

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Name & Code:

Computer Aided Process Synthesis- 3170507

Unit 1: The Design Process

Repeated Questions:

1. **Describe the criteria for selection of separation methods.**
 - Appeared in: S22 (Q4a, 03 marks), W23 (Q1b, 03 marks), S25 (Q2b, 04 marks)
2. **Discuss in brief about design opportunities and general steps in product and process design.**
 - Appeared in: W22 (Q1c, 07 marks), S25 (Q2c, 07 marks)
3. **Briefly describe the role of computers in product and process design. / Explain the role of computers in process design.**
 - Appeared in: W22 (Q3a, 03 marks), S22 (Q1a, 03 marks), W24 (Q2a, 03 marks), S25 (Q1a, 03 marks)
4. **Discuss the environmental factors in process design. / Write a short note on environmental factors in process design.**
 - Appeared in: S22 (Q2c, 07 marks), W23 (Q2b, 03 marks), W24 (Q3a, 03 marks), S25 (Q2c-OR, 07 marks)

Other Important Questions:

5. **Explain the ‘process creation’ step briefly in product and process design.**
 - Appeared in: S22 (Q4a-OR, 03 marks)
6. **List the steps involved in product and process design in algorithmic form.**
 - Appeared in: W24 (Q3b, 04 marks)
7. **Briefly explain safety considerations and design approaches towards safe chemical plants. / What are the safety considerations in Process Design?**
 - Appeared in: S22 (Q5a, 03 marks), W24 (Q1a, 03 marks)
8. **Write ethics of Chemical Engineers. / List the statements of engineering ethics.**
 - Appeared in: W23 (Q5a, 03 marks), W24 (Q3b-OR, 04 marks), S23 (Q3b, 03 marks)
9. **Differentiate between overlapping and non-overlapping operation.**
 - Appeared in: W22 (Q1a, 03 marks), W23 (Q2a, 03 marks), S25 (Q4a, 03 marks)

Unit 2: Reactor Design and Reactor Network Synthesis

Repeated Questions:

1. **Explain the step-by-step procedure for the construction of attainable region for reactor design.**
 - Appeared in: S22 (Q1c, 07 marks), S25 (Q1c, 07 marks)

Other Important Questions:

2. **Discuss the procedure for reactor network design using concept of attainable region.**
 - Appeared in: W23 (Q3b, 04 marks)
3. **Explain reactor designs used for handling large adiabatic changes in temperature.**
 - Appeared in: W22 (Q5c, 07 marks)
4. **Explain reactor design for complex configurations.**
 - Appeared in: W24 (Q2b, 03 marks)
5. **Explain reactor network design using attainable region for van de Vusse kinetics.**
 - Appeared in: S23 (Q4c, 07 marks)
6. **Discuss in detail the phase separation of the reactor effluent.**
 - Appeared in: W24 (Q3a, 03 marks)

Unit 3: Synthesis of Separation Trains

Repeated Questions:

1. **Explain separation sequencing for Solid-Fluid systems.**
 - Appeared in: W22 (Q3a, 03 marks), S22 (Q2a, 03 marks)
2. **Explain marginal vapor rate method. / Explain marginal vapor flows and show how it will be useful for predicting the best sequence of distillation columns.**
 - Appeared in: W22 (Q2b, 04 marks), W24 (Q4c-OR, 07 marks)
3. **Draw the possible sequences for 3/4/5 number of products and explain heuristics for determining favorable sequences. / Sketch all possible distillation column sequences for the separation of a four-component system. / Show the all possible sequences for separation of mixture containing four/five components.**
 - Appeared in: W22 (Q2b, 04 marks), W23 (Q3c, 07 marks), S23 (Q3c, 07 marks), S25 (Q5a, 03 marks)
4. **Use the marginal vapour rate (MV) method to determine the sequence for the separation of light hydrocarbons. Give rank to various sequences.**
 - Appeared in: W22 (Q5c, 07 marks), S22 (Q5c, 07 marks), S23 (Q5c, 07 marks), W23 (Q5c, 07 marks), S25 (Q5c, 07 marks)

Other Important Questions:

5. **Explain Heuristics for determining favorable sequences of ordinary distillation column.**
 - Appeared in: S23 (Q4a, 03 marks)
6. **Write a short note on heuristics for designing separation processes.**
 - Appeared in: W23 (Q4c, 03 marks)
7. **Discuss the heuristics for determining the favorable sequence of distillation operation.**
 - Appeared in: W24 (Q4c-OR, 04 marks)
8. **Explain conditions for most economical operation of distillation column.**
 - Appeared in: S23 (Q4a, 03 marks)
9. **Compare LSF and LSR in distillation.**
 - Appeared in: S23 (Q4b, 03 marks)
10. **Explain the algorithm for establishing distillation column pressure and condenser type.**
 - Appeared in: W22 (Q1b, 04 marks)
11. **Explain node and saddle point in residue curve map.**
 - Appeared in: W23 (Q3a, 03 marks), W24 (Q1b, 04 marks)
12. **Define Residue curve. Construct the residue curves for a system containing [given components].**
 - Appeared in: W23 (Q3c, 07 marks)
13. **Derive the equation for construction of residue curve.**
 - Appeared in: S22 (Q3a-OR, 03 marks)
14. **Sketch the residue curve map for following data: [given components and azeotropes]**
 - Appeared in: S23 (Q3a, 03 marks)

Unit 4: Synthesis of Heat Exchanger Networks

Repeated Questions:

1. **Explain the significance of GCC Curve in Finding Minimum Utility Requirement. / Describe the use of grand composite curve to select utility.**
 - Appeared in: W22 (Q4b, 04 marks), W23 (Q3a, 03 marks), S22 (Q1b, 04 marks), S25 (Q3a, 03 marks)
2. **Discuss the Pinch Design Approach for inventing a Heat Exchanger Network. / Enlist the steps in the Pinch Design Approach to inventing a Heat Exchange Network. / What is the pinch design approach for minimizing utility requirements?**
 - Appeared in: W22 (Q2c, 07 marks), W23 (Q1c, 03 marks), W24 (Q2c, 07 marks), S25 (Q3b, 04 marks)
3. **Explain the generalized rules for stream splitting on both sides of the pinch to satisfy MER requirements. / Could you provide detailed instructions on how to split streams on both sides of the pinch to ensure compliance with MER criteria?**
 - Appeared in: W22 (Q2c-OR, 07 marks), S22 (Q2b, 04 marks), W24 (Q3c, 07 marks)
4. **Justify the statement “No heat should be passed across the pinch for minimum utility targeting”. / “No heat passes across the pinch” Justify the Statement.**
 - Appeared in: S22 (Q5a-OR, 03 marks), S25 (Q1b, 04 marks)
5. **Explain Threshold approach temperature. / Explain “threshold approach temperature” and “optimum approach temperature”. / Write a short note on threshold and optimum approach temperatures for heat exchanger networks.**
 - Appeared in: W22 (Q2a, 03 marks), S23 (Q1a, 03 marks), S25 (Q3b, 04 marks), W24 (Q2c, 04 marks)

Other Important Questions:

6. **For stream matching to be feasible at pinch, justify that $C_h \geq C_c / FC_h \geq FC_c$ must be satisfied on cold side/below pinch region.**
 - Appeared in: W23 (Q1a, 03 marks), S25 (Q3a-OR, 03 marks)
7. **Explain the concept of stream matching in Heat Exchanger Network.**
 - Appeared in: S22 (Q5b, 03 marks)
8. **Decide minimum no. of heat exchangers required for a given network and find loops.**
 - Appeared in: S23 (Q2a, 03 marks)
9. **Determine the minimum utility target and pinch point for the given stream data. (Numerical)**
 - This is a very frequent numerical problem. It appeared in:
 - W22 (Q4c, 07 marks)
 - W23 (Q2c-OR, 07 marks) & (Q4c, 07 marks)
 - S22 (Q3c, 07 marks) & (Q3c-OR, 07 marks)
 - S23 (Q2c, 07 marks)
 - W24 (Q3c-OR, 07 marks)
 - S25 (Q3c, 07 marks) & (Q3c-OR, 07 marks)
10. **Design a heat exchanger network for the given stream data. (Numerical)**
 - Another very frequent design problem. It appeared in:
 - W23 (Q2c, 07 marks)
 - S23 (Q1c, 07 marks)
 - S25 (Q3c, 07 marks)

Unit 5: Energy Integrated Distillation Processes

Repeated Questions:

1. **Explain Vapor Recompression, Reboiler Flashing and Heat Pumping as an energy saving alternative for distillation along with their limitations.**
 - Appeared in: W23 (Q2c, 07 marks), W24 (Q1c, 07 marks)
2. **Explain multi effect distillation. / Discuss the concept of multi effect distillation as possibility of energy integration. / Using TQ diagram justify energy saving in multi-effect distillation compared to the conventional distillation.**
 - Appeared in: W22 (Q5b, 04 marks), S22 (Q4b, 04 marks), W23 (Q4b, 04 marks), W24 (Q4b, 04 marks), S25 (Q5b, 04 marks)
3. **Explain positioning of heat engines & heat pumps relative to pinch. / Construct three alternatives for the placement of heat engines/heat pumps.**
 - Appeared in: W22 (Q4c, 07 marks), S22 (Q2c-OR, 07 marks), S23 (Q5a, 03 marks), S25 (Q5a, 03 marks), W24 (Q4c-OR, 04 marks)

Other Important Questions:

4. **Compare forward heat integration and reverse heat integration in distillation with necessary figure.**
 - Appeared in: W23 (Q4a, 03 marks)
5. **Explain heat integration in distillation column using vapor recompression and reboiler flashing.**
 - Appeared in: S25 (Q5b, 04 marks)
6. **Compare vapor recompression and reboiler flashing in heat integration of distillation column.**
 - Appeared in: S23 (Q4b, 03 marks)
7. **Explain positioning of distillation towers between hot and cold composite curves.**
 - Appeared in: S23 (Q1b, 04 marks)
8. **With a neat sketch explain vapour recompression.**
 - Appeared in: W22 (Q4b, 04 marks)

Unit 6: Design and Scheduling of Batch Processes

Repeated Questions:

1. **Define span and cycle time for batch processes. Explain various policies with example.**
 - Appeared in: W23 (Q5b, 04 marks), S22 (Q4b-OR, 04 marks), S25 (Q4a, 03 marks)
2. **Differentiate Flow shop plant and Job shop plant. / Differentiate Flowshop and Jobshop Plant.**
 - Appeared in: W22 (Q5a, 03 marks), S22 (Q2b, 04 marks), S23 (Q5b, 03 marks), S25 (Q2a, 03 marks), W24 (Q5a-OR, 03 marks)
3. **What is Gantt chart? Draw Gantt chart for [given recipe] for Zero wait, No intermediate storage and Unlimited storage transfer policies.**
 - Appeared in: S22 (Q4c-OR, 07 marks), S23 (Q5c, 07 marks), S25 (Q4c, 07 marks)
4. **Given the processing times for two products A, B determine makespan and cycle time for manufacturing one batch of A, one of B using (a) Zero wait policy (b) No intermediate storage policy (c) Unlimited intermediate storage policy. (Numerical)**
 - This is a very frequent numerical problem. It appeared in:
 - W22 (Q3c, 07 marks)
 - S22 (Q4c, 07 marks)

Other Important Questions:

5. **Explain various transfer policies (ZW, NIS, UIS). / Define: 1. Zero-Wait (ZW), 2. NO Intermediate storage (NIS) policy, 3. Unlimited Intermediate storage (UIS) policy.**
 - Appeared in: W24 (Q5a-OR, 03 marks), S25 (Q4b, 04 marks)
6. **With example show how transfer policy affects the cycle time.**
 - Appeared in: W22 (Q4b, 04 marks)
7. **Develop Gantt charts and find cycle time and makespan for single product campaigns (AAABBB) and mixed product campaigns (ABABAB) considering Zero Wait transfer policy.**
 - Appeared in: S25 (Q4c, 07 marks), S23 (Q5c, 07 marks)
8. **A given batch plant produces one single product... If zero-wait transfer is used, what is the cycle time? How many parallel units should be placed...? (Numerical)**
 - Appeared in: W24 (Q5b-OR, 04 marks)
9. **Compare overlapping and non-overlapping operations.**
 - Appeared in: W24 (Q5a-OR, 03 marks)
