

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Name & Code:

Process Auxiliaries and Utilities- 3170516

Unit 1: Basic Considerations, Flow Diagrams, and Piping Design

Repeated Questions:

1. **Draw/Prepare/Explain Process Flow Diagrams (PFD) and P&ID.**
 - Appeared in: S22 (Q1c, 07 marks), S23 (Q1a, 03 marks), S23 (Q1b, 04 marks), W24 (Q1a, 03 marks)
2. **Explain the selection criteria for piping materials.**
 - Appeared in: S22 (Q1a, 03 marks), W23 (Q3b, 04 marks), W24 (Q1b, 04 marks)
3. **Explain pipe insulation, its importance, types, and materials.**
 - Appeared in: S22 (Q1b, 04 marks), W22 (Q1c, 07 marks), S23 (Q3a, 03 marks), S23 (Q3b, 04 marks), S25 (Q1c, 07 marks)
4. **Describe various types of piping fittings and joints.**
 - Appeared in: S22 (Q1a, 03 marks), S23 (Q2b, 04 marks), S23 (Q2c, 07 marks), W24 (Q1c, 07 marks)

Other Important Questions:

1. **What is the role of pipe drawing, installation, and insulation in piping design?** (S22 - Q1b, 04 marks)
2. **Differentiate between a block diagram, process flow diagram, and P&ID.** (S23 - Q1b, 04 marks)
3. **Draw the diagram of a basic control loop and label different units. Name two commonly used control systems.** (S23 - Q1c, 07 marks)
4. **How to calculate pipe schedule?** (S22 - Q5a, 03 marks)
5. **Give your understanding about pressure rating in pipes.** (S22 - Q4b, 04 marks)
6. **Explain Pump Piping Support.** (W24 - Q2a, 03 marks)
7. **Define: NPSH requirement, Pump piping support, Pipe size, Piping insulation, Piping fittings, Pipe joints.** (W23 - Q2c, 07 marks)
8. **Calculate allowable internal pressure P for Schedule 40 mild steel pipe having ultimate tensile strength (S value) of 65,300 psi. (Assume suitable data if required)** (S23 - Q3a, 03 marks) *[Numerical]*

Unit 2: Valves and Pumps

Repeated Questions:

1. **List different types of valves and their selection criteria.**
 - Appeared in: S22 (Q2a, 03 marks), S22 (Q2b, 04 marks), S23 (Q2c, 07 marks), W23 (Q2a, 03 marks), W23 (Q2b, 04 marks), S25 (Q5c, 07 marks), W24 (Q2c, 07 marks)
2. **Explain NPSH (Net Positive Suction Head) and its significance.**
 - Appeared in: S22 (Q2c, 07 marks), W23 (Q2c, 07 marks), W24 (Q2c, 07 marks)
3. **Explain types of pumps along with advantages and disadvantages.**
 - Appeared in: S22 (Q2c, 07 marks), W22 (Q5c, 07 marks), W24 (Q4a, 03 marks), W24 (Q5c, 07 marks)

Other Important Questions:

1. **Justify valve selection is based on uses.** (S24 - Q2b, 04 marks)
2. **Defend for gate valve why do selection criteria have an important role?** (W22 - Q2b, 04 marks)
3. **Relates NPSH values and location of pump with pumping cost.** (S24 - Q1c, 04 marks)
4. **Explain pump location and pump piping.** (S22 - Q2c, 07 marks)
5. **Describe the factors influencing pump location in industrial plants.** (W24 - Q2b, 04 marks)
6. **List the advantages and disadvantages of a centrifugal pump and describe its characteristic curves.** (W23 - Q5c, 07 marks), (W24 - Q5c, 07 marks)
7. **Explain with an equation and diagram for the positive suction head and negative suction head.** (W22 - Q5c, 07 marks)
8. **Write down applications of valves.** (S22 - Q4c, 07 marks)

Unit 3: Process Water

Repeated Questions:

1. **Compare various methods of water treatment.**
 - Appeared in: W22 (Q4c, 07 marks), S25 (Q2c, 07 marks), W24 (Q3c, 07 marks)
2. **Explain Hard water and Soft water.**
 - Appeared in: W22 (Q2a, 03 marks), W24 (Q3a, 03 marks)
3. **Explain Demineralization.**
 - Appeared in: S22 (Q3b, 04 marks), W23 (Q2c, 07 marks)
4. **Explain Cooling Towers.**
 - Appeared in: S22 (Q3c, 07 marks), W23 (Q1c, 07 marks)

Other Important Questions:

1. **Explain hardness of water.** (S24 - Q1a, 03 marks)
2. **Discuss chemical softening methods for hard water.** (S24 - Q3c, 07 marks)
3. **What is water softening? List out various methods and explain any one.** (W23 - Q2c, 07 marks)
4. **What is Reverse Osmosis and how does it work?** (S22 - Q3a, 03 marks)
5. **Prepare drinking water treatment flow sheet and explain the need of each step.** (S24 - Q3c, 07 marks)
6. **Differentiate the terms “reuse” and “conservation” with respect to the need for water in industry.** (W22 - Q4c, 07 marks)
7. **What are the sources of process water in industrial applications?** (W24 - Q3a, 03 marks)
8. **How you can define waste water? Explain the treatment procedure of water waste.** (S22 - Q3a, 03 marks)
9. **Discuss tertiary treatment of wastewater with special reference to nitrogen and phosphorus removal.** (S23 - Q3c, 07 marks)
10. **List out characteristics of typical domestic wastewater.** (S22 - Q5b, 04 marks)

Unit 4: Process Heating Systems

Repeated Questions:

1. **Differentiate between steam and non-steam heating systems.**
 - Appeared in: S24 (Q4c, 07 marks), S22 (Q4c, 07 marks)
2. **Explain Steam Economy.**
 - Appeared in: S24 (Q4c, 07 marks), W22 (Q4b, 04 marks), S23 (Q3b, 04 marks), W24 (Q3b, 04 marks)
3. **Explain Steam Traps, their types, and working.**
 - Appeared in: S24 (Q5a, 03 marks), W22 (Q4b, 04 marks), S23 (Q4c, 07 marks), W24 (Q4b, 04 marks)
4. **Explain the principle and working of a thermic fluid heater.**
 - Appeared in: S24 (Q5a, 03 marks), S25 (Q4a, 03 marks)

Other Important Questions:

1. **Interpret the importance of steam distribution systems in chemical plants.** (W22 - Q1b, 04 marks), (S25 - Q2b, 04 marks)
2. **State the characteristics of steam which makes it so popular and useful in industry.** (S23 - Q2a, 03 marks)
3. **Discuss design considerations for efficient steam heating systems.** (W24 - Q3b, 04 marks)
4. **What is meant by 'Condensate recovery'? Discuss its benefits.** (S23 - Q3c, 07 marks)
5. **State the reasons for the probable loss of steam pressure through the distribution pipeline.** (S23 - Q4a, 03 marks)
6. **List out desirable characteristics of a heat transfer fluid. Give examples.** (S23 - Q4b, 04 marks)
7. **Explain waste heat utilization and its applications.** (W23 - Q3b, 04 marks), (W24 - Q3c, 07 marks)
8. **State the benefits of waste heat recovery.** (S23 - Q4b, 04 marks)
9. **Enlist various commercial devices used in industry for waste heat recovery. Discuss the working of any one.** (S23 - Q4c, 07 marks)
10. **What is blow down and why it is required?** (S25 - Q4b, 04 marks)
11. **Application of steam in important chemical reactions with examples.** (S23 - Q5b, 04 marks)
12. **Short note: Process heating systems using steam.** (S22 - Q3c, 07 marks)

Unit 5: Air Systems, Compressors, and Vacuum Pumps

Repeated Questions:

1. **Classify and explain Air Compressors (especially reciprocating and rotary types).**
 - Appeared in: S24 (Q2c, 07 marks), W22 (Q3c, 07 marks), S25 (Q2c, 07 marks), S25 (Q4c, 07 marks), W24 (Q4c, 07 marks)
2. **Classify and explain Vacuum Pumps.**
 - Appeared in: S24 (Q2a, 03 marks), W22 (Q1a, 03 marks), W22 (Q5c, 07 marks), S25 (Q2a, 03 marks), W24 (Q5b, 04 marks)
3. **Differentiate between an Air Compressor and a Vacuum Pump.**
 - Appeared in: W22 (Q5a, 03 marks), W23 (Q3a, 03 marks), W24 (Q4a, 03 marks)
4. **Justify the need for an Air Compressor in the industry.**
 - Appeared in: S24 (Q4a, 03 marks), S25 (Q3a, 03 marks)

Other Important Questions:

1. **Explain Air Receivers.** (S24 - Q3a, 03 marks), (W22 - Q2c, 07 marks)
2. **Explain Air Dryers.** (S24 - Q3a, 03 marks), (W22 - Q5a, 03 marks)
3. **List the components involved in an instrument air system.** (S24 - Q4b, 04 marks), (S25 - Q3b, 04 marks)
4. **Explain different types of ejectors.** (W22 - Q2c, 07 marks), (S22 - Q4b, 04 marks), (W23 - Q3c, 07 marks)
5. **Justify the need of ejector for utility economy.** (S24 - Q4a, 03 marks), (S25 - Q3a, 03 marks)
6. **What is an ejector system? Explain any one type with a neat sketch.** (W23 - Q3c, 07 marks)
7. **Explain the performance characteristics of vacuum pumps.** (S22 - Q3b, 04 marks)
8. **Explain methods of vacuum development and their limitations.** (S24 - Q2c, 07 marks)
9. **Point out the application of compressors.** (S22 - Q4a, 03 marks)
10. **Point out the application of vacuum pumps.** (S22 - Q5a, 03 marks)
11. **Explain the lubrication requirement in different types of compressors.** (W23 - Q4c, 07 marks)

Unit 6: Refrigeration, Chilling, and Other Utility Systems

Repeated Questions:

1. **Explain the Vapor Compression Refrigeration Cycle.**
 - Appeared in: W23 (Q3c, 07 marks), S25 (Q5c, 07 marks), W24 (Q5c, 07 marks)
2. **Differentiate between a Chiller and a Refrigerator.**
 - Appeared in: W23 (Q3a, 03 marks), W24 (Q5a, 03 marks)
3. **Explain Nitrogen Blanketing/Padding for storage tanks.**
 - Appeared in: W23 (Q5a, 03 marks), W23 (Q5c, 07 marks), W24 (Q4b, 04 marks)
4. **Define COP of a refrigerator.**
 - Appeared in: S23 (Q5a, 03 marks), S25 (Q5a, 03 marks)

Other Important Questions:

1. **Argue why a refrigeration system is required in the chemical industry.** (W22 - Q4a, 03 marks)
2. **Support with an example the need for the chilling system.** (W22 - Q4a, 03 marks)
3. **Name various types of chillers used in chemical processes.** (S23 - Q4a, 03 marks)
4. **State four factors for the choice of a refrigerant.** (S23 - Q5b, 04 marks), (S25 - Q5b, 04 marks)
5. **What is purging? Why is nitrogen purging required? List applications.** (W23 - Q1a, 03 marks)
6. **Where is the nitrogen system used as a utility?** (W22 - Q3a, 03 marks), (S25 - Q1a, 03 marks)
7. **Discuss the use of nitrogen as a chilling utility.** (S24 - Q5b, 04 marks)
8. **Brief on the oil heating system.** (W22 - Q5b, 04 marks), (W24 - Q5b, 04 marks)
9. **Write down the principles of basic refrigeration. What is a chiller?** (S22 - Q5c, 07 marks)
10. **Application of refrigeration. Write down.** (S22 - Q5c, 07 marks)

Unit 7: Utility Energy Considerations and Management

Repeated Questions:

1. **List all utilities used in chemical plants.**
 - Appeared in: S24 (Q5b, 04 marks), S25 (Q1b, 04 marks)
2. **List challenges/issues involved in the management of utilities.**
 - Appeared in: S24 (Q1b, 03 marks), W22 (Q5b, 04 marks), W24 (Q5a, 03 marks)
3. **List all utility energy considerations for industrial application.**
 - Appeared in: W22 (Q3a, 03 marks), S25 (Q4a, 03 marks)

Other Important Questions:

1. **Explain the scope of material handling in the industry.** (S24 - Q4b, 04 marks)
2. **How is material handling carried out in the industry?** (S25 - Q3b, 04 marks)
3. **Discuss pressure relief devices used in chemical process industries.** (W23 - Q4c, 07 marks)
