

Process Technology II – Systems

Performance and Learning Objectives

Course Performance Objective

The student will apply knowledge of systems acquired in this course to operate and control his/her assigned system(s) on the job, such as:

- Potable Water Systems
- Fire Water Systems
- Service/Utility Water Systems
- Waste Water Systems
- Cooling Water Systems
- Instrument Air Systems
- Utility Air Systems
- Breathing Air Systems
- Nitrogen Systems
- Natural Gas Systems
- Fuel Gas Systems
- Relief and Flare Systems
- Electrical Power Generation and Distribution Systems
- Material Storage Systems
- Blending Systems

- Refrigeration Systems
- Steam Generation and Distribution Systems
- Extraction Systems
- Reaction Systems
- Distillation Systems
- Stripping Systems
- Absorption Systems
- Dehydration Systems
- Adsorption Systems
- Filtration Systems

Session 1: Course Overview_

Learning Objectives

1. List the attendance requirements for Process Technology II – Systems
2. List the homework requirements for Process Technology II – Systems
3. List the class participation requirements for Process Technology II – Systems.
4. List the evaluation requirements (quizzes and tests) for Process Technology II – Systems.
5. List the lab requirements for Process Technology II – Systems.

Session 2: Systems Overview, Potable Water Systems, Fire Water Systems_

Learning Objectives

1. Describe how process industry facilities are divided into systems.
2. Identify the types of systems used in the process industry.
3. Describe the purpose of the potable water system.
4. Identify the basic equipment components found in potable water systems.
5. Explain the purpose of equipment components found in potable water systems.
6. Explain the potable water system theory of operation.

7. List variables that must be controlled to ensure proper operation of the system.
8. Identify potable water system instrumentation.
9. Trace flows through a potable water system on a PFD.
10. Discuss typical safety, health and environmental concerns associated with potable water systems.
11. Describe the purpose of the fire water system.
12. Define terms associated with fire water systems.
13. Identify the basic equipment components found in fire water systems.
14. Explain the purpose of equipment components found in fire water systems.
15. Explain the fire water system theory of operation.
16. List variables that must be controlled to ensure proper operation of the system.
17. Describe factors that affect normal fire water system operation.
18. Identify fire water system instrumentation.
19. Trace flows through a fire water system on a PFD.
20. Discuss typical safety, health and environmental concerns associated with fire water systems.

Session 3: Service/Utility Water Systems, Waste Water Systems_

Learning Objectives

1. Describe the purpose of service/utility water systems.
2. Identify the basic equipment components found in service/utility water systems.
3. Explain the purpose of equipment components found in service/utility water systems.
4. Define terms associated with service/utility water systems.
5. Explain the service/utility water system theory of operation.
6. List variables that must be controlled to ensure proper operation of the service/utility water system.
7. Describe factors that affect normal service/utility water system operation.
8. Identify service/utility water system instrumentation.
9. Trace flows through a service/utility water system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the service/utility water system.
11. Describe the purpose of waste water systems.
12. Identify the basic equipment components found in waste water systems.
13. Explain the purpose of equipment components found in waste water systems.
14. Define terms associated with waste water systems.
15. Explain the waste water system theory of operation.
16. List variables that must be controlled to ensure proper operation of the waste water system.
17. Describe factors that affect normal waste water system operation.
18. Identify waste water system instrumentation.
19. Trace flows through a waste water system on a PFD.

20. Discuss the specific safety, health and environmental concerns associated with the waste water system.

Session 4: Cooling Water Systems_

Learning Objectives

1. Describe the purpose of cooling water systems.
2. Identify the basic equipment components found in cooling water systems.
3. Explain the purpose of equipment components found in cooling water systems.
4. Define terms associated with cooling water systems.
5. Explain the cooling water system theory of operation.
6. List variables that must be controlled to ensure proper operation of the cooling water system.
7. Describe factors that affect normal cooling water system operation.
8. Identify cooling water system instrumentation.
9. Trace flows through a cooling water system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the cooling water system.

Session 5: Instrument Air Systems, Utility Air Systems, Breathing Air Systems_

Learning Objectives

1. Describe the purpose of instrument air systems.
 2. Identify the basic equipment components found in instrument air systems.
 3. Explain the purpose of equipment components found in instrument air systems.
 4. Define terms associated with instrument air systems.
 5. Explain the instrument air system theory of operation.
 6. List variables that must be controlled to ensure proper operation of the instrument air system.
 7. Describe factors that affect normal instrument air system operation.
 8. Identify instrument air system instrumentation.
 9. Trace flows through a instrument air system on a PFD.
 10. Discuss the specific safety, health and environmental concerns associated with the instrument air system.
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1. Describe the purpose of utility air systems.
 2. Identify the basic equipment components found in utility air systems.
 3. Explain the purpose of equipment components found in utility air systems.
 4. Define terms associated with utility air systems.
 5. Explain the utility air system theory of operation.

6. List variables that must be controlled to ensure proper operation of the utility air system.
7. Describe factors that affect normal utility air system operation.
8. Identify utility air system instrumentation.
9. Trace flows through a utility air system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the utility air system.
11. Describe the purpose of breathing air systems.
12. Identify the basic equipment components found in breathing air systems.
13. Explain the purpose of equipment components found in breathing air systems.
14. Define terms associated with breathing air systems.
15. Explain the breathing air system theory of operation.
16. List variables that must be controlled to ensure proper operation of the breathing air system.
17. Describe factors that affect normal breathing air system operation.
18. Identify breathing air system instrumentation.
19. Trace flows through a breathing air system on a PFD.
20. Discuss the specific safety, health and environmental concerns associated with the breathing air system.

Session 6: Nitrogen Systems, Natural Gas Systems, Fuel Gas Systems_

Learning Objectives

1. Describe the purpose of nitrogen systems.
2. Identify the basic equipment components found in nitrogen systems.
3. Explain the purpose of equipment components found in nitrogen systems.
4. Define terms associated with nitrogen systems.
5. Explain the nitrogen system theory of operation.
6. List variables that must be controlled to ensure proper operation of the nitrogen system.
7. Describe factors that affect normal nitrogen system operation.
8. Identify nitrogen system instrumentation.
9. Trace flows through a nitrogen system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the nitrogen system.
11. Describe the purpose of natural gas systems.
12. Identify the basic equipment components found in natural gas systems.
13. Explain the purpose of equipment components found in natural gas systems.
14. Define terms associated with natural gas systems.
15. Explain the natural gas system theory of operation.
16. List variables that must be controlled to ensure proper operation of the natural gas system.
17. Describe factors that affect normal natural gas system operation.
18. Identify natural gas system instrumentation.

19. Trace flows through a natural gas system on a PFD.
20. Discuss the specific safety, health and environmental concerns associated with the natural gas system.
21. Describe the purpose of fuel gas systems.
22. Identify the basic equipment components found in fuel gas systems.
23. Explain the purpose of equipment components found in fuel gas systems.
24. Define terms associated with fuel gas systems.
25. Explain the fuel gas system theory of operation.
26. List variables that must be controlled to ensure proper operation of the fuel gas system.
27. Describe factors that affect normal fuel gas system operation.
28. Identify fuel gas system instrumentation.
29. Trace flows through a fuel gas system on a PFD.
30. Discuss the specific safety, health and environmental concerns associated with the fuel gas system.

Session 7: Relief & Flare Systems, Electrical Power Generation & Distribution Systems, Test #1 Review

Learning Objectives

1. Describe the purpose of relief & flare systems.
2. Identify the basic equipment components found in relief & flare systems.
3. Explain the purpose of equipment components found in relief & flare systems.
4. Define terms associated with relief & flare systems.
5. Explain the relief & flare system theory of operation.
6. List variables that must be controlled to ensure proper operation of the relief & flare system.
7. Describe factors that affect normal relief & flare system operation.
8. Identify relief & flare system instrumentation.
9. Trace flows through a relief & flare system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the relief & flare system.
11. Describe the purpose of electrical power generation & distribution systems.
12. Identify the basic equipment components found in electrical power generation & distribution systems.
13. Explain the purpose of equipment components found in electrical power generation & distribution systems.
14. Define terms associated with electrical power generation & distribution systems.
15. Explain the electrical power generation & distribution system theory of operation.
16. List variables that must be controlled to ensure proper operation of the electrical power generation & distribution system.
17. Describe factors that affect normal electrical power generation & distribution system operation.

18. Identify electrical power generation & distribution system instrumentation.
19. Trace flows through a electrical power generation & distribution system on a PFD.
20. Discuss the specific safety, health and environmental concerns associated with the electrical power generation & distribution system.

Session 8: Test #1, Material Storage – Part 1

Learning Objectives

1. Describe the purpose of material storage systems.
2. Identify the basic equipment components found in material storage systems.
3. Explain the purpose of equipment components found in material storage systems.
4. Define terms associated with material storage systems.
5. Explain the material storage system theory of operation.
6. List variables that must be controlled to ensure proper operation of the material storage system.
7. Describe factors that affect normal material storage system operation.
8. Identify material storage system instrumentation.
9. Trace flows through a material storage system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the material storage system.

Session 9: Material Storage – Part 2, Blending Systems

Learning Objectives

1. Describe the purpose of blending systems.
2. Identify the basic equipment components found in blending systems.
3. Explain the purpose of equipment components found in blending systems.
4. Define terms associated with blending systems.
5. Explain the blending system theory of operation.
6. List variables that must be controlled to ensure proper operation of the blending system.
7. Describe factors that affect normal blending system operation.
8. Identify blending system instrumentation.
9. Trace flows through a blending system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the blending system.

Session 10: Refrigeration Systems – Part 1

Learning Objectives

1. Describe the purpose of refrigeration systems.
2. Identify the basic equipment components found in refrigeration systems.
3. Explain the purpose of equipment components found in refrigeration systems.
4. Define terms associated with refrigeration systems.
5. Explain the refrigeration system theory of operation.

Session 11: Refrigeration Systems – Part 2

Learning Objectives

1. List variables that must be controlled to ensure proper operation of the refrigeration system.
2. Describe factors that affect normal refrigeration system operation.
3. Identify refrigeration system instrumentation.
4. Trace flows through a refrigeration system on a PFD.
5. Discuss the specific safety, health and environmental concerns associated with the refrigeration system.
6. Compare and contrast mechanical and absorption refrigeration systems.

Session 12: Steam Generation & Distribution Systems – Part 1

Learning Objectives

1. Describe the purpose of steam generation & distribution systems.
2. Identify the basic equipment components found in steam generation & distribution systems.
3. Explain the purpose of equipment components found in steam generation & distribution systems.
4. Define terms associated with steam generation & distribution systems.
5. Explain the steam generation & distribution system theory of operation.
6. List variables that must be controlled to ensure proper operation of the steam generation & distribution system.
7. Describe factors that affect normal steam generation & distribution system operation.
8. Identify steam generation & distribution system instrumentation.
9. Trace flows through a steam generation & distribution system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the steam generation & distribution system.

Session 13: Steam Generation & Distribution Systems – Part 2

Learning Objectives

1. Describe the purpose of boiler feedwater systems.
2. Identify the basic equipment components found in boiler feedwater systems.
3. Explain the purpose of equipment components found in boiler feedwater systems.
4. Define terms associated with boiler feedwater systems.
5. Explain the boiler feedwater system theory of operation.
6. List variables that must be controlled to ensure proper operation of the boiler feedwater system.
7. Describe factors that affect normal boiler feedwater system operation.
8. Identify boiler feedwater system instrumentation.
9. Trace flows through a boiler feedwater system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the boiler feedwater system.

Session 14: Steam Generation & Distribution Systems – Part 3

Learning Objectives

1. Describe the purpose of boiler systems.
2. Identify the basic equipment components found in boiler systems.
3. Explain the purpose of equipment components found in boiler systems.
4. Define terms associated with boiler systems.
5. Explain the boiler system theory of operation.
6. List variables that must be controlled to ensure proper operation of the boiler system.
7. Describe factors that affect normal boiler system operation.
8. Identify boiler system instrumentation.
9. Trace flows through a boiler system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the boiler system.

Session 15: Steam Generation & Distribution Systems – Part 4, Test Review #2

Learning Objectives

1. Describe the purpose of steam distribution systems.
2. Identify the basic equipment components found in steam distribution systems.
3. Explain the purpose of equipment components found in steam distribution systems.
4. Define terms associated with steam distribution systems.
5. Explain the steam distribution system theory of operation.
6. List variables that must be controlled to ensure proper operation of the steam distribution system.
7. Describe factors that affect normal steam distribution system operation.
8. Identify steam distribution system instrumentation.

9. Trace flows through a steam distribution system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the steam distribution system.

Session 16: Test #2, Reaction – Part 1

Learning Objectives

1. Describe the purpose of reaction systems.
2. Identify the basic equipment components found in reaction systems.
3. Explain the purpose of equipment components found in reaction systems.
4. Define terms associated with reaction systems.
5. Explain the reaction system theory of operation.
6. List variables that must be controlled to ensure proper operation of the reaction system.

Session 17: Reaction – Part 2

Learning Objectives

1. Describe factors that affect normal reaction system operation.
2. Identify reaction system instrumentation.
3. Trace flows through a reaction system on a PFD.
4. Discuss the specific safety, health and environmental concerns associated with the reaction system.

Session 18: Reaction – Part 3

Learning Objectives

1. Compare and contrast types of reactions that occur in industry.
2. Differentiate between types of reaction systems.

Session 19: Separation Systems Overview, Extraction Systems – Part 1

Learning Objectives

1. Identify types of separation systems in process industry.
2. Define terms associated with separation systems.
3. Describe the purpose of extraction systems.
4. Identify the basic equipment components found in extraction systems.
5. Explain the purpose of equipment components found in extraction systems.
6. Define terms associated with extraction systems.

7. Explain the extraction system theory of operation.

Session 20: Extraction Systems – Part 2

Learning Objectives

1. List variables that must be controlled to ensure proper operation of the extraction system.
2. Describe factors that affect normal extraction system operation.
3. Identify extraction system instrumentation.
4. Trace flows through an extraction system on a PFD.
5. Discuss the specific safety, health and environmental concerns associated with the extraction system.

Session 21: Distillation Systems – Part 1

Learning Objectives

1. Describe the purpose of distillation systems.
2. Identify the basic equipment components found in distillation systems.
3. Explain the purpose of equipment components found in distillation systems.
4. Define terms associated with distillation systems.
5. Differentiate between different types of distillation systems.
6. Describe how the system design determines tower diameter, height, feed entry point, and control point.

Session 22: Distillation Systems – Part 2

Learning Objectives

1. Explain the distillation system theory of operation.
2. List variables that must be controlled to ensure proper operation of the distillation system.
3. Describe distillation tower internals and their relationship during the distillation process.

Session 23: Distillation Systems – Part 3

Learning Objectives

1. Describe factors that affect normal distillation system operation.
2. Identify distillation system instrumentation.

3. Trace flows through a distillation system on a PFD.
4. Discuss the specific safety, health and environmental concerns associated with the distillation system.

Session 24: Distillation Systems – Part 4, Test Review #3

Learning Objectives

1. Describe the uses of batch distillation and continuous process distillation.
2. Compare and contrast components in batch and continuous distillation systems.

Session 25: Test #3, Stripping Systems, Absorption Systems

Learning Objectives

1. Describe the purpose of stripping systems.
2. Identify the basic equipment components found in stripping systems.
3. Explain the purpose of equipment components found in stripping systems.
4. Define terms associated with stripping systems.
5. Explain the stripping system theory of operation.
6. List variables that must be controlled to ensure proper operation of the stripping system.
7. Describe factors that affect normal stripping system operation.
8. Identify stripping system instrumentation.
9. Trace flows through a stripping system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the stripping system.
11. Describe the purpose of absorption systems.
12. Identify the basic equipment components found in absorption systems.
13. Explain the purpose of equipment components found in absorption systems.
14. Define terms associated with absorption systems.
15. Explain the absorption system theory of operation.
16. List variables that must be controlled to ensure proper operation of the absorption system.
17. Describe factors that affect normal absorption system operation.
18. Identify absorption system instrumentation.
19. Trace flows through a absorption system on a PFD.
20. Discuss the specific safety, health and environmental concerns associated with the absorption system.

Session 26: Dehydration Systems, Adsorption Systems

Learning Objectives

1. Describe the purpose of dehydration systems.
2. Identify the basic equipment components found in dehydration systems.
3. Explain the purpose of equipment components found in dehydration systems.
4. Define terms associated with dehydration systems.
5. Explain the dehydration system theory of operation.
6. List variables that must be controlled to ensure proper operation of the dehydration system.
7. Describe factors that affect normal dehydration system operation.
8. Identify dehydration system instrumentation.
9. Trace flows through a dehydration system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the dehydration system.
11. Describe the purpose of adsorption systems.
12. Identify the basic equipment components found in adsorption systems.
13. Explain the purpose of equipment components found in adsorption systems.
14. Define terms associated with adsorption systems.
15. Explain the adsorption system theory of operation.
16. List variables that must be controlled to ensure proper operation of the adsorption system.
17. Describe factors that affect normal adsorption system operation.
18. Identify adsorption system instrumentation.
19. Trace flows through a adsorption system on a PFD.
20. Discuss the specific safety, health and environmental concerns associated with the adsorption system.

Session 27: Filtration Systems, Separation System Comparison

Learning Objectives

1. Describe the purpose of filtration systems.
2. Identify the basic equipment components found in filtration systems.
3. Explain the purpose of equipment components found in filtration systems.
4. Define terms associated with filtration systems.
5. Explain the filtration system theory of operation.
6. List variables that must be controlled to ensure proper operation of the filtration system.
7. Describe factors that affect normal filtration system operation.
8. Identify filtration system instrumentation.
9. Trace flows through a filtration system on a PFD.
10. Discuss the specific safety, health and environmental concerns associated with the filtration system.

Session 28: Systems Procedures & Troubleshooting

Learning Objectives

1. Describe typical process technician responsibilities for the following:
 - operating systems
 - monitoring systems
 - troubleshooting systems
 - completing rounds
 - communication between inside and outside operator
 - communication between process technician and other departments
 - implementing established procedures and specifications
 - completing maintenance tasks as assigned
 - monitoring and maintaining auxiliary equipment
 - completing related sampling and analysis tasks and responding appropriately to results
 - communicating problems to appropriate personnel
 - communicating relevant information to other units.
1. Discuss the Process Technician's role in identifying system problems.

Session 29: Control Systems

Learning Objectives

1. Compare and contrast control systems used in utility, auxiliary, and process systems.

Session 30: System Economics & Optimization

Learning Objectives

1. List factors that can affect plant economics.
2. Discuss the process technician's role in process optimization and control for the following systems:
 - cooling water
 - steam generation and distribution
 - reaction
 - distillation
 - extraction
 - stripping
 - absorption
 - dehydration

- adsorption
- filtration.

Session 31: Test Review

Learning Objectives

No new learning objectives are introduced.

Session 32: Test #4_

Learning Objectives

No new learning objectives are introduced.

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