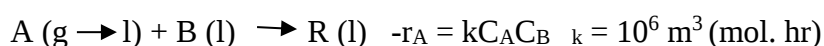


GUJARAT TECHNOLOGICAL UNIVERSITY**BE- SEMESTER- VII EXAMINATION – SUMMER 2026****Subject Code:3170501****Date:01-06-2026****Subject Name:Chemical Reactions Engineering II****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

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	
Q.3	(c) Discuss the method of catalyst's surface area determination.	07
	(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



For this system

$$k_{Ag} a = 0.1 \text{ mol/hr. m}^3. \text{ Pa}$$

$$f_l = 0.01 \text{ m}^3 \text{ liquid/m}^3 \text{ reactor}$$

$$k_{Al} a = 100 \text{ m}^3 \text{ liquid/m}^3 \text{ reactor. hr}$$

$$H_A = 10^4 \text{ Pa. m}^3/\text{mol, very low solubility}$$

$$D_{Al} = D_{Bl} = 10^{-6} \text{ m}^2/\text{hr}$$

$$a = 100 \text{ m}^2/\text{m}^3$$

For a point in the reactor where,

$$p_A = 100 \text{ Pa and}$$

$$C_B = 100 \text{ mol/m}^3$$

(a) calculate the rate of reaction ($\text{mol/m}^3 \text{ hr}$)**(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
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- (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 $A(1) + B(s) \rightarrow R(1)$ **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.
