Reg. No										

AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech. (First Semester) Regular Examinations, February – 2025

24MCHPE11011 - Chemical Reactor Design

(Chemical Engineering)

Time: 3 hrs | Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. What are some common optimal operation policies used to enhance the efficiency of batch reactors?	CO1	K1
b. How can one determine the optimal batch operation time to maximize yield in a batch reactor?	CO1	K1
c. How does a non-steady-state model with axial mixing differ from a steady-state model?	CO2	K2
d. What is a packed column, and how is it used in multiphase flow reactors?	CO1	K2
e. How does a tubular reactor differ from other reactor types?	CO3	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions	Marks	CO #	Blooms Level
2. a. What are optimal temperature policies in chemical reactors, and how do they influence reaction efficiency and safety? Provide examples of how temperature policies can be implemented.	5	CO1	K1
b. Explain the fundamental principles of mass, energy, and momentum balance in chemical engineering. How are these principles applied in the design and operation of reactors?	5	CO2	K2
(OR)			
c. Describe the importance of optimum operation policies and control strategies in chemical reactors. How can these strategies enhance reactor performance?	5	CO1	K3
d. Discuss the stability of operation and transient behavior in mixed flow reactors. What factors can lead to instability, and how can these be managed?	5	CO2	K2
3.a. What are the key reasons for the importance of fixed bed catalytic processes in the chemical industry? List and describe at least four significant applications of fixed bed reactors.	5	CO2	K1
b. Explain the critical factors that must be considered during the preliminary design phase of fixed bed reactors. How do these factors influence reactor performance?	5	CO2	K2
(OR)			
c. Discuss the mechanisms of catalytic reactions in fixed bed reactors. What are the key steps involved, and how do they affect the overall reaction rate?	5	CO2	K2
d. How do the engineering properties of catalysts, such as BET surface area, pore volume, and pore size distribution, influence the performance of fixed bed reactors? Provide examples of how these properties can be optimized.	5	CO3	K3
4.a. Explain the operational principles of trickle bed reactors and fluidized bed reactors. How do their designs influence the performance of multiphase reactions?	5	CO1	K1

b.	What are the primary causes of catalyst deactivation in multiphase flow reactors? How do ideal and non-ideal flow patterns influence the rate of deactivation and overall reactor performance?	5	CO1	K1
	(OR)			
c.	Discuss the significance of intra-particle heat and mass transfer in multiphase flow reactors. How do models like Wheeler's parallel pore model and the random pore model of Wakao and Smith contribute to understanding these processes?	5	CO1	K1
d.	Differentiate between global and intrinsic reaction rates in the context of fixed bed catalytic reactors. How do these rates influence reactor design and operation?	5		
5.a.	What are the different types of multiphase flow reactors? List and describe at least four types, including their key characteristics and typical applications.	5	CO1	K1
b.	How do external mass and heat transfer affect the performance of catalysts in multiphase flow reactors? Discuss the significance of these factors in the context of reactor design.	5	CO1	K1
	(OR)			
c.	Compare and contrast packed bed reactors and slurry reactors in terms of their design, operation, and applications. What are the advantages and disadvantages of each type?	5	CO1	K1
d.	Explain the operational principles of trickle bed reactors and fluidized bed reactors. How do their designs influence the performance of multiphase reactions?	5	CO1	K1
6.a.	What is the significance of temperature in chemical reactors? List and describe at least three ways in which temperature affects chemical reactions.	5	CO1	K1
b.	Explain the concepts of limit cycles and oscillatory reactions in chemical reactors. How can temperature fluctuations contribute to these behaviors, and what are the implications for reactor stability?	5	CO1	K1
	(OR)			
c.	What are the key characteristics of tubular reactors, and how does temperature influence their operation? Discuss the implications of temperature control in tubular reactor design.	5	CO1	K1
d.	Discuss the concept of diffusion control in chemical reactors and how temperature affects diffusion rates. What are the implications of diffusion control for reactor design and operation?	5	CO1	K1

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