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Total number of printed pages – 2

B. Tech
PCCH 4305

Sixth Semester Back Examination – 2015

CHEMICAL REACTION ENGINEERING

BRANCH : CHEM

QUESTION CODE : M 173

Full Marks – 70

Time : 3 Hours

*Answer Question No. 1 which is compulsory and any **five** from the rest.*

The figures in the right-hand margin indicate marks.

Assume suitable notations and any missing data wherever necessary.

1. Answer the following questions : 2 × 10
- (a) Differentiate between elementary and non-elementary reactions.
 - (b) Write down the significance of activation energy.
 - (c) Define a constant volume batch reactor with a suitable example.
 - (d) Write down the integrated rate equation for irreversible unimolecular type first order reaction.
 - (e) Define space velocity with a suitable example.
 - (f) Compare the performance equation of batch reactor with that of steady state mixed flow reactor.
 - (g) Mention the advantages of continuous reactor over batch reactor.
 - (h) Define residence time of a molecule in a reaction vessel.
 - (i) Differentiate between ideal and non-ideal flow in a reactor.
 - (j) Define ε_A in a variable volume batch reactor.

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2. (a) Devise a relationship between activation energy and rates known at two different temperatures T_1 and T_2 . 8
- (b) The rate constants of a certain reaction are 1.6×10^{-3} and $1.625 \times 10^{-2} \text{s}^{-1}$ at 10°C and 30°C . Calculate the activation energy. 2
3. (a) Step wise explain the integral method of analysis of reaction data. 7
- (b) Decomposition of a gas is of second order when initial concentration of gas is $5 \times 10^{-4} \text{mol/l}$. It is 40% decomposed in 50 minutes. Calculate the value of rate constant. 3
4. With a graphical representation derive and explain the performance equation for an ideal batch reactor for a constant and variable density system. 10
5. Substance A reacts according to second order kinetics and conversion is 95% from a single plug flow reactor. We buy a second unit identical to the first. For the same degree of conversion, by how much is the capacity increased if we operate these two units in parallel or in series ? 10
6. Give a qualitative discussion about the product distribution of parallel reactions. 10
7. With graphical representation derive and explain the relationship between F and E curves. 10
8. Write short notes on any **two** of the following : 5×2
- (a) Space time
- (b) Differential method of analysis
- (c) Transition state theory
- (d) Recycle reactor.
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