

PTAC2420 - PROCESS TECHNOLOGY II - SYSTEMS

Topic	Objectives
Systems Overview	1. Describe how process industry facilities are divided into systems. Identify the types of systems used in the process industries.
Water Systems: <ul style="list-style-type: none"> • Potable Water • Fire Water 	1. Describe the purpose of the potable and fire water systems. 2. Identify the basic equipment components found in potable and fire water systems. 3. Explain the purpose of equipment components found in potable and fire water systems. 4. Explain the potable and fire water systems theory of operation. 5. List variables that must be controlled to ensure proper operation of the potable and fire water systems. 6. Discuss potable water and fire systems instrumentation. 7. Trace flows through a potable and fire water systems on a flow diagram (PFD, EFD, P & ID). 8. Discuss typical safety, health and environmental concerns associated with potable and fire water systems. 9. Describe pre-treatment systems for potable water. 10. Describe factors (flows, pressure, pH, conductivity, etc.) that affect normal potable and fire water systems operation.
Water Systems: <ul style="list-style-type: none"> • Service/Utility • Waste Water • Storm Water 	1. Describe the purpose of service/utility, waste and storm water systems. 2. Identify the basic equipment components found in service/utility, waste and storm water systems. 3. Explain the purpose of equipment components found in service/utility, waste and storm water systems. 4. Define terms associated with service/utility, waste and storm water systems. 5. Explain the service/utility, waste and storm water systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the service/utility, waste and storm water systems. 7. Describe factors (flows, pressure, temperature, pH, conductivity, etc.) that affect normal service/utility and waste water systems operation. 8. Discuss service/utility, waste and storm water systems instrumentation. 9. Trace flows through a service/utility, waste and storm water systems on a diagram (PFD, EFD, P & ID). 10. Discuss the specific safety, health and environmental concerns associated with the service/utility, waste and storm water systems. 11. Describe post-treatment systems for waste water systems.

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Cooling Water Systems	<ol style="list-style-type: none"> 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 (flows, pressure, temperature, pH, conductivity, etc.) that affect normal cooling water system operation. 8. Discuss cooling water system instrumentation. 9. Trace flows through a cooling water system on a diagram (PFD, EFD, P&ID). 10. Discuss the specific safety, health and environmental concerns associated with the cooling water system. 11. Describe the treatment of cooling water systems and why it is necessary.
Air Systems: <ul style="list-style-type: none"> • Instrument Air • Utility Air • Breathing Air 	<ol style="list-style-type: none"> 1. Describe the purpose of instrument, utility and breathing air systems. 2. Identify the basic equipment components found in instrument, utility and breathing air systems. 3. Explain the purpose of equipment components found in instrument, utility and breathing air systems. 4. Define terms associated with instrument, utility and breathing air systems. 5. Explain the instrument, utility and breathing air systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the instrument, utility and breathing air systems. 7. Describe factors that affect normal instrument, utility and breathing air systems operation. 8. Discuss instrument, utility and breathing air systems instrumentation. 9. Trace flows through a instrument, utility and breathing air systems on a diagram (PFD, EFD, P & ID). 10. Discuss the specific safety, health and environmental concerns associated with the instrument, utility and breathing air systems. 11. Discuss the specific safety concerns associated with breathing air (cross-contamination), 12. Discuss usage of a self-contained breathing apparatus (SCBA). 13. Discuss the importance of having instrument air at a low dew-point. 14. Discuss process upsets associated with the failure of the instrument air system including backup systems.

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<p>Nitrogen and Hydrogen Systems</p>	<ol style="list-style-type: none"> 1. Describe the purpose of nitrogen and hydrogen systems. 2. Discuss the basic equipment components found in nitrogen and hydrogen systems. 3. Explain the purpose of equipment components found in nitrogen and hydrogen systems. 4. Define terms associated with nitrogen and hydrogen systems. 5. Explain the nitrogen and hydrogen systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the nitrogen and hydrogen systems. 7. Describe factors that affect normal nitrogen and hydrogen systems operation. 8. Discuss nitrogen and hydrogen systems instrumentation. 9. Trace flows through a nitrogen and hydrogen systems on a diagram (PFD, EFD, P&ID). 19. Discuss the specific safety, health and environmental concerns associated with nitrogen systems. <ul style="list-style-type: none"> • Discuss specific safety concern of displacement of oxygen with nitrogen in a confined space. 20. Discuss the specific safety, health and environmental concerns associated with a hydrogen system. <ul style="list-style-type: none"> • Highly combustible • Auto-ignition • Burns colorless flame • Extremely high temperature flame 20. Describe the treatment nitrogen and hydrogen and why it is necessary. 21. Discuss equipment purging activities using nitrogen.
<p>Fuel Gas Systems</p>	<ol style="list-style-type: none"> 1. Describe the various types of gases used in fuel gas systems (natural, off-gas, etc.) 2. Describe the purpose of fuel gas systems. 3. Identify the basic equipment components found in fuel gas systems. 4. Explain the purpose of equipment components found in fuel gas systems. 5. Define terms associated with fuel gas systems. 6. Explain the fuel gas systems theory of operation. 7. List variables that must be controlled to ensure proper operation of the fuel gas systems. 8. Describe factors that affect normal fuel gas systems operation. 9. Discuss fuel gas systems instrumentation. 10. Trace flows through a fuel gas systems on a diagram (PFD, EFD, P&ID). 11. Discuss the specific safety, health and environmental concerns associated with the fuel gas systems. 12. Discuss the sources of fuel gas and heating (BTU content) value. 13. List variables that must be controlled to ensure proper operation of the fuel gas system (pressure, step-down, contamination, etc.). 30. Discuss the specific safety, health and environmental concerns associated with the fuel gas system. <ol style="list-style-type: none"> a. Flammability b. Methyl Mercaptan addition

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Relief and Flare Systems	<ol style="list-style-type: none"> 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 systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the relief & flare systems. 7. Describe factors that affect normal relief & flare systems operation. 8. Discuss relief & flare systems instrumentation. 9. Trace flows through a relief & flare systems on a diagram (PFD, EFD, P&ID) 10. Discuss the specific safety, health and environmental concerns associated with the relief & flare systems. <ul style="list-style-type: none"> • Reporting requirements • Environmental and safety impacts during flaring incidents due to incomplete combustion (smoke, noise, thermal radiation, etc.)
Electrical Power Generation & Distribution Systems	<ol style="list-style-type: none"> 1. Describe the purpose of electrical power generation & distribution systems. 2. Identify the basic equipment components found in electrical power generation & distribution systems. 3. Explain the purpose of equipment components found in electrical power generation & distribution systems. 4. Define terms associated with electrical power generation & distribution systems. 5. Explain the electrical power generation & distribution systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the electrical power generation & distribution systems. 7. Describe factors that affect normal electrical power generation & distribution systems operation. 8. Discuss electrical power generation & distribution systems instrumentation. 9. Trace flows through an electrical power generation & distribution systems on an electrical one-line diagram. 30. Discuss the specific safety, health and environmental concerns associated with the electrical power generation & distribution 31. Discuss safety concerns when operating switch gear.
Thermal Oxidation Systems (Incinerators)	<ol style="list-style-type: none"> 1. Describe the purpose of thermal oxidation systems. 2. Discuss the basic equipment components found in thermal oxidation systems. 3. Explain the purpose of equipment components found in thermal oxidation systems. 4. Define terms associated with thermal oxidation systems. 5. Explain the thermal oxidation systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the thermal oxidation systems. 7. Describe factors that affect normal thermal oxidation systems operation. 8. Discuss thermal oxidation systems instrumentation. 9. Trace flows through a thermal oxidation systems on a diagram (PFD, EFD, P&ID) 10. Discuss the specific safety, health and environmental concerns associated with the thermal oxidation systems.

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Material Storage	<ol style="list-style-type: none">1. Describe the various types and purposes of material storage systems.2. Discuss 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.<ul style="list-style-type: none">• Storage time• Temperature• Cross-contamination• Inhibitors8. Discuss material storage system instrumentation.9. Trace flows through a material storage system on a diagram (PFD, EFD, P&ID).10. Discuss the specific safety, health and environmental concerns associated with the material storage systems.<ul style="list-style-type: none">• Vapor recovery and control• Blanketing
Blending Systems	<ol style="list-style-type: none">1. Describe the various types and purposes of blending systems.2. Discuss 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 systems theory of operation.6. List variables that must be controlled to ensure proper operation of the blending systems.7. Describe factors that affect normal blending systems operation.8. Discuss blending systems instrumentation.9. Trace flows through a blending systems on a diagram (PFD, EFD, P&ID).10. Discuss the safety, health and environmental concerns associated with blending systems.

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Refrigeration Systems	<ol style="list-style-type: none"> 1. Describe the purpose of refrigeration systems. 2. Discuss 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. 6. List variables that must be controlled to ensure proper operation of the refrigeration system. 7. Describe factors that affect normal refrigeration system operation. 8. Discuss system instrumentation. 9. Trace flows through a refrigeration system on a diagram (PFD, EFD, P&ID). 10. Discuss the specific safety, health and environmental concerns associated with the refrigeration system. <ul style="list-style-type: none"> • refrigerant 11. Compare and contrast mechanical and absorption refrigeration systems.
Steam Systems Overview – Generation, Distribution, and Condensate Return	<ol style="list-style-type: none"> 1. Describe the purpose of steam generation & distribution systems. 2. Discuss 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 (moisture, pH, hardness, conductivity, etc.). 7. Describe factors that affect normal steam generation & distribution system operation. <ul style="list-style-type: none"> • Freeze protection • Effect or impact of steam trap failure 8. Discuss steam generation & distribution systems instrumentation. 9. Trace flows through a steam generation & distribution systems on a diagram (PFD, EFD, P&ID). 10. Discuss the specific safety, health and environmental concerns associated with the steam generation & distribution system. <ol style="list-style-type: none"> a. Expansion b. Extreme temperatures/heat content (BTUs) c. Pressures

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Steam Systems – Boilers and Boiler Feedwater	<ol style="list-style-type: none"> 1. Describe the purpose of boilers and boiler feedwater systems. 2. Discuss the basic equipment components found in boilers and boiler feedwater systems. 3. Explain the purpose of equipment components found in boilers and boiler feedwater systems. <ul style="list-style-type: none"> • Including pre-treatment systems such as de-mineralization and chemical treatment of boiler feedwater 4. Define terms associated with boilers and boiler feedwater systems 5. Explain the boilers and boiler feedwater systems theory of operation. 6. List variables that must be controlled to ensure proper operation of the boilers and boiler feedwater systems. 7. Describe factors that affect normal boilers and boiler feedwater systems operation. 8. Discuss boilers and boiler feedwater systems instrumentation. 9. Trace flows through a boiler and boiler feedwater system on a diagram (PFD, EFD, P&ID). 10. Discuss the specific safety, health and environmental concerns associated with the boilers and boiler feedwater systems.
Reaction Part 1 – Introduction	<ol style="list-style-type: none"> 1. Distinguish between a chemical blending/separation and a chemical reaction. 2. Describe the purpose of reaction systems. 3. Discuss the basic equipment components found in reaction systems. 4. Explain the purpose of equipment components found in reaction systems. 5. Define terms associated with reaction systems. 6. Distinguish between continuous and batch reaction systems.
Reaction Part 2 - Batch	<ol style="list-style-type: none"> 1. Describe the types of batch reactors. 2. List variables that must be controlled to ensure proper operation of the reaction systems. 3. Discuss reaction systems instrumentation. 4. Trace flows through a reaction system on a PFD. 5. Discuss the specific safety, health and environmental concerns associated with the reaction systems.
Reaction Part 3 - Continuous	<ol style="list-style-type: none"> 1. Describe the types of continuous reactors. 2. Describe the importance of flow ratios between reactants. 3. List variables that must be controlled to ensure proper operation of the reaction systems. 4. Discuss reaction systems instrumentation. 5. Trace flows through a reaction system on a PFD. 6. Discuss the specific safety, health and environmental concerns associated with the reaction systems.
Separation Systems Overview – Part 1	<ol style="list-style-type: none"> 1. Identify types of separation systems in process industries. 2. Define terms associated with separation systems.

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Extraction, Absorption & Solvent Recovery Systems – Part 2	<ol style="list-style-type: none"> 1. Describe the purpose of extraction, absorption and solvent recovery systems. 2. Discuss the basic equipment components found in extraction, absorption and solvent recovery systems. 3. Explain the purpose of equipment components found in extraction, absorption and solvent recovery systems. 4. Define terms associated with extraction, absorption and solvent recovery. 5. Explain the extraction, absorption and solvent recovery systems theory of operation 6. List variables that must be controlled to ensure proper operation of the extraction, absorption and solvent recovery systems. 7. Describe factors that affect normal extraction, absorption and solvent recovery systems operation. 8. Discuss extraction, absorption and solvent recovery systems instrumentation. 9. Trace flows through an extraction, absorption and solvent recovery systems on a diagram (PFD, EFD, P&ID). 10. Discuss the specific safety, health and environmental concerns associated with the extraction, absorption and solvent recovery systems.
Distillation Systems	<ol style="list-style-type: none"> 1. Describe the purpose of distillation systems. 2. Discuss 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. <ul style="list-style-type: none"> • Batch & continuous • Vacuum, atmospheric and pressurized 6. Describe how the system requirements determine the following: <ul style="list-style-type: none"> • tower diameter • height • feed entry point • control points • tower internals (trays, packing) 7. Explain the distillation system theory of operation. 8. List variables that must be controlled to ensure proper operation of the distillation system. 9. Describe factors that affect normal distillation system operation. 10. Discuss distillation system instrumentation. 11. Trace flows through a distillation system on a PFD. 12. Discuss the specific safety, health and environmental concerns associated with the distillation system.

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Adsorption & Dehydration Systems	<ol style="list-style-type: none">1. Describe the purpose of adsorption and dehydration systems.2. Discuss the basic equipment components found in adsorption and dehydration systems.3. Explain the purpose of equipment components found in adsorption and dehydration systems.4. Define terms associated with adsorption and dehydration systems.5. Explain the adsorption and dehydration systems theory of operation.6. List variables that must be controlled to ensure proper operation of the in adsorption and dehydration systems.7. Describe factors that affect normal adsorption and dehydration systems operation.8. Discuss adsorption and dehydration systems instrumentation.9. Trace flows through an adsorption and dehydration systems on a PFD.10. Discuss the specific safety, health and environmental concerns associated with the adsorption and dehydration systems.
Filtration Systems	<ol style="list-style-type: none">1. Describe the purpose of filtration systems.2. Describe the types of filtration systems.3. Discuss the basic equipment components found in filtration systems.4. Explain the purpose of equipment components found in filtration systems.5. Define terms associated with filtration systems.6. Explain the filtration system theory of operation.7. List variables that must be controlled to ensure proper operation of the filtration system.8. Describe factors that affect normal filtration system operation.9. Discuss filtration system instrumentation.10. Trace flows through a filtration system on a PFD.11. Discuss the specific safety, health and environmental concerns associated with the filtration system.

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Operator Responsibilities	<ol style="list-style-type: none">1. Describe typical process technician responsibilities for each of the following:<ul style="list-style-type: none">• 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• Impact on plant economics2. Discuss the process technician's role in identifying system problems.3. Discuss the process technician's role in process optimization and control for the following systems:<ul style="list-style-type: none">• cooling water• steam generation and distribution• reaction• distillation• extraction/ absorption• stripping/solvent recovery• dehydration• adsorption• filtration <p>Compare and contrast control systems used in utility, auxiliary, and process systems.</p>