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AY 24

GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR

(GIET UNIVERSITY)

M.Tech.(First Semester) Regular/Supplementary Examinations, January – 2025

24MPECH11011- Chemical Reactor Analysis

(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.	What distinguishes heterogeneous models from pseudo-homogeneous models in catalytic reactors?	CO1	K1
c.	How do plate columns differ from packed columns in multiphase flow reactors?	CO2	K2
d.	Mention the main assumptions made in the mathematical modelling of a semi-batch reactor?	CO1	K2
e.	What is meant by auto-thermal operation in fixed bed reactors?	CO3	K1

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions		Marks	CO #	Blooms Level
2. a.	What are the key chemical factors that influence the choice of reactor type in chemical processes? Discuss how these factors impact reactor design and operation.	5	CO1	K1
b.	Create a framework for determining the optimal batch operation time and temperature policies in batch reactors. What factors should be considered?	5	CO2	K2
	(OR)			
c.	Analyze the factors influencing the stability of operation and transient behavior in mixed flow reactors. How can these factors affect 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.	Explain the significance of fixed bed catalytic processes in the chemical industry. What are the advantages of using fixed bed reactors compared to other reactor types?	5	CO2	K1
b.	Identify and discuss the key factors that must be considered in the preliminary design of fixed bed reactors. How do these factors influence reactor performance?	5	CO2	K2
	(OR)			
c.	Evaluate the role of heterogeneous models in the analysis of fixed bed reactors. How do these models contribute to understanding catalytic reactions?	5	CO2	K2
d.	Analyze the application of two-dimensional pseudo-homogeneous models in fixed bed reactors. What advantages do they offer over one-dimensional models?	5	CO3	K3
4.a.	Explain the process of developing rate equations for solid-catalyzed fluid phase reactions. What factors must be considered, and how do these equations aid in reactor design?	5	CO1	K1
b.	Discuss the significance of external mass and heat transfer in catalyst particles. How do these factors influence the overall reaction rate in multiphase flow reactors?	5	CO1	K1
	(OR)			
c.	Investigate the mechanisms of catalyst deactivation in multiphase flow reactors. What are the common causes of deactivation, and how can they be mitigated?	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	CO2	K3

5.a.	Differentiate between ideal and non-ideal flow in multiphase flow reactors. How do these flow patterns affect reactor design and performance?	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	K3
	(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?	10	CO1	K2
6.a.	Explain the behavior of a well-mixed reactor system with a steady feed. How does temperature affect the concentration of reactants and products in such a system? Discuss the implications for reactor design and operation.	10	CO1	K3
	(OR)			
b.	Evaluate the stability and start-up procedures of Continuous Stirred Tank Reactors (CSTR). What role does temperature play in achieving stable operation, and what challenges may arise during the start-up phase? Discuss strategies to mitigate these challenges.	10	CO1	K2

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