Exam.Code:0908
Sub. Code: 6703

1019
B.E. (Bio-Technology)
Fourth Semester
BIO-413: Chemical Reaction Engineering

Time allowed: 3 Hours **Max. Marks: 50**

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

x-x-x

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 → 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)

UNIT – I

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 non-elementary 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.

UNIT – II

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-time. State the assumptions made. (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. (5,5)

VII. Justify how series-parallel reaction can be analyzed in terms of their constituent series and parallel reactions for obtaining favorable product distribution. (10)

x-x-x