Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL – MAY 2025

Seventh Semester

Chemical Engineering

CH3701 - Chemical Reaction Engineering - II

Regulations - 2021

Duration : 3 Hrs ***Maximum : 100 Marks***

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	When a gas and solid are reacting with each other, the products may be in gas, solid or mixture of gas and solid phases. Specify an example with stoichiometric equation, for gas-solid reaction that gives products in the form of gas phase alone.	L2	1	2
2.	Pictorially represent the progressive conversion model and indicate the concentration profile of the reaction particle with respect to its radius.	L2	1	2
3.	Mention the specific role of catalyst in a catalytic reaction.	L1	2	2
4.	Distinguish between monolayer and multilayer adsorption.	L2	2	2
5.	Write the various steps involved in the solid catalyzed gas-phase heterogeneous reaction.	L1	3	2
6.	Define the term Eley-Rideal mechanism and give an example.	L1	3	2
7.	Distinguish between bulk diffusivity and Knudsen diffusivity for diffusion in porous solids.	L2	4	2
8.	How does the porosity of the solid affect the thermal conductivity of the porous solid? Write the formula for finding the effective thermal conductivity in porous solid.	L2	4	2
9.	Give an example for fluid-fluid reaction and write its stoichiometric equation and rate equation.	L1	5	2
10.	List any two important factors considered for choosing the contactors for gas-liquid reaction.	L1	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	A feed consisting: 30% of 50-pm-radius particles 40% of 100-pm-radius particles 30% of 200-pm-radius particles is to be fed continuously in a thin layer onto a moving grate crosscurrent to a flow of reactant gas. For the planned operating conditions, the time required for complete conversion is 5, 10, and 20 min for the three sizes of particles. Find the conversion of Solids on the grate for a residence time of 8 min in the reactor.	L3	1	16

Or

	b	Uniform-sized spherical particles UO_3 are reduced to UO_2 in a uniform environment with the following results: If the reaction follows the shrinking-core model, find the controlling mechanism and the time for complete conversion of the particles.	L3	1	16

t, h	0.18	0.347	0.453	0.567	0.733
X_B	0.45	0.72	0.82	0.93	0.98

12.	a	List and describe the various methods used for the preparation of catalyst.	L2	2	16
		Or			
	b	Describe the methods for determination of surface area of catalyst.	L2	2	16
13.	a	Consider the following gas phase reaction with solid catalyst $A \rightarrow B + C$ Determine the overall rate of reaction if adsorption is the rate-limiting step.	L4	3	16
		Or			
	b	For the following solid-catalyzed reaction $A + B \rightarrow C$ Determine the overall rate of reaction if surface reaction is the rate-controlling step.	L4	3	16
14.	a	Discuss in detail about effective thermal conductivity in porous catalyst particle.	L2	4	16
		Or			
	b	With neat diagrams, describe the following method for determining the effective diffusivity in porous catalyst: (i) Static method (ii) Dynamic method	L2	4	16
15.	a	Describe in detail various kinetic regimes of gas-liquid reaction taking place in an absorber including the heat of absorption and temperature distribution.	L2	5	16
		Or			
	b	Explain various cases of mass transfer with chemical reaction including the concentration profile and film resistances.	L2	5	16