QP Code: RM23MTECH103 | Reg. No | | | | | | | | | | | AY 23

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (Second Semester) Examinations, May – 2024

MPCCH2052 – Advance Reaction Engineering

(Chemical)

Time: 3 Hrs | Maximum: 70 Marks

(The figures in the right hand margin indicate marks.)

PART – A **(2 x 10 = 20 Marks)**

Q.1. Answer all questions	CO#	Blooms Level
a. Experiment shows that the homogeneous decomposition of ozone proceeds with a rate $-r_{O3}= k [O_3]^2 [O_2]^{-1}$. What is the overall order of reaction?	CO1	K2
b. Calculate ε_A for a reaction A+ Inerts = 2R + Inerts, having 20% inerts in the reactant initially.	CO1	K3
c. On doubling the concentration of reactant, the rate of reaction triples. Find the reaction order	CO1	K3
d. Given the reaction $2NO_2 +1/2\ O_2 = N_2O_5$, what is the relation between the rates of formation and disappearance of the three reaction components?	CO2	K3
e. Draw the schematic graph of concentration vs time for zero order reaction.	CO1	K1
f. What are the design parameters for semi batch reactor?	CO1	K3
g. Differentiate space time and space velocity.	CO1	K2
h. How can you differentiate micro mixing and macro mixing?	CO1	K2
i. Write the expression for energy balance in a reactor.	CO1	K3
j. Define the terms yield and selectivity.	CO1	K1

PART – B **(10 x 5=50 Marks)**

Answer ***ANY FIVE*** questions

		Marks	CO#	Blooms Level
2. a.	Derive the performance equation of irreversible first order reaction for constant volume batch reactor. Show in the graph to calculate rate constant by using this equation.	5	CO1	K3
b.	Liquid A decomposes by second-order kinetics, and in a batch reactor 50% of A is converted in a 5-minute run. How much longer would it take to reach 75% conversion?	5	CO2	K3
3.a.	A rocket mixture burns a stoichiometric mixture of fuel (liquid hydrogen) in oxidant (liquid oxygen). The combustion chamber is cylindrical, 75cm long and 60 cm in diameter and the combustion process produces 108 kg /sec of exhaust gases. If the combustion is complete, find the rate of reaction of hydrogen and of oxygen.	5	CO3	K4
b.	The aqueous phase reaction A → R proceeds as follows:	5	CO2	K3

t (sec)	780	2080	3540	7200
X_A (%)	11.2	25.7	36.7	55.2

	Find the reaction rate constant and the order of reaction. Determine the time required for 50% conversion of A. Assume C_{Ao} = 0.05 mol / lit.			
4. a.	What are the design parameters for fixed bed reactor? Write it's design challenges.	5	CO3	K4
b.	What are the importance of multiple reactions and reaction networks and write their applications.	5	CO3	K2
5.a.	Write the steps for performing Wei-Prater analysis for first order reaction networks>	5	CO2	K2
b.	Write short notes on segregated flow model	5	CO3	K2
6. a.	Classify the heterogeneous reactions based on phases.	5	CO1	K2
b.	What are the different steps for mechanism of mass transfer in solid-gas chemical reaction?	5	CO3	K3
7.a.	In a batch reactor, reactant is 70% converted after 8 min and 90% converted after 18%. Find the rate expression to represent this reaction of C_{A0}= 1 mol/l.	5	CO2	K3
b.	Find the maximum time for C_{Rmax}, in a series reaction of A → R → S, with the rate constants for first order reactions K_1 and K_2 are 5 and 2 min-1 respectively.	5	CO2	K3
8. a.	Describe briefly about the different models for micromixing phenomena in reactors.	5	CO3	K2
b.	A first order reaction is to be treated in a series of two mixed reactors. Show that the total volume of the two reactors is minimum, when the reactors are equal in size.	5	CO3	K3

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