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

Total Number of Pages : 02 **B.Tech**
PCE5I103

5th Semester Regular/Back Examination 2019-20
CHEMICAL REACTION ENGINEERING
BRANCH : CHEM
Max Marks : 100
Time : 3 Hours
Q.CODE : HRB221

Answer Question No.1 (Part-1) which is compulsory, any EIGHT from Part-II and any TWO from Part-III.
The figures in the right hand margin indicate marks.

Part- I

Q1 **Only Short Answer Type Questions (Answer All-10)** **(2 x 10)**

a) Differentiate between elementary and non elementary reactions.
b) Define order and molecularity of a reaction.
c) Write down the difference between space velocity and space time.
d) Write the steps involved in heterogeneous catalytic reactions?
e) Prove that the space time for CSTR in series approaches that of PFR for 1st order reaction.
f) Why real reactors deviate from ideal reactors.
g) Differentiate between micro-mixing and macro-mixing.
h) Write the difference between homogeneous and heterogeneous reactions.
i) Write down the performance equation for a batch, plug flow and stirred tank reactor.
j) What do you understand by Arrhenius plot for a reaction?

Part- II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) The pyrolysis of ethane proceeds with activation energy of about 70 kcal. How much faster is the decomposition at 600 C than 500 C?
b) A liquid B decomposes by first order kinetics and in a batch reactor 60% B is converted in 10 minutes. How much longer would it take to reach 80% conversion?
c) Write a short note on Arrhenius Theory, Transition state theory and collision theory.
d) A homogeneous liquid phase reaction B→C; $-r_A = KC_B^2$ takes with 50% conversion in a mixed reactor. What will be the conversion if the reactor is replaced by 6 times as large –all else remaining uncharged?
e) What are the methods used to interpret kinetic data from a batch reactor?
f) Let S be the fractional change in volume of the reactor system between no conversion and complete conversion of reactant A. What is the value of S for a reaction A→3B, starting with 50% inerts?
g) Show in a diagram the effect of temperature of equilibrium conversion for endothermic and exothermic reactions.
h) After 8 minutes in a batch reactor, reactant (C_{A0} = 1 mole/litre) is 10 % converted; after 18 minutes, conversion is 90%. Find a rate equation to represent this reaction.
i) What are the factors decided in the design of a reactor?
j) Derive the expression for tri-molecular third order reaction.
k) In a CSTR 50 % conversion is obtained for a homogeneous, isothermal, liquid phase, irreversible second order reaction. What is the conversion if the reactor volume is 5 times the original all else remaining unchanged?
l) A(1st order)→B(1st order)→C series reaction taking place in a CSTR. Find out the time required to get maximum concentration of B.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 A homogenous gas reaction B→4R has reported rate at 200C with first order rate $-r_B$ = (0.05/min) C_B. What sixe of plug flow reactor operating at 200 C and 4 atmosphere can produce 75% conversion of feed consisting of 2 g moles of pure B per hour? **(16)**

Q4 The rate of a liquid phase reaction of the type, A+B→Products; is found to be independent of concentration of A and B, and equal to 1kmol (m^3) (min) at 300 K, then find the conversion in a mixed flow reactor having volume 2 m^3 with feed concentration of A and B equal to 5 kmol/m^3, feed flow rate equal to 1m^3/min and reactor temperature equal to 300K. **(16)**

Q5 The first order reaction A →7B is carried out in a tubular reactor in which the volumetric flow rate determine the reactor volume to reduce the existing concentration to 10% of the entering concentration when the volumetric flow rate is 10 m3/min. and the specific reaction rate is (K) is 0.23 min^{-1}. **(16)**

Q6 **Write short notes on :**

a) RTD theory **(8)**

b) Tank in series model **(8)**