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B.TECH
PEBT5304

5th Semester Regular / Back Examination 2015-16
BIOCHEMICAL REACTION ENGINEERING
BRANCH: BIOTECH
Time: 3 Hours
Max Marks: 70
Q.CODE: T597

Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: **(2 x 10)**

a) What do you mean by performance equation?
b) What are the characteristic features of an ideal reactor?
c) Differentiate elementary and non-elementary reactions by giving one example of each.
d) The pyrolysis of ethane proceeds with an activation energy of about 75000 cal. How much faster is the decomposition at 650 ^{0}C than 500 ^{0}C?
e) Differentiate integral method and differential method of data analysis.
f) Differentiate heat of solution and heat of mixing.
g) Write the advantages of recycling.
h) On doubling the concentration of reactant the rate of reaction triples. Find the order of reaction.
i) Define limiting reactant and excess reactant.
j) Write the steps of solid catalyzed reaction.

Q2 **a)** Write the integral method of analysis for constant volume batch reactor operating at second order kinetics. **(5)**

b) After 8 min in a batch reactor, reactant is 80% converted and after 18 minutes the conversion is 90%. Find the rate expression for this reaction if C_{A0} =1 mol/lit. **(5)**

Q3 **a)** A feed to a fractionating column analyzes by weight 30% is benzene and rest is toluene. The analysis of the distillate shows 52 weight % benzene and 4% benzene in bottom product. Calculate the amount of distillate and bottom product per 1000 kg of feed per hour. Also calculate the % recovery of benzene. **(5)**

b) In production of SO_3, 100 kmol of SO_2 and 100 kmol of O_2 are fed to a reactor. If the % conversion of SO_2 is 80%, calculate the composition of the product stream on mole basis. **(5)**

Q4 . The catalytic reaction $A \rightarrow 4R$ is run at 3.2 atm and 117 ^{0}C in PFR which contains 0.01 kg catalyst and used as a feed consisting of partially converted product of 20 lit/hr of pure unreacted A The results **(10)**

are as follows

Run	1	2	3	4
C_{Ain}, mol/lit	0.1	0.08	0.06	0.04
$C_{Aout,}$mol/lit	0.084	0.07	0.055	0.038

Find the rate equation to represent this reaction

Q5 **a)** Gaseous reactant A decomposes as follows. **(5)**
$A \longrightarrow 3R$, $-r_A = 0.6\ min^{-1} C_A$
Find the space time and conversion of A in 50% A-50% inert feed having flow rate 180 lit/min and C_{A0}=300 mol/lit, to a 1 m^3 mixed flow reactor.

b) Write the advantages and disadvantages of fixed bed and fluidized bed reactor. **(5)**

Q6 **a)** Derive the kinetic expression for the competitive inhibition by a foreign substance **(5)**

b) Calculate the standard heat of formation of acetylene(C_2H_2), given that the standard heat of combustion of acetylene is -1299 kJ, the standard heat of combustion of carbon is -393.51 kJ and standard heat of formation of liquid water is -285.84 kJ. **(5)**

Q7 **a)** What are the different methods of evaluating the parameters In Michaelis-Menten equation. Derive those equations from it. **(5)**

b) Determine the Michaelis-Menten parameters v_m and K_m for the reaction **(5)**
Urea + Urease $\rightleftharpoons$ [Urea Urease] $\rightarrow$ 2 NH_3 + CO_2 + Urease
having rate constants k_1(forward), k_2(backward) and k_3 respectively. The rate of reaction is a function of Urea concentration as shown in the following table.

C_{urea},kmol/m^3	0.2	0.02	0.01	0.005	0.002
$-r_{urea}$,kmol/m3	1.08	0.55	0.38	0.2	0.09

Finally express the rate equation for the above.

Q8 Write short notes on any two: **(5 x 2)**

a) Immobilized cell bioreactor
b) Autocatalytic reaction
c) Phases of cell growth
d) Psychrometric chart