GUJARAT TECHNOLOGICAL UNIVERSITY

BE 7 SEMESTER – OLD PAPER – SUMMER 2022 TO SUMMER 2026 – QUESTION BANK

Subject Name & Code: Chemical Reactions Engineering II - 3170501

Chapter 1: Heterogeneous Reactions: Rate Steps, Overall Rate Expressions, Contacting Patterns

Repeated Questions:

1. Contacting Patterns:

- **Q.** With proper sketches illustrate various contacting patterns for two flowing fluids / two-phase systems. [Diagram required – refer to the original question paper] **(SUMMER 2024, 3 Marks; SUMMER 2026, 3 Marks)**

Other Important Questions:

1. Heterogeneous Reactions – Examples and Differences:

- **Q.** Enlist three examples for both catalytic heterogeneous reactions & non-catalytic heterogeneous reactions. **(SUMMER 2023, 3 Marks)**
- **Q.** What is heterogeneous reaction? Give example of heterogeneous reactions. **(WINTER 2023, 3 Marks)**
- **Q.** Differentiate homogeneous and heterogeneous reactions with examples. **(SUMMER 2026, 3 Marks)**

Chapter 2: Fluid-Fluid Systems: Rate Equations, Kinetic Regimes, Film Conversion Parameter, Reactor Design

Repeated Questions:

1. Rate Equations and Film Theory:

- **Q.** Derive / establish the rate equation for straight mass transfer / physical absorption based on the two-film theory; also draw surface and boundary plots where asked. [Diagram required – refer to the original question paper] **(SUMMER 2022; WINTER 2023, 7 Marks)**
- **Q.** Derive the rate expression/rate equation for a fluid-fluid / gas-liquid non-catalytic reaction with gas film as the rate-controlling step. **(WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks)**

2. Kinetic Regimes, Hatta Number and Film Conversion Parameter:

- **Q.** Discuss/explain the significance of Hatta number / Hatta modulus (with Enhancement factor where asked). **(SUMMER 2023, 3 Marks; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks)**
- **Q.** Discuss the importance/significance of solubility data for determination of kinetic regime for fluid-fluid reactions. **(SUMMER 2022, 3 Marks OR; SUMMER 2023, 3 Marks OR; WINTER 2025, 4 Marks; SUMMER 2026, 4 Marks OR)**
- **Q.** What is film conversion parameter? State various criteria used in the study of fluid-fluid reactions / discuss film conversion parameters. **(SUMMER 2023, 7 Marks; SUMMER 2026, 4 Marks)**

3. Fluid-Fluid Reactions and Contactors:

- **Q.** Give examples of various fluid-fluid reactions / three examples of heterogeneous fluid-fluid reactions. **(SUMMER 2022, 3 Marks; WINTER 2023, 3 Marks OR; WINTER 2024, 3 Marks OR; SUMMER 2026, 3 Marks)**
- **Q.** State various types of tower and tank contactors for gas-liquid reactions. **(WINTER 2022, 3 Marks OR; WINTER 2025, 3 Marks OR)**
- **Q.** Discuss factors/criteria for selecting a fluid-fluid contactor. **(WINTER 2023, 4 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 3 Marks)**
- **Q.** Explain salient features / selection / comparison of packed column, tray column, and agitated tank contactors for fluid-fluid heterogeneous reactions. [Diagram required – refer to the original question paper] **(WINTER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 3 Marks; SUMMER 2025, 4 Marks; SUMMER 2025, 3 Marks OR; SUMMER 2025, 4 Marks OR)**

4. Numericals:

- **Q.** Hydrogen sulfide is absorbed by a solution of methanolamine (MEA) in a packed column — calculate rate of absorption / enhancement factor and compare with pure water. [Data truncated in source – refer to the original question paper] [Diagram required – refer to the original question paper] **(WINTER 2022, 7 Marks; WINTER 2024, 7 Marks)**
- **Q.** It is proposed to remove CO_2 from air by countercurrent contact with water — calculate resistances offered by gas and liquid film and suggest simplest form of rate equation for tower design. **(WINTER 2022, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Gaseous A absorbs and reacts with B in liquid in a packed bed/absorber — calculate rate of reaction, locate major resistance, determine behaviour in liquid film / reaction zone. [Data truncated in source – refer to the original question paper] [Diagram required – refer to the original question paper] **(SUMMER 2023, 7 Marks; SUMMER 2025, 7 Marks; SUMMER 2026, 7 Marks)**

Other Important Questions:

1. Rate Equations and Kinetic Regimes:

- **Q.** Derive the rate equation for a fast reaction with low concentration of liquid reactant in fluid-fluid reaction. **(SUMMER 2023, 4 Marks)**

- **Q.** Derive the rate equation for a fast reaction with high concentration of liquid reactant B in fluid-fluid reaction. **(SUMMER 2024, 4 Marks OR)**
- **Q.** Derive the rate equation for fluid-fluid reaction in the case of instantaneous irreversible reaction with higher concentration of constituent B. **(SUMMER 2022, 7 Marks)**
- **Q.** Derive rate equation for slow reaction with respect to mass transfer. **(SUMMER 2026, 7 Marks OR)**
- **Q.** Explain liquid film enhancement factor E plotted against Hatta modulus M_H as a function of E_i. **(WINTER 2023, 4 Marks)**
- **Q.** Discuss different kinetic regimes for fluid-fluid systems. **(WINTER 2025, 4 Marks)**
- **Q.** Discuss eight special cases of non-catalytic fluid-fluid heterogeneous reactions. **(WINTER 2024, 7 Marks OR)**
- **Q.** Discuss Segregation model in brief. **(SUMMER 2022, 4 Marks OR)**

2. Contacting Schemes and Contactors:

- **Q.** Give name of the type of reactor used for fluid-fluid reactions. **(SUMMER 2022, 3 Marks)**
- **Q.** How can Hatta number be used to decide the type of contacting device for fluid-fluid reactions? **(SUMMER 2022, 4 Marks)**
- **Q.** The four p_A versus C_A sketches represent various possible ideal contacting schemes of gas with liquid. Sketch the contacting scheme for straight physical absorption corresponding to operating lines XY shown. [Diagram required – refer to the original question paper] **(SUMMER 2024, 7 Marks)**
- **Q.** Discuss steps to determine the volume of reactor for mass transfer and reaction in an agitated tank contactor for mixed flow of gas and liquid. **(WINTER 2022, 3 Marks)**
- **Q.** Discuss resistances involved in G/L reaction on a catalyst surface with sketch. [Diagram required – refer to the original question paper] **(SUMMER 2026, 7 Marks OR)**

3. Numericals:

- **Q.** Air with gaseous A bubbles through a tank containing aqueous B; reaction $A_{(g-l)} + 2B_{(l)} \rightarrow R_{(l)}$, $-r_A = kC_AC_B$. Locate resistance to reaction, locate reaction zone, determine behaviour in liquid film, calculate rate of reaction. [Data truncated in source – refer to the original question paper] **(SUMMER 2024, 7 Marks OR)**
- **Q.** CO_2 absorption into an alkaline buffered solution of K_2CO_3 and $KHCO_3$ — find fraction of entering CO_2 absorbed. [Data truncated in source – refer to the original question paper] **(SUMMER 2025, 7 Marks OR)**

Chapter 3: Fluid-Particle Systems: SCM/PCM, Rate-Controlling Steps, Design

Repeated Questions:

1. Rate-Controlling Step and Time Calculations (Numericals):

- **Q.** Determine the rate-controlling mechanism from SCM conversion/core-size data. [Data truncated in source – refer to the original question paper] [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks; WINTER 2024, 7 Marks; WINTER 2025, 7 Marks OR; SUMMER 2026, 7 Marks OR)**
- **Q.** Spherical particles of zinc blende / zinc sulfide are roasted in an 8% oxygen stream — calculate time for complete conversion and relative resistance of ash layer diffusion. [Data truncated in source – refer to the original question paper] **(WINTER 2022, 7 Marks OR; SUMMER 2024, 7 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Calculate the time needed to burn to completion graphite particles in an oxygen stream. [Data truncated in source – refer to the original question paper] **(SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks)**

2. SCM / PCM – Derivations and Concepts:

- **Q.** Derive/show the ash-layer-diffusion-controlled SCM rate/time expression for spherical or slab particles. **(WINTER 2022, 7 Marks; WINTER 2023, 7 Marks; WINTER 2024, 7 Marks)**
- **Q.** Discuss SCM / PCM / Progressive Conversion Model — steps, concentration profiles, schematic diagrams, limitations. [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 7 Marks; SUMMER 2026, 4 Marks)**
- **Q.** Dilute A diffuses through a stagnant liquid film onto a plane surface consisting of B, reacts to produce R which diffuses back — derive overall rate expression for L/S reaction $A_{(l)} + B_{(s)} \rightarrow R_{(l)}$. **(SUMMER 2024, 4 Marks; SUMMER 2026, 4 Marks OR)**

3. Fluid-Solid Reactions – Examples, Experiments and Model Selection:

- **Q.** Give examples of fluid-particle / fluid-solid reactions, including non-catalytic reactions and reactions where solid does not appreciably change in size. **(SUMMER 2022, 4 Marks; WINTER 2022, 3 Marks; WINTER 2023, 3 Marks OR; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 3 Marks OR)**
- **Q.** Analyze/discuss the role of time, temperature and particle size for experimentally determining the rate-controlling step of a fluid-particle noncatalytic reaction. **(WINTER 2023, 4 Marks; SUMMER 2024, 4 Marks OR)**
- **Q.** Discuss/select a suitable model for fluid-particle reactions for different situations. **(SUMMER 2024, 4 Marks; SUMMER 2025, 4 Marks)**

Other Important Questions:

1. Theory and Derivations:

- **Q.** Explain Stokes' regime in fluid-particle reaction system. **(WINTER 2023, 3 Marks)**
- **Q.** Sketch the concentration profile for gas-solid non-catalytic reaction in which resistance through the ash layer is rate controlling. [Diagram required – refer to the original question paper] **(SUMMER 2023, 4 Marks OR)**
- **Q.** Draw a plot showing progress of reaction of a single spherical particle of constant size with surrounding fluid measured in terms of time for complete conversion for all different resistances. [Diagram required – refer to the original question paper] **(SUMMER 2024, 3 Marks OR)**
- **Q.** Gaseous reactant A diffuses through a gas film and reacts on the surface of a solid according to a reversible first-order rate; develop expression for rate of reaction accounting for both mass transfer and reaction steps. **(SUMMER 2023, 7 Marks)**

- **Q.** An instantaneous reaction takes place between gas A and spherical solid B giving solid product S and gaseous product R; show flux expression $Q_{AS} = D_e r_e(C_{Ag} - C_{Ae}) / [R(R - r_e)]$ and simplify when reaction goes to completion. **(WINTER 2022, 7 Marks)**
- **Q.** Derive the time-conversion-radius relationship for shrinking-core model for spherical particles of unchanging size when chemical reaction controls. **(WINTER 2025, 7 Marks)**

2. Numericals:

- **Q.** Solids of unchanging size, R = 0.3 mm, are reacted with gas in a steady flow bench scale fluidized reactor; design a commercial-sized fluidized bed reactor (find W) to treat 4 metric tons/hr of solid feed to 90% conversion. [Data truncated in source – refer to the original question paper] **(WINTER 2024, 7 Marks)**
- **Q.** If $\tau/t = 1/3$, find average conversion for a particle B of constant size in a mixed flow reactor for chemical reaction controlling. **(SUMMER 2023, 4 Marks)**
- **Q.** In a uniform environment 4 mm solid particles are 87.5% converted to product in 5 min; solids unchanged in size and ash diffusion step is rate controlling. What mean conversion is obtainable in a fluidized bed reactor operating with ...? [Data truncated in source – refer to the original question paper] **(SUMMER 2023, 7 Marks OR)**
- **Q.** In a gas-phase environment, particles of B are converted to solid product according to SCM with reaction control and time for complete conversion of 1 hr; design a fluidized bed to treat 1 ton/hr solids to 90% conversion using stoichiometric feed of A; find weight of solids if gas is mixed flow. [Diagram required – refer to the original question paper] **(SUMMER 2024, 7 Marks)**
- **Q.** A solid feed consisting of 20 wt% of 1-mm particles and smaller, 30 wt% of 2-mm particles, 50 wt% of 4-mm particles passes through a rotating tubular reactor; SCM reaction control, T = 4 h for 4-mm particles. Find residence time needed for 100% conversion and mean conversion for residence time of 15 min. [Data truncated in source – refer to the original question paper] **(SUMMER 2025, 7 Marks)**
- **Q.** A feed consisting of 30% 50-µm, 40% 100-µm, 30% 200-µm radius particles is to be reacted in a fluidized-bed steady-state flow reactor; find conversion for feed rate 1 kg/min if bed contains 10 kg solids. [Data truncated in source – refer to the original question paper] **(WINTER 2023, 7 Marks OR)**

Chapter 4: Introduction to Catalysis: Properties, Classification, Preparation, Promoters/Inhibitors/Poisons

Repeated Questions:

1. Classification and Properties of Catalysts:

- **Q.** Discuss/explain classification of catalysts / broad classification of catalysts. **(WINTER 2023, 4 Marks; WINTER 2025, 3 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Discuss various physical properties of catalyst. **(SUMMER 2022, 3 Marks OR; WINTER 2025, 3 Marks)**
- **Q.** Explain monolithic catalyst / molecular sieves. **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks; WINTER 2025, 3 Marks)**

2. Catalyst Preparation:

- **Q.** Discuss various methods of catalyst preparation / name methods and explain any one in detail. **(SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks OR; SUMMER 2023, 4 Marks; SUMMER 2024, 4 Marks; WINTER 2025, 7 Marks)**
- **Q.** Discuss sol-gel method for heterogeneous catalyst preparation / generalized sol-gel method to synthesize solid nano-catalyst. **(WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks)**

3. Promoters, Inhibitors and Poisons:

- **Q.** Discuss/define the role of catalyst promoters, inhibitors, poisons (and reactivation where asked). **(SUMMER 2022, 4 Marks; WINTER 2022, 7 Marks; SUMMER 2023, 3 Marks; SUMMER 2024; WINTER 2024, 3 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 4 Marks; SUMMER 2026; SUMMER 2026, 3 Marks)**

4. Characterization and Performance of Catalysts:

- **Q.** Discuss surface area determination of catalysts / BET equation / nitrogen desorption / mercury penetration method. [Data truncated in source – refer to the original question paper] [Diagram required – refer to the original question paper] **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks OR; SUMMER 2023, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 7 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 4 Marks; SUMMER 2026, 7 Marks OR)**
- **Q.** Discuss XRD, SEM and TPD analysis in characterization of catalyst. **(WINTER 2024, 7 Marks; SUMMER 2025, 3 Marks)**
- **Q.** Explain turn over frequency and selectivity / effectiveness factor for catalysts. **(SUMMER 2022, 3 Marks; WINTER 2023, 3 Marks)**

Other Important Questions:

1. Catalysts – Role, Properties and Applications:

- **Q.** What is the role of catalysts in reaction system? How will it enhance the rate of reaction? **(SUMMER 2022, 3 Marks)**
- **Q.** Discuss advantages and disadvantages of solid heterogeneous catalysts. **(WINTER 2024, 3 Marks)**
- **Q.** What are the carriers or supports used and why are they used with catalyst? Name the three categories of industrial catalysts. **(SUMMER 2023, 3 Marks)**
- **Q.** Suggest suitable heterogeneous catalyst used in Petrochemical/Petroleum Refining, Polymerisation and Bulk Chemical industries. **(SUMMER 2025, 3 Marks)**
- **Q.** Define: (i) Catalyst (ii) Promoter (iii) Inhibitor (iv) Carrier (v) Accelerator (vi) selectivity. **(SUMMER 2024)**
- **Q.** Discuss in detail the nature and mechanism of catalytic reactions. **(WINTER 2023, 7 Marks)**

2. Catalyst Preparation and Deactivation:

- **Q.** Discuss catalyst preparation through wet impregnation method. **(WINTER 2024, 3 Marks OR)**

- **Q.** Write in brief about catalyst deactivation. **(WINTER 2023, 3 Marks OR)**

Chapter 5: Solid-Catalyzed Reactions: Adsorption, Kinetics, Pore Diffusion, Experimental Methods

Repeated Questions:

1. Effectiveness Factor, Thiele Modulus and Pore Diffusion:

- **Q.** Discuss/define effectiveness factor and its significance (including interphase effectiveness factor where asked). **(SUMMER 2022, 3 Marks; WINTER 2022, 3 Marks OR; SUMMER 2023, 3 Marks OR; WINTER 2023, 4 Marks; SUMMER 2024, 3 Marks; SUMMER 2025, 3 Marks OR)**
- **Q.** Define/discuss Thiele modulus and its significance. **(SUMMER 2023, 3 Marks OR; SUMMER 2024, 4 Marks; WINTER 2024, 4 Marks OR; SUMMER 2025, 3 Marks; WINTER 2025, 4 Marks)**
- **Q.** Discuss concept/role of pore diffusion in solid-catalyzed reactions. **(SUMMER 2023, 3 Marks OR; WINTER 2024, 3 Marks; WINTER 2024, 4 Marks; SUMMER 2025, 4 Marks)**

2. Adsorption and Reaction Mechanism:

- **Q.** Adsorption isotherms / Langmuir adsorption / desorption / monolayer and multilayer adsorption / van der Waals versus activated adsorption. **(SUMMER 2022, 7 Marks OR; WINTER 2022, 3 Marks OR; WINTER 2022, 4 Marks OR; SUMMER 2023, 7 Marks; WINTER 2023, 4 Marks OR; WINTER 2025, 4 Marks)**
- **Q.** Discuss steps involved in solid-catalyzed fluid-phase reactions / mechanism of solid-catalyzed reactions. **(WINTER 2022, 4 Marks; SUMMER 2023; SUMMER 2024; WINTER 2025, 3 Marks; SUMMER 2026, 4 Marks)**

3. Experimental Methods and Rate Laws:

- **Q.** Experimental methods / experimental reactors for solid-catalyzed reactions and for finding rates/rate laws. **(SUMMER 2022, 7 Marks; WINTER 2022, 7 Marks; WINTER 2024, 7 Marks; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 7 Marks)**
- **Q.** Determine/suggest a rate law and/or mechanism consistent with experimental data. [Diagram required – refer to the original question paper] **(WINTER 2022, 4 Marks; SUMMER 2024, 7 Marks; SUMMER 2024, 7 Marks OR; SUMMER 2025, 7 Marks OR)**

Other Important Questions:

1. Theory:

- **Q.** Which of the following constants is a type of equilibrium constant? a) Association constant b) Solubility c) Decay constant d) Dissociation constant. **(SUMMER 2023, 4 Marks)**
- **Q.** Define internal effectiveness factor and develop an expression considering diffusion and reaction of reactant A through a single cylindrical catalyst pore; assume first-order reaction. **(SUMMER 2026, 7 Marks)**
- **Q.** Justify: For a given treatment rate, the conversion of a reacting fluid flowing through a batch of deactivating catalyst decreases with time during the run. **(SUMMER 2023, 7 Marks)**

2. Numericals:

- **Q.** A first-order catalytic reaction $A_{(l)} \rightarrow R_{(l)}$ is run in a long, narrow vertical reactor with upflow of liquid through a fluidized bed of catalyst particles; conversion is 95% at start with 5-mm particles; after shrinking to 3-mm spheres, what is conversion? Consider (i) no pore diffusion resistance and (ii) strong pore diffusion resistance. **(WINTER 2024, 4 Marks)**
- **Q.** Cl_2 is removed from a waste stream by passing effluent gas over a solid granular absorbent in a tubular PBR; presently 63.2% removed and reaction is external diffusion limited. If flow rate increased by factor 4, particle diameter decreased by factor 3, tube length increased by 1.5×, what percentage of Cl_2 would be removed? What guidelines (T, C_A, u) do you propose? **(SUMMER 2024, 7 Marks)**

- **Q.** The catalytic reaction A → 4R is run at 3.2 atm and 117°C in a plug flow reactor containing 0.01 kg catalyst; find a rate equation from the given table. [Diagram required – refer to the original question paper] **(SUMMER 2024, 7 Marks OR)**
- **Q.** The first-order decomposition of A is run in an experimental mixed flow reactor; find role played by pore diffusion — diffusion-free, strong resistance, or intermediate conditions. [Diagram required – refer to the original question paper] **(SUMMER 2025, 4 Marks)**
- **Q.** Gaseous A reacts in an experimental plug flow reactor; from conversion data find a rate equation. [Diagram required – refer to the original question paper] **(SUMMER 2025, 7 Marks OR)**
- **Q.** The catalytic reaction A → B takes place within a fixed bed containing spherical porous catalyst X22; figure shows overall rates versus temperature for various entering total molar flow rates. Answer whether reaction is limited by external diffusion, reaction-rate-limited, internal diffusion; determine overall effectiveness factor at 360 K for F_{TO} = 10 gmol/h; estimate internal effectiveness factor at 367 K. [Diagram required – refer to the original question paper] **(SUMMER 2024, 7 Marks OR)**

Chapter 6: Catalytic Reactions, LHHW Model, Catalytic Reactors

Repeated Questions:

1. LHHW Kinetic Model:

- **Q.** Derive/explain/discuss the LHHW (Langmuir–Hinshelwood–Hougen–Watson) kinetic model, including assumptions and surface reaction as rate-controlling step. **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks; SUMMER 2024; WINTER 2024, 7 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 4 Marks)**

2. Slurry and Trickle Bed Reactors:

- **Q.** Discuss/derive slurry reactor kinetics / write short note on slurry reactors. **(SUMMER 2022, 7 Marks; WINTER 2022, 4 Marks; SUMMER 2023, 4 Marks; WINTER 2023, 7 Marks OR; WINTER 2025, 7 Marks)**
- **Q.** Write short note / discuss salient features of trickle bed reactor. **(WINTER 2022, 4 Marks OR; WINTER 2023, 3 Marks; SUMMER 2024, 3 Marks OR; WINTER 2024, 3 Marks OR; WINTER 2025, 4 Marks; SUMMER 2026, 3 Marks OR)**

3. Fixed Bed, Fluidized Bed and Packed Bed Catalytic Reactors:

- **Q.** Discuss working / salient features / advantages and disadvantages / applications of fluidized bed reactor and compare with fixed bed reactor. **(SUMMER 2022, 7 Marks; WINTER 2023, 7 Marks; SUMMER 2024, 4 Marks OR; WINTER 2024, 4 Marks OR; SUMMER 2025, 4 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 4 Marks OR)**
- **Q.** Write merits and demerits of fixed bed reactors / distinguish fixed bed and fluidized bed reactors / discuss effective temperature control of large fixed beds. **(WINTER 2022, 4 Marks; WINTER 2023, 7 Marks; WINTER 2025, 7 Marks; SUMMER 2026, 3 Marks OR)**
- **Q.** Derive design/performance equations for packed bed catalytic reactor containing porous catalysts / solve packed bed catalytic reactor numerical. **(WINTER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks)**
- **Q.** With neat sketches enlist various types of catalytic reactors / draw schematic diagram of industrial fixed bed catalytic reactors with heat removal arrangements. [Diagram required – refer to the original question paper] **(SUMMER 2025, 3 Marks OR; SUMMER 2026, 7 Marks OR)**

Other Important Questions:

1. Kinetics and Mass Transfer:

- **Q.** State mass transfer correlations for fluidized bed catalytic reactor. **(WINTER 2022, 3 Marks)**
- **Q.** Write algorithm for determining reaction mechanism, rate limiting step and rate law for isomerization of n-pentene to i-pentene over alumina as catalyst. **(WINTER 2022, 4 Marks OR)**
- **Q.** The decomposition of cumene is carried out over platinum catalyst to form benzene and propylene. Draw a conceptual model depicting the sequence of steps in this reaction and derive the rate law if surface reaction is rate limiting. [Diagram required – refer to the original question paper] **(WINTER 2025, 7 Marks OR)**

****