

B.Tech - 6th(Chem. Engg.)
Reaction Kinetics and Catalysis

Full Marks : 70

Time : 3 hours

Answer all questions

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

1. Answer *all* questions : 2 × 10
- (a) What are elementary reactions ? Give an example.
 - (b) Define order and molecularity.
 - (c) Define ideal reactor.
 - (d) Write the significance of Damkohler Number.
 - (e) Differentiate Space time and Space Velocity.
 - (f) Mention the non-ideality parameters in a batch PFR and MFR.

(Turn Over)

(2)

- (g) Explain Macro and Micro Fluids.
(h) Define activation energy ?
(i) What are Autocatalytic Reactions ?
(j) Write the performance equation for PFR ?
2. Classify the different types of reactions based on different parameters. 10

Or

- Find the expression for volume (V) for the reaction $A + B \rightarrow$ Product, for a PFR with a variable density system C_{A0} is not equal to C_{B0} . 10
3. Derive an expression for ideal recycle reactors. 10

Or

- Write short notes on any two : 10
- (i) Transition State Theory
(ii) Arrhenius Law
(iii) Collision Theory

(3)

- (iv) Differential Analysis for finding the rate equation.
4. For a first order isomerisation reaction carried out in a batch reactor on a catalyst that is decaying as a result of poisoning. Derive an expression of conversion as a function of time. 10

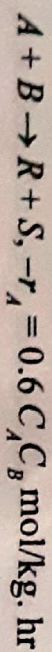
Or

- Explain sequential steps involved in Catalytic Reaction for gas-solid systems. 10
5. Assuming a stoichiometry $A \rightarrow R$ for a first order gas phase reaction, the size of PFR required to achieve 99% conversion of pure A is 32 L. In fact the stoichiometry if the reaction is $A \rightarrow 3R$. For this corrected stoichiometry, find the required size of the same reactor type. 10
- Or
- State the advantages of fluidized bed reactor in place of fixed bed reactors. 10

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6. $10 \text{ m}^3/\text{hr}$ of gaseous feed contains A and B passes through an experimental reactor packed with 4 kg of catalyst.

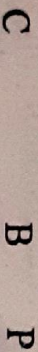
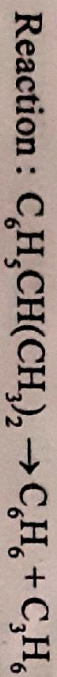
The stoichiometry and the rate is given by :



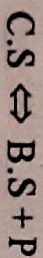
Find the conversion of reactants if the feed to the reactor contains 0.1 mol A/m^3 and 10 mol B/m^3 . 10

Or

The mechanism of decomposition of cumene on the catalyst surface is given by



Mechanism :



Where the last step represents Inhibitor present along with the feed, it gets attached with

(5)

the catalytic site and reduces the rate of reaction. Find the rate expression if surface reaction is the rate determining step. 10