Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER– VII EXAMINATION – SUMMER 2026

Subject Code:3170501 Date:01-06-2026

Subject Name:Chemical Reactions Engineering II

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Differentiate homogeneous and heterogeneous reactions with examples.	**03**
	(b)	Discuss steps involved in heterogeneous catalytic reactions.	**04**
	(c)	Discuss Catalysts with its broad classification.	**07**
Q.2	**(a)**	With proper sketches illustrate various contacting patterns for two flowing fluids.	**03**
	(b)	Explain the mechanism of solid catalyzed Gas phase reactions using Langmuir-Hinshelwood-Hougen-Watson (LHHW) model.	**04**
	(c)	Define internal effectiveness factor and develop an expression for the same considering diffusion and reaction of reactant A through a single cylindrical catalyst pore. Assume first order reaction.	**07**
		OR	
	(c)	Discuss the method of catalyst's surface area determination.	**07**
Q.3	**(a)**	Give examples for various fluid fluid reactions.	**03**
	(b)	Discuss film conversion parameters in detail.	**04**
	(c)	Air with gaseous A bubbles through a tank containing aqueous Reaction occurs as follows:	**07**

$A\ (g \rightarrow l) + B\ (l) \rightarrow R\ (l) \quad -r_A = kC_AC_B \quad k = 10^6\ m^3\ (mol.\ hr)$

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
$H_A = 10^4$ 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
$C_B = 100$ mol/m^3

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

OR

Q.3	**(a)**	Give reason for the statement. "Effective temperature control of large fixed beds can be difficult".	**03**

(b) Dilute A diffuses through a stagnant liquid film onto a plane surface consisting of B, reacts there to produce R which diffuses back into the mainstream. Develop the overall rate expression for the liquid solid (L/S) reaction A(1) + B **(s)** → R(1) **04**

(c) State various experimental methods for finding rates in solid catalyzed reaction. **07**

Q.4 **(a)** Enlist the criteria for selection of a good contactor depends for gas liquid (G/L) reactions. **03**

(b) Discuss catalysts poisons and reactivation. **04**

(c) With neat sketches enlist various types of catalytic reactors. **07**

OR

Q.4 **(a)** Discuss Trickle bed reactor in brief. **03**

(b) Discuss the importance of solubility data for determination of kinetic regime for fluid – fluid reaction. **04**

(c) Discuss the resistances involved in the *G/L* reaction on a catalyst surface with sketch. **07**

Q.5 **(a)** Discuss catalyst's promoters and inhibitors with example. **03**

(b) Explain Progressive Conversion Model for fluid particle reaction. **04**

(c) Derive rate equation for slow reaction with respect to mass transfer. **07**

OR

Q.5 **(a)** Give examples of fluid solid reactions in which solid does not appreciably change in size during reaction. **03**

(b) Discuss in brief about fluidised bed reactor. **04**

(c) Uniform-sized spherical particles UO_3 are reduced to UO_2 in a uniform environment with the following results: **07**

T, hr	0.180	0.347	0.453	0.567	0.733
X_B	0.45	0.68	0.80	0.95	0.98

If reaction follows the Shrinking Core Model (SCM), find the rate controlling mechanism and a rate equation to represent this reaction.

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