QP Code: RJ23MTECH043 | Reg. No | | | | | | | | | | | AY 23

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (First Semester) Examinations, January– 2024

MPECH1032 - Chemical Reactor Analysis

(Chemical Engineering)

Time: 3Hrs | 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. Determine ε_A for a reaction A+ Inerts = 2R + Inerts having 20% inerts in the reactant initially.	CO2	K2
b. State General form of Arrhenius equation.	CO1	K1
c. On doubling the concentration of reactant, the rate of reaction triples. Determine the reaction order.	CO3	K1
d. Differentiate space time and space velocity.	CO2	K2
e. What are the factors affecting the rate of reaction?	CO3	K2
f. What are C and E curves?	CO2	K1
g. For the complex reaction with stoichiometry $A + 3B \rightarrow 2R + S$, what is the relation between r_A, r_B, r_R.	CO4	K1
h. How can you differentiate micro mixing and macro mixing?	CO3	K2
i. What is effectiveness factor? Write its importance in cylindrical pore.	CO2	K2
j. Write the three steps of surface kinetics.	CO2	K1

PART – B **(10 x 5=50 Marks)**

Answer ***ANY FIVE*** questions	Marks	CO#	Blooms Level
2. a. A certain reaction has a rate given by -r, = $0.005C^2$, mol/cm^3.min. If the concentration is to be expressed in mol/liter and time in hours, what would be the value and units of the rate constant?	4	CO1	K1
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?	6	CO2	K2
3. Draw a neat sketch of semi-batch reactor and derive the semi-batch reactor modelling (reactant concentration) expression.	10	CO2	K2

4. a.	Derive the performance equation for irreversible second order bimolecular constant volume batch reactor.	4	CO4	K1
b.	Evaluate 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.	6	CO2	K2
5.a.	Derive the performance equation for plug flow reactor for variable volume with first order kinetics.	5	CO4	K2
b.	Derive the design equation of non-ideal plug flow reactors.	5	CO2	K3
6. a.	A first order reaction is to be treated in a series of two mixed reactors. Prove that the total volume of the two reactors is minimum, when the reactors are equal in size.	4	CO4	K2
b.	Draw a neat sketch of multi bed adiabatic reactor for SO3 production.	6	CO3	K2
7.a.	Differentiate between single site and dual site mechanism of surface reaction	4	CO4	K2
b.	Explain the mechanism of catalyst deactivation.	6	CO4	K1
8. a.	What are the different steps for mechanism of mass transfer in solid-gas chemical reaction?	4	CO2	K2
b.	Distinguish between batch and semi-batch reactors.	6	CO2	K1

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