Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–VII (NEW) EXAMINATION – WINTER 2020

Subject Code:2170501 **Date:19/01/2021**

Subject Name:Chemical Reaction Engineering - II

Time:10:30 AM TO 12:30 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

MARKS

Q.1 **(a)** Draw the figures for various ways of studying the flow pattern in vessels. **03**

(b) Explain: 1) Residence time distribution 2) Dirac delta function 3) Early mixing 4) Micro fluid **04**

(c) Explain Step experiment to study the RTD in non- ideal reactor. **07**

Q.2 **(a)** Discuss closed vessel boundary condition. **03**

(b) Derive the equation for E_Θ for single stirred tank reactor. **04**

(c) A sample of tracer was injected as a pulse to a reaction vessel and the effluent concentration was measured as a function of time resulting in following data If the reaction vessel is used to carry out liquid decomposition reaction with rate $-r_A = kC_A$, $k = 0.1\ min^{-1}$, Find the mean conversion. **07**

T, min	0	1	2	3	4	5	6	7	8	9	10	12	14
C, gm/ m^3	0	1	5	8	10	8	6	4	3	2.2	1.5	0.6	0

Q.3 **(a)** Write about C pulse curve. **03**

(b) What is Knudson equation? Explain the mechanism of solid catalyzed Gas phase reactions using LHHW model. **04**

(c) Derive BET equation for surface area of catalysts. **07**

Q.4 **(a)** Discuss the effect of Henry's constant value on the solubility of gas in liquid. **03**

(b) Write on 'Film conversion parameter'. **04**

(c) Define: 1) Catalysts 2) Promoters 3) Inhibitors 4) Poisons 5) Accelerator 6) Coking 7) Sintering **07**

Q.5 **(a)** Give examples for various fluid fluid reactions. **03**

(b) Draw diagram for various contacting pattern in two phase system **04**

(c) Air with gaseous A bubbles through a tank containing aqueous Reaction occurs as follows: **07**

A (g→l) + B (l) → R (l) $-r_A = kC_AC_B$ $k = 10\ m^3\ (mol^2.\ hr)$

For this system
$k_Ag\ a = 0.1$ mol/hr. m^3. Pa
$f_l = 0.01\ m^3$ liquid/m^3 reactor
$k_{Al}\ a = 100\ m^3$ liquid/m^3 reactor. hr
$H_A = 10^5$ Pa. m^3/mol, very low solubility
$D_{Al} = D_{Bl} = 10^{-6}\ m^2$/hr
$a = 100\ m^2/m^3$
For a point in the reactor where
$p_A = 100$ Pa and
$C_B = 1$ mol/m^3
For $M_H < 0.02$, we have infinitely slow reaction.

(a) calculate the rate of reaction (mol/m^3 hr)
(b) Resistance offered by the main body of liquid

Q.6	**(a)**	Write in detail about Progressive conversion model.	**03**
	(b)	Discuss the significance of Effectiveness factor for solid catalysed reaction.	**04**
	(c)	Discuss in brief about slurry reaction kinetics.	**07**
Q.7	**(a)**	Write about mean time and variance.	**03**
	(b)	Write the significance of Thiele Modulus.	**04**
	(c)	For chemical reaction controls, derive expression for relation for time required for unreacted core model for spherical particles of unchanging size. Also find time required for complete conversion.	**07**
Q.8	**(a)**	Give names for the different fluid particle contactors.	**03**
	(b)	Discuss about various types of nonideality exists in non-ideal flow reactors.	**04**
	(c)	Write in brief about catalysts deactivation.	**07**

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