

**B. TECH. (CBCS - 2014 COURSE) SEM - VIII (CHEMICAL
ENGG.) : SUMMER - 2018**
SUBJECT: CHEMICAL PROCESS MODELING AND SIMULATION

Day: **Saturday**
Date: **09/06/2018**

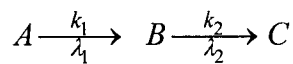
S-2018-4653

Time: **02.30 PM TO 05.30 PM**
Max Marks. : 60

N.B. :

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Assume suitable data, if necessary.
- 4) Use of non-programmable calculator is allowed.
- 5) Draw neat and labeled diagrams wherever necessary.

Q.1 A CSTR in which consecutive first order reactions occur with exothermic heats of reaction λ_1 & λ_2 (10)

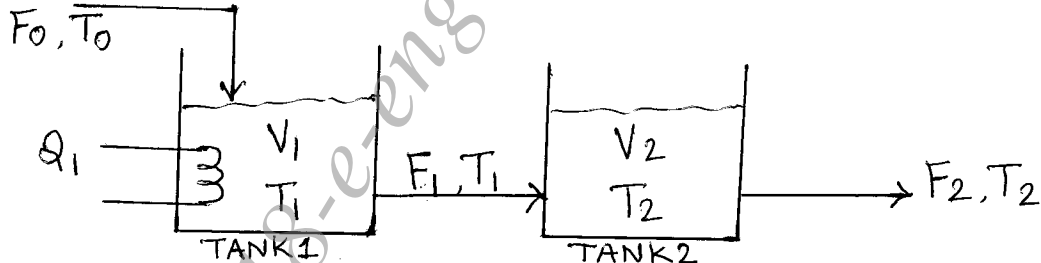


- i) Write total continuity equation
- ii) Write component continuity equation
- iii) Write energy equation

OR

Q.1 Define process modeling. Explain principle of formulation and applications of modeling in chemical engineering. (10)

Q.2 An oil, passing through two perfectly mixed tanks in series as shown below. (10)



The density and heat capacity of oil are constant. Develop the model equations which describe the above system. Check the degrees of freedom of this system.

OR

Q.2 Develop mathematical model for single component vaporizer with following conditions. (10)

- i) Steady state condition
- ii) Liquid phase dynamics
- iii) Liquid and vapor phase dynamics

Q.3 a) Write the assumptions to be made while modeling a binary distillation column. (05)

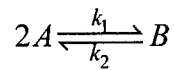
b) Compare the modeling of plate column and packed column. (05)

OR

Q.3 Postulate a mathematical model for batch distillation with hold up. State all assumptions with justification. (10)

P.T.O.

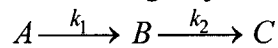
- Q.4 Develop model equations for a gas phase pressurized reactor filled with reacting gases which are perfectly mixed. A reversible reaction occurs in the reactor. (10)



Write all assumptions clearly.

OR

- Q.4 First order liquid phase consecutive reactions takes place in batch reactor. (10)
All reactions are endothermic. The reacting mixture is heated by steam which flows through a jacket around the reactor with rate Q (kg/min)



Develop mathematical model for the system.

- Q.5 Define process simulation. Explain equation solving approach of simulation for chemical engineering system. (10)

OR

- Q.5 What is decomposition of networks? Give the composition of various tearing algorithms for decomposition of networks. (10)

- Q.6 Write the equations describing the series of three CSTR's. Simulate the equation using Eulers method with initial condition as (10)

$$\left. \begin{array}{l} CA_1 = 0.4 \text{ kmol of } A / m^3 \\ CA_2 = 0.2 \text{ kmol of } A / m^3 \\ CA_3 = 0.1 \text{ kmol of } A / m^3 \\ CA_0 = 1.8 \text{ kmol of } A / m^3 \end{array} \right\} \text{ at } t = 0$$

Parameters $\tau = 2$ min. $k = 0.5 \text{ min}^{-1}$

Find values of CA_1 , CA_2 and CA_3 at $t = 2$ min with step size of 1 min.

OR

- Q.6 Write any six methods with their mathematical forms applied for numerical integral analysis. (10)

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