MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

End semester

SUBJECT: **Chemical Reactor Theory (CHE 4061)**

Time duration: 180 minutes Date: 05/12/2023 ***MAX.MARKS: 50***

Q. No		M	CO	PO	BL
1.	Develop an interim rate expression for the following catalytic reaction when adsorption is controlling. A → B. Assume inhibition to be an added resistance.	5	4	1,3	3
2	Explain with a neat diagram, the SCM and PCM models.	3	2	1,2	2
3	List any two important assumptions proposed under Langmuir adsorption isotherm	2	4	1,3	1
4	Analyse in detail, the kinetics involved in Slurry reactors.	5	5	1,3	4
5	Explain the terms, Ignition and Extinction temperature	3	1	1.3	2
6	Derive an expression for heat load for a non-isothermal batch reactor	2	1	1,3	2
7	With a neat sketch, relate time and conversion for a constant sized spherical particle, when the controlling resistance is gas film.	5	2	1,3	5
8	Explain the interphase behaviour for gas-liquid contact systems and the rate equation employed.	3	3	1,3	5
9	Describe effectiveness factor and obtain a relation for a first order reaction.	2	4	1,3	2
10	Summarize the salient points employed in the BET equations to determine the surface area experimentally.	5	4	1,2	2
11	Identify the possible resistances involved for a reaction in a trickle bed reactor.	3	5	1,2	4
12	Write a note on the classification of catalyst poisons	2	4	1,2	1
13	For a certain fluid-particle reaction, represented by A(g) + bB(s) → products, it is proposed to change some of the operating parameters as follows: the particle size R_1 is to be tripled to R_2 and the temperature is to be increased from T_1 = 800 K to T_2 = 900 K. Solve for the partial pressure (P_{Ag2}), if the original partial pressure (P_{Ag1}) was 2 bar, and the fractional conversion (X_A) be unchanged for a given reaction time? The particles are spherical, and reaction rate is controlling for the shrinking-core model. For the reaction, E_A/R = 12,000 K	4	2	1,3	3
14	For an elementary liquid phase reaction A↔B . Make a plot of equilibrium conversion as a fraction of temperature. Determine the adiabatic equilibrium temperature when pure A is fed to the reactor at temperature of 300 K.	4	1	1,2,4	3

	Data: ΔH°_{fa} = -40000 cal/mol ΔH°_{fb} = -60000 cal/mol. $C_{pA} = C_{pB}$ = 50 cal/ molK. K = 100000 at 298 K				
15	What is meant by heterogenization of homogenous catalyst, and why is it done?	2	3	1,2	1