#### 1019

# B.E. (Bio-Technology) Fourth Semester BIO-413: Chemical Reaction Engineering

## Time allowed: 3 Hours

2

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### Max. Marks: 50

**NOTE**: Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.

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- I. Attempt the following:
  - a) Name three ideal contacting patterns.
  - b) State distinguishing factors between single and multiple types of reactions.
  - c) Explain the terms Space-time and space-velocity.
  - 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) Explain 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 continuous bioreactor.
  - j) How are biochemical reactions different from chemical reactions? (10x1)

## <u>UNIT – I</u>

- II. Explain how total volume and total pressure methods help in arriving at the kinetics of the given reaction. Derive relevant equations. (10)
- III. a) Discuss about the procedure used while proposing a kinetic model for nonelementary reaction.
  - b) Discuss the relative merits and demerits of the differential and integral method of analysis. (4,6)
- IV. a) 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.
  - b) Discuss how best you will arrange two unequal-sized stirred tank reactors for a given conversion and reaction order. (5,5)

P.T.O.

(5,5)

(2)

# <u>UNIT – 11</u>

- V. 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. (10)
- VI. Define a limiting substrate. Discuss in details the following type of biochemical reactions:
  - a) Substrate limited cell-growth
  - b) Toxin limited cell-growth.
- VII. Justify how series-parallel reaction can be analyzed in terms of their constituent series and parallel reactions for obtaining favorable product distribution. (10)

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