Total No. of Printed Pages:2

SUBJECT CODE NO:- H-320
FACULTY OF SCIENCE AND TECHNOLOGY
T.E. (Chemical) (Sem-I)
Chemical Reaction Engineering-I
[OLD]

[Time: Three Hours] **[Max. Marks:80]**

Please check whether you have got the right question paper.

N.B i) Q.No. 1& 6 are compulsory.
ii) Solve any two question from remaining of section A & B.
iii) State clearly any assumption made.

Section 'A'

Q.1 (a) Explain variable volume plug flow reactor. 05
(b) Why was the order of reaction need not be an integer? 05

Q.2 Estimate the volume of two mixed flow reactors and into plug floor reactors for the reaction given data below which is for a gas mixture containing 50% A & 50% inert at 10 atm. The gas mixture enters the reactor with flow rate of 0.600m^3/sec at 144°C. The reaction is carried out in two mix flow reactors & two plug flow reactors separately in series with 40% conversion in first rector & overall conversion 85% of the reactant A compare the result obtained & suggest suitable alternative. 15

X	0.0	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.85
-rA	0.0053	0.0052	0.0050	0.0045	0.0040	0.0033	0.0025	0.0018	0.00125	0.0010

Draw neat sketches for the reactor system indicating all inlet & outlet streams.

Q.3 The liquid phase reaction between trimethylamine (TMA) and n-propyl bromine (n.PB) is studied in a constant temperature bath at 137°C by immersing sealed glass tubes containing the reactants in the bath. Initial solutions of TMA, nPB in benzene, 02 molar are mixed and sealed in glass tube and placed in the constant temperature bath. After various intervals the tubes are cooled to stop the reaction and the contents analysed. Determine the order of reaction and specific reaction rate assuming the reaction is irreversible. Use both the differential method and integral method of analysis and compare the results obtained. Data available is 15

Run	Time (min)	Conversion
01	13.0	11.2
02	34.0	25.7
03	57.0	36.7
04	120.0	55.2

Q.4 (a) Detail out the qualitative discussion about product distribution for the decomposition of 08
A by either of the below given two paths A $\xrightarrow{K1}$ R (derived product) A $\xrightarrow{K2}$ S (underlined products)

b) Acetic anhydride hydrolysis in mixed flow reactor (MFR). The concentration of acetic anhydride at the start of the reaction is 0.4 mol/lit The degree of conversion desired is 65%. The feed rate to the reactor is 28.0 lit/min., large excess of water is used. The reaction rate constant is 0.4 min^{-1}. Calculate 07

i) Reaction volume of a single MFR.
ii) The reaction volume of a single PFR.
iii) The number of stages of a MFR whose total volume is close to that of PFR.

Q.5 (a) Explain in detail kinetics of series – parallel reaction. 08

(b) How is the optimum recycle for a reactor found? Discuss in detail by specific example. 07

Section B

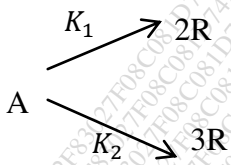
Q.6 (a) How is product distribution affected by temp. 05

(b) What is the best arrangement of a set of ideal reactors and why? 05

Q.7 Detail out the quantitative treatment of product distribution and of reactor size for multiple reactions, If rate equation are known for the individual reactions. 15

Q8 (a) Write a detailed note on search for a rate equation and explain the need and use of the search. 08

(b)



In an irreversible parallel reaction the fractional conversion of A is 80%. The space time is 15 sec. The reaction is carried out in liquid phase under isothermal conditions in tubular reactor. The rate expression in the two path are $(-rA_1) = K_1CA$ & $(-rA_2) = K_2CA$.

Calculate the values of specification reaction rate constantK_1& K_2. If the moles of R produced per mole of 85 produced is 3.5. 07

Q.9 Develop the isothermal performance equation for the reaction $A+B \underset{K_2}{\overset{K_1}{\rightleftharpoons}} R$ for the feed of A, B, R and inerts is an isothermal plug flow reactors. Also show with the relevant chemical reaction example how to test this equation for an equation and feed of A&B. 15

Q.10 (a) Show that the reaction between CO & Cl2 to form phosgene follows the rate law 08

$$\frac{d(cocl2)}{dt} = K.(Co)(Cl2)^{3/2}$$

(b) In vapor phase decomposition of hydrogen iodide (HI) the equilibrium value of fraction of HI decompose can be calculated as $X_{eq} = 0.138 + 7.2 \times 10^{-5}t + 2.6 \times 10^{-7}t^2$ where t is temperature ^{0}C.the initial concentration of HI is 0.024 gmole/Lit. The decomposition reaction is carried out at 321°C. Calculate the reaction rate constant for the forward and backward reaction HI decomposed was observed to be 0.83% after 23.5 min. 07