Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – WINTER 2023

Subject Code:3170501 Date:12-12-2023

Subject Name: Chemical Reactions Engineering II

Time: 10:30 AM TO 01:00 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)**	What is heterogeneous reaction? Give example of heterogeneous reactions.	**03**
	(b)	Give classification of catalysts.	**04**
	(c)	Discuss in detail about nature and mechanism of catalytic reactions.	**07**
Q.2	**(a)**	Explain stokes' regime in fluid particle reaction system.	**03**
	(b)	Discuss the effect of time for determination of rate controlling step for fluid solid reactions.	**04**
	(c)	Establish the rate equation for straight mass transfer (i.e. physical absorption of A based on the two film theory). Also draw surface and boundaries plot for the same.	**07**
		OR	
	(c)	Discuss slurry reaction kinetics in detail.	**07**
Q.3	**(a)**	Give brief about trickle bed reactor.	**03**
	(b)	Explain effectiveness factor for solid catalyzed reactions.	**04**
	(c)	Calculate the time needed to burn to completion particles of graphite (R, = 5 mm, ρ_B = 2.2 gm/cm^3, k" = 20 cm/sec) in an 8% oxygen stream. For the high gas velocity used assume that film diffusion does not offer any resistance to transfer and reaction. Reaction temperature = 900°C. (wt. C = 12) C (s) + O_2 (g) $\longrightarrow$ CO_2 (g)	**07**
		OR	
Q.3	**(a)**	Give examples for fluid-fluid reactions.	**03**
	(b)	Explain liquid film enhancement factor (E) is plotted against Hatta modulus (M_H) as a function of Ei.	**04**
	(c)	Derive LHHW (Langmuir-Hinshelwood-Hougen-Watson) model with surface reaction as the rate controlling mechanism for the reaction A $\rightleftarrows$ R.	**07**
Q.4	**(a)**	Explains the steps occur in shrinking core model (SCM).	**03**
	(b)	Discuss the effect of Henry's constant value on the solubility of gas in liquid.	**04**
	(c)	Give difference between fixed bed and fluidized bed reactor.	**07**
		OR	
Q.4	**(a)**	Give examples of fluid solid reaction.	**03**
	(b)	Discuss factors to consider in selecting a fluid fluid contactor.	**04**
	(c)	Discuss about determination of surface area for catalysts.	**07**

Q.5	**(a)**	Explain accelerators and promoters in detail.	**03**
	(b)	Explain turn over frequency and Effectiveness factor for catalysts.	**04**
	(c)	For a diffusion through Ash layer control, 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**

OR

Q.5	**(a)**	Write in brief about catalysts deactivation.	**03**
	(b)	Give details about Monolayer & Multilayer adsorption.	**04**
	(c)	A feed consisting 30% of 50-pm-radius particles 40% of 100-pm-radius particles 30% of 200-pm-radius particles is to be reacted in a fluidized-bed steady-state flow reactor constructed from a vertical 2-m long 20-cm ID pipe. The fluidizing gas is the gas-phase reactant, and at the planned operating conditions the time required for complete conversion is 5,10, and 20 min for the three sizes of feed. Find the conversion of solids in the reactor for a feed rate of 1 kg solids/min if the bed contains 10 kg solids.	**07**

****