of wall is negligible but the wall has finite heat capacity.

Q6 Encode the following information flow diagram with the following matrices



a) Process matrix
b) Stream connection matrix
c) Incidence matrix
d) Adjacency matrix
e) Recycle set