

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Process Intensification- 3170510

Unit 1: Introduction to Process Intensification

Repeated Questions:

1. **Define Process Intensification and explain its benefits.**
 - Appeared in: S25 (Q1a, 03 marks), S24 (Q1c, 07 marks), S23 (Q1c, 07 marks), W24 (Q1b, 04 marks)
2. **Explain the fundamental principles of Process Intensification.**
 - Appeared in: S25 (Q1b, 04 marks), S23 (Q1b, 04 marks), S22 (Q2b, 04 marks)
3. **Draw and explain the schematic of the Process Intensification toolbox.**
 - Appeared in: S25 (Q1c, 07 marks), S23 (Q1c, 07 marks), W23 (Q1c, 07 marks), W24 (Q2c-OR, 07 marks)

Other Important Questions:

4. **Discuss the several objectives of Process Intensification.** (S22 - Q1a, 03 marks)
5. **Discuss the philosophy and opportunities of process intensification.** (W23 - Q1b, 04 marks)
6. **Mention the history of Process Intensification in brief.** (W22 - Q1b, 04 marks) & (W24 - Q1c, 07 marks)
7. **Give various definitions of Process Intensification and explain its Interpretations.** (W22 - Q3a-OR, 03 marks)
8. **Explain the numerous Barriers for Process Intensification.** (S23 - Q1a, 03 marks)
9. **Write a short note on various techniques of Process Intensification (PI) Applications.** (S22 - Q1b, 04 marks) & (S25 - Q2b, 04 marks) & (S23 - Q2b, 04 marks)
10. **Define Process Intensification. Enlist the four applications of PI.** (W23 - Q1a, 03 marks)

Unit 2: Novel Reactors

Repeated Questions:

1. **Explain the working principle of a Spinning Disc Reactor (SDR).**
 - Appeared in: S24 (Q2a, 03 marks), S25 (Q2c, 07 marks), S23 (Q2c, 07 marks), W24 (Q3c-OR, 07 marks), S22 (Q4c-OR, 07 marks)
2. **Discuss Catalytic Plate Reactor (CPR) with a neat sketch, its working principle, merits, and demerits.**
 - Appeared in: S24 (Q2b, 04 marks), S25 (Q2c-OR, 07 marks), S22 (Q2c-OR, 07 marks), S23 (Q5c, 07 marks)
3. **Explain/Discuss Taylor Couette Reactor in detail.**
 - Appeared in: S24 (Q2c, 07 marks), W22 (Q5c-OR, 07 marks), W24 (Q4c-OR, 07 marks)
4. **Discuss Micro Reactors in detail.**
 - Appeared in: S24 (Q2c-OR, 07 marks), W22 (Q3b-OR, 04 marks)
5. **Discuss in detail the construction and working of an Oscillatory Baffled Reactor (OBR).**
 - Appeared in: S24 (Q3c, 07 marks), W22 (Q4c, 07 marks), W24 (Q4c, 07 marks), W23 (Q2c-OR, 07 marks)

Other Important Questions:

6. **Differentiate: Conventional reactor and Micro reactor.** (W24 - Q2a, 03 marks)
7. **Define the HEX reactors. Explain the working principle of a HEX reactor.** (W23 - Q2b, 04 marks)
8. **Describe the working principle of Rotor stator reactors: the STT reactor with a neat sketch. Explain how it differs from a spinning disc reactor (Only three points).** (W23 - Q2c, 07 marks)
9. **Discuss Rotating Packed bed reactor with a neat sketch and applications in detail.** (S22 - Q2c, 07 marks)
10. **Explain the principle of a Rotor Stator reactor.** (S24 - Q3a, 03 marks)
11. **Elaborate on Rotor Stator Reactor.** (S24 - Q3b, 04 marks) & (W22 - Q3c-OR, 07 marks) & (W24 - Q4b-OR, 04 marks)
12. **Describe the working of Oscillatory baffled reactors (OBRs) with a neat diagram. Also, enlist the key benefits of OBR over a rotating packed bed reactor (Any three).** (W23 - Q2c-OR, 07 marks)

Unit 3: Intensified Mixing

Repeated Questions:

1. **Explain the concept of Ultrasound mixers.**
 - Appeared in: S24 (Q3a-OR, 03 marks), W22 (Q4a, 03 marks), W24 (Q5a, 03 marks)
2. **Explain Ejectors in brief / Write a short note on Ejectors.**
 - Appeared in: S24 (Q3b-OR, 04 marks), W22 (Q3a, 03 marks), S22 (Q4a-OR, 03 marks), W24 (Q4a, 03 marks)
3. **Explain Impinging Jets in detail.**
 - Appeared in: S24 (Q3c-OR, 07 marks), W22 (Q2a, 03 marks), W24 (Q3b-OR, 04 marks)

Other Important Questions:

4. **Explain the significance of intensified mixing in process industries.** (W23 - Q2a, 03 marks)
5. **Define Tee mixers and Nebulizers.** (W23 - Q3a, 03 marks)
6. **Enlist the four names of inline reactors. Describe a motionless mixer with a neat diagram. Also, explain the five benefits of a motionless mixer over traditional agitation.** (W23 - Q3c, 07 marks)
7. **Define: Static mixers.** (W24 - Q3a-OR, 03 marks) & (S23 - Q3b-OR, 04 marks)
8. **Explain the significance of Reynolds number and Hydraulic diameter in a motionless mixer.** (W23 - Q3b-OR, 04 marks)
9. **Explain the construction and working of ejectors as mixers used in process industries. Enlist the advantage and limitation of ejectors over a static reactor (Two each).** (W23 - Q3c-OR, 07 marks)
10. **Describe briefly about Rotor stator mixers.** (S25 - Q5a, 03 marks)
11. **Describe the Mixing in intensified equipment.** (S25 - Q5b-OR, 04 marks)

Unit 4: Structural Catalysts and Reactors

Repeated Questions:

1. **Explain the concept of Structured reactors / Give an overview of structured reactors.**
 - Appeared in: S24 (Q4a, 03 marks), S25 (Q3b, 04 marks), S22 (Q5a, 03 marks), S23 (Q4b-OR, 04 marks)
2. **Discuss Monolith reactor / Monolithic Catalysts and Reactors with example and applications.**
 - Appeared in: S24 (Q4b, 04 marks), S22 (Q4c-OR, 07 marks), W23 (Q4b, 04 marks), S25 (Q4a, 03 marks)
3. **Describe the construction and working of a Membrane Enclosed Catalytic Reactor (MECR).**
 - Appeared in: S24 (Q4c, 07 marks), W22 (Q2c, 07 marks), W24 (Q3c, 07 marks), S23 (Q5c-OR, 07 marks)

Other Important Questions:

4. **Define Three-Levels-of-Porosity (TLP) Reactors.** (W23 - Q4a, 03 marks)
5. **Explain the Gauzes, Structured Packings, Foams in the field of reactors.** (S22 - Q3b, 04 marks) & (S25 - Q3b-OR, 04 marks) & (S23 - Q5b, 04 marks)
6. **Explain the role of Environmental Catalysis in designing of reactors.** (S22 - Q3a, 03 marks) & (S25 - Q3a-OR, 03 marks) & (S23 - Q4a-OR, 03 marks)
7. **Discuss the environmental catalysts with two suitable examples.** (W23 - Q3b, 04 marks)
8. **Briefly discuss the Hydrodynamics and Mass Transfer in Monoliths.** (W23 - Q3a-OR, 03 marks) & (S22 - Q5a-OR, 03 marks)
9. **Define and explain Adsorptive membrane and Membrane chromatography.** (W22 - Q5a-OR, 03 marks) & (W24 - Q4a-OR, 03 marks)
10. **Define structure reactors. Give classification of structure reactors with typical examples.** (W23 - Q4b-OR, 04 marks) & (S23 - Q4b-OR, 04 marks)
11. **Membrane-Enclosed Catalytic Reactor (MECR).** (W23 - Q4a-OR, 03 marks)

Unit 5: Hybrid Separation

Repeated Questions:

1. **Explain Dividing Wall Columns in distillation with a neat sketch.**
 - Appeared in: W22 (Q2b, 04 marks), S25 (Q4b-OR, 04 marks), S22 (Q5b, 04 marks), S23 (Q5b-OR, 04 marks), W24 (Q5c, 07 marks)
2. **Explain barriers and future prospects of Hybrid separation.**
 - Appeared in: S24 (Q4b-OR, 04 marks), W22 (Q4b-OR, 04 marks), S25 (Q5b, 04 marks), S22 (Q5b-OR, 04 marks), S23 (Q4b, 04 marks), W24 (Q3b, 04 marks)
3. **Explain the concept of Membrane distillation.**
 - Appeared in: S25 (Q2a, 03 marks), W22 (Q9, from syllabus list)
4. **Explain Supercritical separation / extraction.**
 - Appeared in: W22 (Q1a, 03 marks), S24 (Q1a, part of 03 marks), W24 (Q2b, 04 marks), S23 (Q3a, 03 marks)
5. **Explain Short Path Distillation.**
 - Appeared in: W22 (Q2c-OR, 07 marks), S24 (Q4a-OR, 03 marks)

Other Important Questions:

6. **Explain the Advantages and Disadvantages of Extractive distillation.**
 - Appeared in: W22 (Q5b, 04 marks), S24 (Q4c-OR, 07 marks), S25 (Q5c-OR, 07 marks), W24 (Q5b, 04 marks)
7. **Define: Process Intensification, Supercritical separation and Extractive Distillation.** (S24 - Q1a, 03 marks)
8. **Discuss Membrane absorption and Membrane stripping.** (S25 - Q5c, 07 marks)
9. **Define Membrane absorption/stripping with a suitable example.** (S22 - Q3a-OR, 03 marks)
10. **List out the existing and potential applications of extractive distillation.** (S23 - Q4a-OR, 03 marks)
11. **Discuss working of Extractive distillation operation with necessary diagram, merits and demerits.** (S25 - Q5c-OR, 07 marks) & (S22 - Q5c, 07 marks)
12. **Explain Adsorptive distillation.** (From syllabus list)
13. **Explain working of Supercritical separation operation with necessary diagram, merits and demerits.** (S22 - Q5c-OR, 07 marks)

Unit 6: Integration of Reaction and Separation

Repeated Questions:

1. **Explain Synthesis of Methyl Tertiary Butyl Ether (MTBE) / Discuss its case study.**
 - Appeared in: W22 (Q3b, 04 marks), S24 (Q5b, 04 marks), S25 (Q4c-OR, 07 marks), S23 (Q4c-OR, 07 marks), W23 (Q5c, 07 marks), W24 (Q5b, 04 marks)
2. **Explain Coke Gas Purification / Discuss its case study.**
 - Appeared in: W22 (Q5b-OR, 04 marks), S24 (Q5a, 03 marks), W23 (Q5c-OR, 07 marks), W24 (Q4b, 04 marks)
3. **Explain Heat Integrated Distillation Trains.**
 - Appeared in: S22 (Q2a, 03 marks), S24 (Q5c, 07 marks), S23 (Q5a, 03 marks)
4. **Explain the concept in Reactive absorption.**
 - Appeared in: S25 (Q3a, 03 marks), S23 (Q2a, 03 marks)

Other Important Questions:

5. **Discuss and elaborate the case study of Methyl Acetate Synthesis as PI.** (S25 - Q4c, 07 marks)
6. **Explain the Fundamentals of process modeling considering example of Methyl Acetate Synthesis.** (S22 - Q3b-OR, 04 marks)
7. **Explain reactive distillation with a suitable example.** (W23 - Q5a, 03 marks)
8. **Discuss the process intensification in the process of Absorption of NO_x to reduce air pollution.** (W23 - Q4c, 07 marks) & (S23 - Q3c-OR, 07 marks)
9. **Explain Reactive extraction.** (From syllabus list)
10. **Explain Reactive adsorption.** (From syllabus list)

Unit 7: New Heat Exchangers

Repeated Questions:

1. **Explain the principle and working of Micro-channel / Microchannel heat exchangers.**
 - Appeared in: S25 (Q3c, 07 marks), W22 (Q4a-OR, 03 marks), S24 (Q5a-OR, 03 marks), W23 (Q5b-OR, 04 marks), S23 (Q4c, 07 marks)
2. **Describe Plate Heat Exchangers in detail / Discuss their advantages and disadvantages.**
 - Appeared in: W22 (Q3c, 07 marks), W24 (Q2c, 07 marks), S22 (Q4b-OR, 04 marks)
3. **Discuss Printed Circuit Heat Exchanger (PCHE) in detail.**
 - Appeared in: S22 (Q3c-OR, 07 marks), S24 (Q5c-OR, 07 marks), S23 (Q2c-OR, 07 marks), W24 (Q5c-OR, 07 marks)

Other Important Questions:

4. **Explain the concept of Integrated Heat Exchangers in separation processes.**
 - Appeared in: W22 (Q5a, 03 marks), W24 (Q5a-OR, 03 marks)
5. **Discuss the selection criteria of heat exchanger technology.**
 - Appeared in: S25 (Q4b, 04 marks), S22 (Q4b, 04 marks), S23 (Q3b, 04 marks)
6. **Explain the principle and working of Flat tube-and-fin heat exchangers with a necessary diagram.**
 - Appeared in: S25 (Q3c-OR, 07 marks), S23 (Q3c, 07 marks)
7. **Discuss Mesh heat exchangers with a neat sketch.** (S22 - Q3c, 07 marks)
8. **Write a short note on Foam heat exchangers.** (W23 - Q5a-OR, 03 marks)
9. **Explain the principle and working of Chart-flow heat exchanger. Enlist the name of two parameters which are to be intensified for the same.** (W23 - Q5b, 04 marks)
10. **Write a short note on Ultrasound Atomization.** (S25 - Q4a-OR, 03 marks) & (S22 - Q4a, 03 marks) & (S23 - Q5a-OR, 03 marks)
11. **Enlist and elaborate the selection criteria of heat exchangers.** (S25 - Q4b, 04 marks)
