PAPER ID-310759

Subject Code: KCH502

Roll No: | | | | | | | | | | | | | |

B. TECH.
(SEM-V) THEORY EXAMINATION 2020-21
CHEMICAL REACTION ENGINEERING - II

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

Q no.	Question	Marks	CO
a.	Explain homogeneous reaction with examples.	2	1
b.	Explain heterogeneous reaction with examples.	2	1
c.	What do you understand by kinetic regimes?	2	2
d.	Write the importance of Thiele modulus.	2	2
e.	Explain in brief, shrinking core model.	2	3
f.	How can you define the fluidized bed reactor?	2	3
g.	Write any two criteria of selecting right kind of reactor.	2	4
h.	Differentiate between fluid –fluid reactions and fluid solid reactions.	2	4
i.	Write the expression for plug flow fermenter.	2	5
j.	What are biochemical reactors?	2	5

SECTION B

2. Attempt any *three* of the following:

Q no.	Question	Marks	CO
a.	What do you mean by poisoning of a catalyst? Explain the mechanism in detail with an example.	10	1
b.	Describe the K-L modal for BFB reactor in detail.	10	2
c.	In the absence of pore diffusion resistance, a particular first-order gas phase reaction proceeds as below. $-r_A^m = 10^{-6}$ mol/cm^3 cat.s at $C_A = 10^{-5}$ mol/cm^3 at 1 atm and 400 ^{0}C.What size of spherical catalyst pellets ($D_e = 10^{-3}$ cm^3/cm cat.s) would ensure that pore resistance effects do not intrude to slow the rate of reaction?	10	3
d.	Liquid A decomposes in a batch reactor by zeroth order kinetics. The initial concentration of A is 0.5 kmol/m^3 and for a reaction time of 1200s, the conversion is 40%. Assume isothermal conditions. Determine the rate constant for this reaction.	10	4
e.	What is the role of cellubiose in the breakdown of cellulose (find the type of inhibition, and rate equation).	10	5

SECTION C

3. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Classify non-catalytic heterogeneous reactions illustrating industrial examples.	10	1
b.	What is the significance of surface area and pore size of a catalyst pellet? How can you estimate total surface area and active surface area of a supported catalyst?	10	1

4. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Derive the performance equation for BFB reactor assuming plug flow of gas through the bed.	10	2
b.	Develop an expression for the effectiveness factor for a straight cylindrical pore of length 2L. Both ends of the pore are open to reactant gas. A first order irreversible reaction, A → R course on the pore walls.	10	2

5. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Derive the equation $t/z = 1- (1-x_B)^{1/3}$ For shrinking core model when chemical reaction controls.	10	3
b.	In an experiment it was found that the time for a complete conversion for the given material was related to particle size as follows: $T \alpha R^{1.5}$ Particles remained as hard solids during reaction. A fluidized bed reactor was used for the conversion. The feed was of uniform size, τ = 20 min with mean residence time t = 60 min in the reactor. What fraction of material remains unconverted?	10	3

6. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
An irreversible homogeneous liquid phase reaction A → B+C, is carried out in two isothermal flow reactors of 100 liters capacity each operating at 60 ^{0}C. Find the exit conversion if both the reactors are operated in series, when;			
a.	Both the reactors are ideal plug flow reactors.	10	4
b.	An ideal plug flow reactor is followed by an ideal back mix reactor.	10	4

7. Attempt any *one* part of the following:

Q no.	Question	Marks	CO
a.	Write short note on; I. Microbial fermentation II. Polymerization reactors	10	5
b.	Substrate A and enzyme E flow through a mixed flow reactor (V=6lt.). From the entering and leaving concentrations and flow rate fond a rate equation to represent the action of enzyme on substrate.	10	5

C_{E0}, mol/lt	C_{A0}, mol/lt	C_A, mol/lt	v, lt/hr
0.02	0.2	0.04	3.0
0.01	0.3	0.15	4.0
0.001	0.69	0.60	1.2