

Exam.Code:0908

Sub. Code: 6703

2062

B.E. (Biotechnology) Fourth Semester
BIO-413: Chemical Reaction Engineering

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Unit. Assume any missing data.

x-x-x

1. Attempt the following:-

- a) Name three ideal contacting patterns.
- b) State distinguishing factors between single and multiple types of reactions.
- c) Explain autocatalytic reactions.
- d) Differentiate between order and molecularity of reaction.
- e) Define fractional change in volume for any system.
- f) 0.5 liter/sec of gaseous reactant A is introduced into a mixed reactor of volume 2 liters. Calculate its space time.
- g) What is the significance of Arrhenius Plot?
- h) For the equation $B + 2D \rightarrow 3T$ compare the relative rate constants for all the components. Also account for sign – or +.
- i) Write a material balance equation with schematic representation for a flow reactor.
- j) How are biochemical reactions different from chemical reactions?

(10x1)

UNIT - I

2. i) Explain how total volume and total pressure methods help in arriving at the kinetics of the given reaction. Derive relevant equations.
ii) With the help of suitable plots, explain how to interpret kinetic data for a second order reaction using the integral method. (4+6)
3. i) Derive an expression for the concentration in the N-th reactor, if N equal sized stirred tank reactors are assembled in series. Assume first order reaction.

P.T.O.

(2)

ii) A specific enzyme acts as a catalyst in the fermentation of reactant A. At a given enzyme concentration in the aqueous feed stream (25 lit/min) Find the volume of plug flow reactor needed for 95% conversion of reactant A ($C_{A0}=2$ mol/lit). The kinetics of the fermentation at this enzyme concentration is given by



4. i) Explain various considerations while proposing a kinetic model for non-elementary reaction.
- ii) With the help of suitable expressions and plots, discuss the competitive type inhibitions kinetics of an enzyme-substrate reaction. (4+6)

UNIT - II

5. A homogeneous first order reaction is carried out in a batch reactor under adiabatic conditions. Develop a suitable method to find the relation temperature-conversion-time. State the assumptions. (10)
6. Define a limiting substrate. Discuss in details the following type of biochemical reactions: a) Substrate limited cell-growth b) Toxin limited cell-growth. (5+5)
7. Justify how series-parallel reaction can be analyzed in terms of their constituent series and parallel reactions for obtaining favorable product distribution. (10)