K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year: 2025-2026	Semester: V
Class: TY	Program: B.Tech
Branch Code: CHE	Pattern: 2023
Name of Course: Process Intensification	Course Code: 2307381
Max. Marks: 60	Duration: 2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome of the Question/sub-question.

		Marks	CO
Question No. 1			
1a)	What is the significance of miniaturization in process intensification? List examples of microreactor applications.	(6)	CO1
Question No. 2			
2a)	Describe the principle and working of a Plate Heat Exchanger and analyse its efficiency, applications, and limitations.	(6)	CO2
Question No. 3			
3a)	Describe the design and operation of static mixers. Explain how they enhance convective mixing and reduce mixing time compared to conventional systems.	(8)	CO2
	OR		
3b)	Discuss membrane reactors that integrate reaction and separation. Explain how they enhance conversion, selectivity, and energy efficiency.	(8)	CO3
3c)	With a neat sketch, explain the working of a Spinning Disc Reactor (SDR). Analyze its advantages in heat and mass transfer intensification.	(8)	CO3
	OR		
3d)	Describe microstructured (microchannel) reactors and explain how their design accelerates heat removal and improves process safety.	(8)	CO2
Question No. 4			
4a)	Apply the concept of reactive extraction to describe its principle, components, and working, and illustrate its application using the extraction of carboxylic acids with amines.	(8)	CO2
	OR		
4b)	Apply the concept of Reactive Membrane Reactors by describing any two types, such as Catalytic Membrane Reactor (CMR) and Pervaporative Reactive Membrane Reactor (PRMR), with suitable examples.	(8)	CO2

4c)	Analyze the working principle of Dividing-Wall Columns (DWCs) and explain how internal partitioning helps reduce energy consumption and the number of equipment required.	(8)	CO4

OR

4d)	Evaluate how reactive absorption combines chemical reaction and mass transfer. Suggest a suitable example where this process can achieve higher removal efficiency.	(8)	CO4

Question No. 5

5a)	Explain the mechanism of sonochemical reactions and describe how acoustic cavitation enhances reaction rates. Illustrate with industrial applications.	(8)	CO2

OR

5b)	Evaluate the advantages and limitations of microwave-assisted reactors compared to conventional thermal reactors in terms of energy efficiency, selectivity, and scalability.	(8)	CO4
5c)	Evaluate the effectiveness of a photocatalytic reactor by examining electron–hole pair generation and radical formation, using the TiO_2–Methylene Blue degradation example.	(8)	CO4

OR

5d)	Evaluate the energy efficiency of a chemical process and explain the assessment using the ethanol–water distillation process, highlighting the energy saving measures applied.	(8)	CO4

····· End of question paper·····