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: VI
Class: TY	Program: B.Tech
Branch Code: CHE	Pattern: 2022
Name of Course: Process Intensification	Course Code: CHE223021
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)	Differentiate conventional and intensified processes in terms of equipment size, energy efficiency, and process integration.	(6)	CO1
Question No. 2			
2a)	Describe the concept and working of membrane-based separation contactors and analyse how their advantages influence their use in processes such as pervaporation.	(6)	CO2
Question No. 3			
3a)	Describe the principle of high-pressure homogenization. Discuss its role in particle-size reduction and emulsion/dispersion formation.	(8)	CO2
	OR		
3b)	Explain the concept of Confined Impinging Jet Reactors (CIJR). Discuss their ability to achieve rapid micromixing and narrow particle size distribution.	(8)	CO3
3c)	Explain the principle of a static mixer and how it enhances mixing for emulsion or dispersion formation.	(8)	CO2
	OR		
3d)	Draw and explain the working of an SDR and discuss its heat and mass transfer intensification benefits	(8)	CO3
Question No. 4			
4a)	Apply the concept of Reactive Membrane Separation (RMS) to explain how reaction and separation occur together in one unit, using the esterification of acetic acid with ethanol as an example.	(8)	CO2
	OR		
4b)	Apply the principle of Dividing Wall Columns (DWC) to explain how a ternary mixture (Benzene–Toluene–Xylene) can be separated in a single column. Draw a neat schematic and describe the role of each section.	(8)	CO2

4c)	Evaluate how the principle of simultaneous reaction and separation in reactive distillation helps improve conversion and energy efficiency compared to a conventional reactor separator system.	(8)	CO4

OR

4d)	Evaluate how the working principle of a centrifugal extractor provides faster phase separation and better solvent recovery compared to conventional mixer settler systems.	(8)	CO4

Question No. 5

5a)	Discuss different applications of sonochemistry in organic synthesis, material processing, and environmental remediation. Evaluate the benefits over conventional methods.	(8)	CO4

OR

5b)	Explain the principles of plasma generation and describe how plasma reactors enable activation of molecules for chemical synthesis and pollution control.	(8)	CO2
5c)	Evaluate energy-based process intensification (PI) for the esterification of acetic acid with ethanol, comparing reactive distillation with the conventional process in terms of energy, equipment size, and yield.	(8)	CO4

OR

5d)	Evaluate photocatalytic reactors by analyzing their working mechanism and comparing them with conventional oxidation methods (chlorination/ozonation).	(8)	CO4

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