

(Following Paper ID and Roll No. to be filled in your Answer Books)

Paper ID : 2289925

Roll No.

B.TECH

Regular Theory Examination (Odd Sem - V) 2016 - 17 CHEMICAL REACTION ENGINEERING - I

Time : 3 Hours

Max. Marks : 100

Note: Attempt all questions.

Section - A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)

- A reaction has the stoichiometric equation $A+B=2R$. What is the order of reaction?
- Define Holding Time.
- Define Rate Constant.
- Write a short note on semi batch reactor.
- Define rate of reaction.
- Define space time and space velocity.
- Define Autocatalytic reaction.

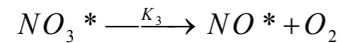
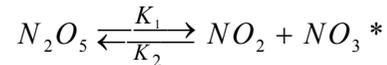
- Define activation energy.
- Give the design equation of PFR.
- Define expansion factor in a variable volume reactor.

Section - B

Note : Attempt any five questions from this section.
(5×10=50)

- The pyrolysis of ethane proceeds with an activation energy of about 300 kJ/mol. How much faster is the decomposition at 650C than at 500 C?
 - On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order.
- A rocket engine, burns a stoichiometric mixture of fuel (liquid hydrogen) in oxidant (liquid oxygen). The combustion chamber is cylindrical, 75 cm long and 60 cm in diameter, and the combustion process produces 108 kg/s of exhaust gases. If combustion is complete, find the rate of reaction of hydrogen and of oxygen.
 - Milk is pasteurized if it is heated to 63C for 30 min, but if it is heated to 74°C it only needs 15 s for the same result. Find the activation energy of this sterilization process.
- Derive the design equation for mixed flow reactor.
 - Explain the Half life method.

5. Discuss the performance and size comparison of plug flow reactor Vs mixed flow reactor for first order reaction.
6. Show that the following scheme



is consistent with, and can explain, the observed first-order decomposition of N_2O_5 .

7. A liquid reactant stream (1mol/lit) passes through two mixed flow reactors in series. The concentration of A in the exit of the first reactor is 0.5mol/lit. Find the concentration A in the exit of the second reactor. The reaction is second order with respect to A and $V_2/V_1=2$.
8. a) Show that N plug Flow Reactors in series with a total volume V give the same conversion as a single PFR of volume V.
- b) A reactor set up consisting of two parallel branches D and E. Branch D has a reactor of volume 80 liters and branch E has a reactor of volume 40 liters. What fraction of feed should go to these branches?
9. Explain the differential method of analyzing the kinetic data.

Section - C

Note : Attempt any two parts of the following:
(2×15=30)

10. Explain C, E and F curve.
11. What is effect of temperature and pressure on a single reaction? Also write a short note on optimal temperature progression.
12. Define RTD. Also explain tank in series model with neat diagram.