# Brazosport College

## Syllabus for PTAC 2420 – Process Technology II - Systems

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## I. COURSE DESCRIPTION:

**PTAC 2420 - Process Technology II - Systems CIP** 4103010003
Study of the interrelation of process equipment and process systems including related scientific principles. Laboratory exercises include operating small plants representing the following unit operations: distillation, extraction, demineralization, reactors, and waste treatment.
**Credit Hours:** 4 (3 lecture, 3 lab)

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**A. Prerequisite*:*** Grade of "C" or better in **PTAC 1432** and **PTAC 1410**.
**Required skill level:** College-level reading, writing and math.

## II. COURSE OBJECTIVES

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

| 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:**<br>• **Potable Water**<br>• **Fire Water** | 1. Describe the purpose of the potable and fire water systems.<br>2. Identify the basic equipment components found in potable and fire water systems.<br>3. Explain the purpose of equipment components found in potable and fire water systems.<br>4. Explain the potable and fire water systems theory of operation.<br>5. List variables that must be controlled to ensure proper operation of the potable and fire water systems.<br>6. Discuss potable water and fire systems instrumentation. |

| Topic | Objectives |
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| **Water Systems:**<br>• **Potable Water**<br>• **Fire Water**<br>**(cont.)** | 7. Trace flows through a potable and fire water systems on a flow diagram (PFD, EFD, P & ID).<br>8. Discuss typical safety, health and environmental concerns associated with potable and fire water systems.<br>9. Describe pre-treatment systems for potable water.<br>10. Describe factors (flows, pressure, pH, conductivity, etc.) that affect normal potable and fire water systems operation. |
| **Water Systems:**<br>• **Service/Utility**<br>• **Waste Water**<br>• **Storm Water** | 1. Describe the purpose of service/utility, waste and storm water systems.<br>2. Identify the basic equipment components found in service/utility, waste and storm water systems.<br>3. Explain the purpose of equipment components found in service/utility, waste and storm water systems.<br>4. Define terms associated with service/utility, waste and storm water systems.<br>5. Explain the service/utility, waste and storm water systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the service/utility, waste and storm water systems.<br>7. Describe factors (flows, pressure, temperature, pH, conductivity, etc.) that affect normal service/utility and waste water systems operation.<br>8. Discuss service/utility, waste and storm water systems instrumentation.<br>9. Trace flows through a service/utility, waste and storm water systems on a diagram (PFD, EFD, P & ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the service/utility, waste and storm water systems.<br>11. Describe post-treatment systems for waste water systems. |

| Topic | Objectives |
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| **Cooling Water Systems** | 1. Describe the purpose of cooling water systems.<br>2. Identify the basic equipment components found in cooling water systems.<br>3. Explain the purpose of equipment components found in cooling water systems.<br>4. Define terms associated with cooling water systems.<br>5. Explain the cooling water system theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the cooling water system.<br>7. Describe factors (flows, pressure, temperature, pH, conductivity, etc.) that affect normal cooling water system operation.<br>8. Discuss cooling water system instrumentation.<br>9. Trace flows through a cooling water system on a diagram (PFD, EFD, P&ID). |

| Topic | Objectives |
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| **Cooling Water Systems (cont.)** | 10. Discuss the specific safety, health and environmental concerns associated with the cooling water system.<br>11. Describe the treatment of cooling water systems and why it is necessary. |
| **Air Systems:**<br>**Instrument Air**<br>**Utility Air**<br>**Breathing Air** | 1. Describe the purpose of instrument, utility and breathing air systems.<br>2. Identify the basic equipment components found in instrument, utility and breathing air systems.<br>3. Explain the purpose of equipment components found in instrument, utility and breathing air systems.<br>4. Define terms associated with instrument, utility and breathing air systems.<br>5. Explain the instrument, utility and breathing air systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the instrument, utility and breathing air systems.<br>7. Describe factors that affect normal instrument, utility and breathing air systems operation.<br>8. Discuss instrument, utility and breathing air systems instrumentation.<br>9. Trace flows through a instrument, utility and breathing air systems on a diagram (PFD, EFD, P & ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the instrument, utility and breathing air systems.<br>11. Discuss the specific safety concerns associated with breathing air (cross-contamination),<br>12. Discuss usage of a self-contained breathing apparatus (SCBA).<br>13. Discuss the importance of having instrument air at a low dew-point.<br>14. Discuss process upsets associated with the failure of the instrument air system including backup systems. |

| Topic | Objectives |
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| **Nitrogen and Hydrogen Systems** | 1. Describe the purpose of nitrogen and hydrogen systems.<br>2. Discuss the basic equipment components found in nitrogen and hydrogen systems.<br>3. Explain the purpose of equipment components found in nitrogen and hydrogen systems.<br>4. Define terms associated with nitrogen and hydrogen systems.<br>5. Explain the nitrogen and hydrogen systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the nitrogen and hydrogen systems.<br>7. Describe factors that affect normal nitrogen and hydrogen systems operation.<br>8. Discuss nitrogen and hydrogen systems instrumentation. |

| Topic | Objectives |
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| **Nitrogen and Hydrogen Systems (cont.)** | 9. Trace flows through a nitrogen and hydrogen systems on a diagram (PFD, EFD, P&ID).<br>10. Discuss the specific safety, health and environmental concerns associated with nitrogen systems.<br>11. Discuss specific safety concern of displacement of oxygen with nitrogen in a confined space.<br>12. Discuss the specific safety, health and environmental concerns associated with a hydrogen system.<br>• Highly combustible<br>• Auto-ignition<br>• Burns colorless flame<br>• Extremely high temperature flame<br>13. Describe the treatment nitrogen and hydrogen and why it is necessary.<br>14. Discuss equipment purging activities using nitrogen. |
| **Fuel Gas Systems** | 1. Describe the various types of gases used in fuel gas systems (natural, off-gas, etc.)<br>2. Describe the purpose of fuel gas systems.<br>3. Identify the basic equipment components found in fuel gas systems.<br>4. Explain the purpose of equipment components found in fuel gas systems.<br>5. Define terms associated with fuel gas systems.<br>6. Explain the fuel gas systems theory of operation.<br>7. List variables that must be controlled to ensure proper operation of the fuel gas systems.<br>8. Describe factors that affect normal fuel gas systems operation.<br>9. Discuss fuel gas systems instrumentation.<br>10. Trace flows through a fuel gas systems on a diagram (PFD, EFD, P&ID).<br>11. Discuss the specific safety, health and environmental concerns associated with the fuel gas systems.<br>12. Discuss the sources of fuel gas and heating (BTU content) value.<br>13. List variables that must be controlled to ensure proper operation of the fuel gas system (pressure, step-down, contamination, etc.).<br>14. Discuss the specific safety, health and environmental concerns associated with the fuel gas system.<br>a. Flammability<br>b. Methyl Mercaptan addition |

| Topic | Objectives |
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| **Relief and Flare Systems** | 1. Describe the purpose of relief & flare systems.<br>2. Identify the basic equipment components found in relief & flare systems.<br>3. Explain the purpose of equipment components found in relief & flare systems. |

| Topic | Objectives |
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| **Relief and Flare Systems (con.t)** | 4. Define terms associated with relief & flare systems.<br>5. Explain the relief & flare systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the relief & flare systems.<br>7. Describe factors that affect normal relief & flare systems operation.<br>8. Discuss relief & flare systems instrumentation.<br>9. Trace flows through a relief & flare systems on a diagram (PFD, EFD, P&ID)<br>10. Discuss the specific safety, health and environmental concerns associated with the relief & flare systems.<br>• Reporting requirements<br>• Environmental and safety impacts during flaring incidents due to incomplete combustion (smoke, noise, thermal radiation, etc.) |
| **Electrical Power Generation & Distribution Systems** | 1. Describe the purpose of electrical power generation & distribution systems.<br>2. Identify the basic equipment components found in electrical power generation & distribution systems.<br>3. Explain the purpose of equipment components found in electrical power generation & distribution systems.<br>4. Define terms associated with electrical power generation & distribution systems.<br>5. Explain the electrical power generation & distribution systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the electrical power generation & distribution systems.<br>7. Describe factors that affect normal electrical power generation & distribution systems operation.<br>8. Discuss electrical power generation & distribution systems instrumentation.<br>9. Trace flows through an electrical power generation & distribution systems on an electrical one-line diagram.<br>10. Discuss the specific safety, health and environmental concerns associated with the electrical power generation & distribution<br>11. Discuss safety concerns when operating switch gear. |
| **Thermal Oxidation Systems (Incinerators)** | 1. Describe the purpose of thermal oxidation systems.<br>2. Discuss the basic equipment components found in thermal oxidation systems.<br>3. Explain the purpose of equipment components found in thermal oxidation systems.<br>4. Define terms associated with thermal oxidation systems.<br>5. Explain the thermal oxidation systems theory of operation. |

| Topic | Objectives |
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| | 6. List variables that must be controlled to ensure proper operation of the thermal oxidation systems.<br>7. Describe factors that affect normal thermal oxidation systems operation.<br>8. Discuss thermal oxidation systems instrumentation.<br>9. Trace flows through a thermal oxidation systems on a diagram (PFD, EFD, P&ID)<br>10. Discuss the specific safety, health and environmental concerns associated with the thermal oxidation systems. |

| Topic | Objectives |
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| **Material Storage** | 1. Describe the various types and purposes of material storage systems.<br>2. Discuss the basic equipment components found in material storage systems.<br>3. Explain the purpose of equipment components found in material storage systems.<br>4. Define terms associated with material storage systems.<br>5. Explain the material storage system theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the material storage system.<br>7. Describe factors that affect normal material storage system operation.<br>• Storage time<br>• Temperature<br>• Cross-contamination<br>• Inhibitors<br>8. Discuss material storage system instrumentation.<br>9. Trace flows through a material storage system on a diagram (PFD, EFD, P&ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the material storage systems.<br>• Vapor recovery and control<br>• Blanketing |
| **Blending Systems** | 1. Describe the various types and purposes of blending systems.<br>2. Discuss the basic equipment components found in blending systems.<br>3. Explain the purpose of equipment components found in blending systems.<br>4. Define terms associated with blending systems.<br>5. Explain the blending systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the blending systems.<br>7. Describe factors that affect normal blending systems operation.<br>8. Discuss blending systems instrumentation.<br>9. Trace flows through a blending systems on a diagram (PFD, EFD, P&ID).<br>10. Discuss the safety, health and environmental concerns associated with blending systems. |

| Topic | Objectives |
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| **Refrigeration Systems** | 1. Describe the purpose of refrigeration systems.<br>2. Discuss the basic equipment components found in refrigeration systems.<br>3. Explain the purpose of equipment components found in refrigeration systems.<br>4. Define terms associated with refrigeration systems.<br>5. Explain the refrigeration system theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the refrigeration system.<br>7. Describe factors that affect normal refrigeration system operation.<br>8. Discuss system instrumentation.<br>9. Trace flows through a refrigeration system on a diagram (PFD, EFD, P&ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the refrigeration system.<br>• refrigerant<br>11. Compare and contrast mechanical and absorption refrigeration systems. |
| **Steam Systems Overview – Generation, Distribution, and Condensate Return** | 1. Describe the purpose of steam generation & distribution systems.<br>2. Discuss the basic equipment components found in steam generation & distribution systems.<br>3. Explain the purpose of equipment components found in steam generation & distribution systems.<br>4. Define terms associated with steam generation & distribution systems.<br>5. Explain the steam generation & distribution system theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the steam generation & distribution system (moisture, pH, hardness, conductivity, etc.).<br>7. Describe factors that affect normal steam generation & distribution system operation.<br>• Freeze protection<br>• Effect or impact of steam trap failure<br>8. Discuss steam generation & distribution systems instrumentation.<br>9. Trace flows through a steam generation & distribution systems on a diagram (PFD, EFD, P&ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the steam generation & distribution system.<br>a. Expansion<br>b. Extreme temperatures/heat content (BTUs)<br>c. Pressures |

| Topic | Objectives |
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| **Steam Systems – Boilers and** | 1. Describe the purpose of boilers and boiler feedwater systems.<br>2. Discuss the basic equipment components found in boilers and boiler feedwater systems. |

| Topic | Objectives |
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| **Boiler Feedwater**<br><br>**Steam Systems – Boilers and Boiler Feedwater (cont.)** | 3. Explain the purpose of equipment components found in boilers and boiler feedwater systems.<br>• Including pre-treatment systems such as de-mineralization and chemical treatment of boiler feedwater<br>4. Define terms associated with boilers and boiler feedwater systems<br>5. Explain the boilers and boiler feedwater systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the boilers and boiler feedwater systems.<br>7. Describe factors that affect normal boilers and boiler feedwater systems operation.<br>8. Discuss boilers and boiler feedwater systems instrumentation.<br>9. Trace flows through a boiler and boiler feedwater system on a diagram (PFD, EFD, P&ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the boilers and boiler feedwater systems. |
| **Reaction Part 1 – Introduction** | 1. Distinguish between a chemical blending/separation and a chemical reaction.<br>2. Describe the purpose of reaction systems.<br>3. Discuss the basic equipment components found in reaction systems.<br>4. Explain the purpose of equipment components found in reaction systems.<br>5. Define terms associated with reaction systems.<br>6. Distinguish between continuous and batch reaction systems. |
| **Reaction Part 2 – Batch** | 1. Describe the types of batch reactors.<br>2. List variables that must be controlled to ensure proper operation of the reaction systems.<br>3. Discuss reaction systems instrumentation.<br>4. Trace flows through a reaction system on a PFD.<br>5. Discuss the specific safety, health and environmental concerns associated with the reaction systems. |
| **Reaction Part 3 - Continuous** | 1. Describe the types of continuous reactors.<br>2. Describe the importance of flow ratios between reactants.<br>3. List variables that must be controlled to ensure proper operation of the reaction systems.<br>4. Discuss reaction systems instrumentation.<br>5. Trace flows through a reaction system on a PFD.<br>6. Discuss the specific safety, health and environmental concerns associated with the reaction systems. |
| **Separation Systems Overview – Part 1** | 1. Identify types of separation systems in process industries.<br>2. Define terms associated with separation systems. |

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| Topic | Objectives |
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| **Extraction, Absorption & Solvent Recovery Systems – Part 2** | 1. Describe the purpose of extraction, absorption and solvent recovery systems.<br>2. Discuss the basic equipment components found in extraction, absorption and solvent recovery systems.<br>3. Explain the purpose of equipment components found in extraction, absorption and solvent recovery systems.<br>4. Define terms associated with extraction, absorption and solvent recovery.<br>5. Explain the extraction, absorption and solvent recovery systems theory of operation<br>6. List variables that must be controlled to ensure proper operation of the extraction, absorption and solvent recovery systems.<br>7. Describe factors that affect normal extraction, absorption and solvent recovery systems operation.<br>8. Discuss extraction, absorption and solvent recovery systems instrumentation.<br>9. Trace flows through an extraction, absorption and solvent recovery systems on a diagram (PFD, EFD, P&ID).<br>10. Discuss the specific safety, health and environmental concerns associated with the extraction, absorption and solvent recovery systems. |
| **Distillation Systems** | 1. Describe the purpose of distillation systems.<br>2. Discuss the basic equipment components found in distillation systems.<br>3. Explain the purpose of equipment components found in distillation systems.<br>4. Define terms associated with distillation systems.<br>5. Differentiate between different types of distillation systems.<br>• Batch & continuous<br>• Vacuum, atmospheric and pressurized<br>6. Describe how the system requirements determine the following:<br>• tower diameter<br>• height<br>• feed entry point<br>• control points<br>• tower internals (trays, packing)<br>7. Explain the distillation system theory of operation.<br>8. List variables that must be controlled to ensure proper operation of the distillation system.<br>9. Describe factors that affect normal distillation system operation.<br>10. Discuss distillation system instrumentation.<br>11. Trace flows through a distillation system on a PFD.<br>12. Discuss the specific safety, health and environmental concerns associated with the distillation system. |

| Topic | Objectives |
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| **Adsorption & Dehydration Systems** | 1. Describe the purpose of adsorption and dehydration systems.<br>2. Discuss the basic equipment components found in adsorption and dehydration systems.<br>3. Explain the purpose of equipment components found in adsorption and dehydration systems.<br>4. Define terms associated with adsorption and dehydration systems.<br>5. Explain the adsorption and dehydration systems theory of operation.<br>6. List variables that must be controlled to ensure proper operation of the in adsorption and dehydration systems.<br>7. Describe factors that affect normal adsorption and dehydration systems operation.<br>8. Discuss adsorption and dehydration systems instrumentation.<br>9. Trace flows through an adsorption and dehydration systems on a PFD.<br>10. Discuss the specific safety, health and environmental concerns associated with the adsorption and dehydration systems. |
| **Filtration Systems** | 1. Describe the purpose of filtration systems.<br>2. Describe the types of filtration systems.<br>3. Discuss the basic equipment components found in filtration systems.<br>4. Explain the purpose of equipment components found in filtration systems.<br>5. Define terms associated with filtration systems.<br>6. Explain the filtration system theory of operation.<br>7. List variables that must be controlled to ensure proper operation of the filtration system.<br>8. Describe factors that affect normal filtration system operation.<br>9. Discuss filtration system instrumentation.<br>10. Trace flows through a filtration system on a PFD.<br>11. Discuss the specific safety, health and environmental concerns associated with the filtration system. |

| Topic | Objectives |
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| **Operator Responsibilities** | 1. Describe typical process technician responsibilities for each of the following:<br>• operating systems<br>• monitoring systems<br>• troubleshooting systems<br>• completing rounds<br>• communication between inside and outside operator<br>• communication between process technician and other departments<br>• implementing established procedures and specifications<br>• completing maintenance tasks as assigned<br>• monitoring and maintaining auxiliary equipment |

| Topic | Objectives |
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| **Operator Responsibilities (cont.)** | • completing related sampling and analysis tasks and responding appropriately to results<br>• communicating problems to appropriate personnel<br>• communicating relevant information to other units<br>• Impact on plant economics<br>2. Discuss the process technician's role in identifying system problems.<br>3. Discuss the process technician's role in process optimization and control for the following systems:<br>• cooling water<br>• steam generation and distribution<br>• reaction<br>• distillation<br>• extraction/ absorption<br>• stripping/solvent recovery<br>• dehydration<br>• adsorption<br>• filtration<br>Compare and contrast control systems used in utility, auxiliary, and process systems. |

**PLANT B**

**Process Objectives**

1. Describe what is happening in a liquid-liquid extraction.
2. Describe what is happening inside an extraction column.
3. Describe how the interface level is controlled.
4. Explain the extraction process pertaining to Plant B.
   a. What is being separated?
   b. How is it separated?
   c. How the process is controlled?
5. Explain how a change in feed flow ratios might affect the extraction process.
6. Explain how the acetic acid analysis of overhead and bottom samples relate to operating conditions.
7. List the possible safety hazards for Plant B.
8. Draw a flow sheet of Plant B and show the basic control loops associated with the plant.
9. Given a description of a carrier solvent, extracting solvent and solute for a particular separation, describe an extraction process which could accomplish the separation.
10. Do all pre-lab exercises.
    a. Analyze process streams by acid-base titrations and relate analytical results to process conditions.
11. Given operating procedures safely do the following:
    a. Startup process
    b. Line out at steady state
    c. Perform experimental procedures in lab book
    d. Shutdown process

e. Troubleshoot process

**PLANT C**

**Process Objectives**

1. Draw a flow sheet of Plant C and show the basic control loops associated with the plant.
2. Predict changes in product composition for Plant C based on a change in operating conditions.
3. Describe the relationships that exist between operating conditions and percent conversion and optical rotation readings.
4. Do all pre-lab exercises.
5. Describe the safety devices used in Plant C.
6. Analyze process streams using a polarimeter and relate analytical results to process conditions.
7. List the safety hazards present when operating Plant C.
8. Given operating procedures safely do the following:
   a. Startup process
   b. Line out at steady state
   c. Perform experimental procedures in lab book
   d. Shutdown process
   e. Troubleshoot process

**PLANT E**

**Process Objectives**

1. Explain what happens to the composition in the bottoms and overhead products when one of the following process variables are changed:
   a. temperature
   b. pressure
   c. feed flow
   d. reflux flow

2. Point out the basic parts of a distillation process and explain how each part is related to the whole process.
   a. bottoms
   b. overheads
   c. column
   d. condenser

3. Understand the basic controls of a distillation column and how these controls affect the operation of a column and the G.C. analysis of overhead and bottoms product streams.
   a. feed
   b. temperature
   c. reflux
   d. level
4. Draw a flow sheet of the Plant E distillation plant and show the basic control loops associated with the plant.
5. Do all pre-lab exercises.
6. Analyze process streams using gas chromatography or refractive index and relate analytical results to process conditions**.**
7. List the possible safety hazards when operating Plant E.
8. Given operating procedures safely do the following:
   a. Startup process
   b. Line out at steady state
   c. Perform experimental procedures in lab book
   d. Shutdown process
   e. Troubleshoot process

**PLANT F**

**Process Objectives**

1. Draw a flow diagram with the instrument control loops for Plant F.
2. Describe how to tune a pH controller.
3. Explain how a pH control loop works.
4. Do all pre-lab exercises.
5. Given operating procedures safely do the following:
    a. Startup process
    b. Line out at steady state
    c. Perform experimental procedures in lab book
    d. Shutdown process
    e. Troubleshoot process

## III. STUDENT LEARNING OUTCOMES

**The following list of learning outcomes are recommended by NAPTA for the Process Technology II – Systems course.**

1. Describe and utilize process drawings, process controls, and energy/material balances associated with process systems.
2. Identify and explain the combinations of equipment into typical unit operations (reaction and separation systems) and the relationships among the different pieces of the equipment.
3. Identify and explain the combinations of equipment into common utility systems (cooling, heating, gas, etc.) and how they support the various unit operations within a plant.
4. Discuss the specific safety, heath, and environmental concerns (examples: relief and flare systems, emergency shutdowns, etc.) associated with process systems.
5. Demonstrate an understanding of the operator's responsibilities for the safe and efficient operation of systems, including the interaction among the various pieces of equipment within these systems.

**The following list of learning outcomes are Key Activities from the Chemical/Refining Process Technician skill standards, developed by the North American Process Technology Alliance (NAPTA), and recognized by the Texas Skill Standards Board (TSSB). These outcomes have been integrated into PTAC 2420, Process Technology II - Systems.**

1. Monitor and Regulate Stripping System.
2. Monitor and Regulate Filtration System.
3. Monitor and Regulate Absorption System.
4. Monitor and Regulate Adsorption System.
5. Monitor and Regulate Extraction System.
6. Monitor and Regulate Dehydration System.
7. Monitor and Regulate Refrigeration System.
8. Monitor and Regulate Batch Reaction System.
9. Monitor Electrical Generation/Distribution System.
10. Monitor and Regulate Thermal Oxidation System.

11. Monitor and Regulate Storm Water System.
12. Monitor and Regulate Waste Water System.
13. Monitor and Regulate Process Water System.
14. Monitor and Regulate Potable Water System.
15. Monitor and Regulate Fire Water System.

**The following list of Student Learning Outcomes were identified to be the primary focus for the PTAC 2420 course in the Brazosport College 2016 Program review for Chemical Technology:**

Explain the operation of common process systems such as distillation, extraction, absorption, stripping, etc. (SLO4)

Process Technology II - Systems is one of the core courses in the Process Technology Degree. The two-year program has been created to train students for careers as Process Technicians in the chemical and refining process industries.

Process Technology II – Systems provides a *s*tudy of the interrelation of process equipment and process systems including related scientific principles. Laboratory exercises include operating small plants representing the following unit operations: distillation, extraction, demineralization, reactors, and waste treatment. The laboratory is designed to emphasize hands-on training in plant operations.

## IV. TEXTBOOK OR COURSE MATERIAL INFORMATION

### A. Textbook

1. Process Technology II – Systems Lab Exercise, BC Custom Publisher, Nov., 2021 (required)
2. Process Technology II – Systems Theory, BC Custom Publisher, Nov., 2021. (required)
3. Process Tech Systems, Speegle, 8th Edition, Cengage Publisher ISBN: 978-1-4180399-9-8 (required)
4. Visorgogs Safety Glasses (required)

Required course materials are available at the Brazosport College bookstore, on campus or online at http://brazosport.edu/bookstore/home.html. A student of this institution is not under any obligation to purchase a textbook from the college bookstore. The same textbook is/may also be available from an independent retailer, including an online retailer."

**For Distance Education Courses include the following:** Contact the Brazosport College Bookstore with a credit card for course materials. Phone: 979-230-3651. Fax: 979-230-3653. Email: bookstore@brazosport.edu. Website: http://brazosport.edu/bookstore/home.html

**B. Course Outline**

**This is a sample outline which may vary with individual instructors. It will also vary based on whether the course is a summer course or a fall/spring course. Students should contact their instructor for the outline of the course they are taking.**

| WEEK # | TOPIC |
|---|---|
| **1** | Introduction and Pre-Test |
| | Systems Overview, Potable Water, Fire Water |
| **2** | Service/Utility Water, Waste Water |
| | Cooling Water |
| **3** | Instrument Air, Utility Air, Breathing Air |
| | Nitrogen, Natural Gas, Fuel Gas |
| **4** | Relief and Flare, Electrical Power Generation and Distribution<br>Exam #1 Review |
| | **Exam#1**<br>Material Storage - Part 1 |
| **5** | Material Storage - Part 2<br>Blending |
| | Refrigeration - Part 1 |
| **6** | Refrigeration - Part 2 |
| | Steam Generation and Distribution Systems - Part 1 (Overview) |
| **7** | Steam Generation and Distribution Systems - Part 2 (Boiler Feed Water) |
| | Steam Generation and Distribution Systems - Part 3 (Boilers) |
| **8** | Steam Generation and Distribution Systems - Part 4 (Distribution Systems),<br>Exam #2 Review |
| | **Exam #2** Reaction Systems - Part 1 |
| **9** | Reaction Systems - Part 2 |
| | Reaction Systems - Part 3 |
| **10** | Separation Systems Overview, Extraction Systems – Part 1 |
| | Extraction Systems – Part 2 |
| **11** | Distillation Systems – Part 1 |
| | Distillation Systems – Part 2 |
| **12** | Distillation Systems – Part 3 |
| | Distillation Systems – Part 4<br>Exam #3 Review |
| **13** | **Exam #3** Stripping Systems, Absorption Systems |
| | Dehydration Systems, Adsorption Systems |
| **14** | Filtration Systems, Separation System Comparison |
| | Systems Procedures and Troubleshooting |
| **15** | Control Systems |
| | System Economics and Optimization |
| **16** | Exam #4 Review |

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| | **Exam #4** |

**C. LAB Outline**

| WEEK # | TOPIC | |
|---|---|---|
| **1** | UNITS 1 & 2 POT & FIRE WATER | |
| **1** | **PROCESS CONTROL REVIEW PLT A, B, C** | **ACRYLIC PLANTS (OPERATE P & ID)** |
| **2** | UNITS 3 & 4 SERVICE/UTILITY & WASTE WATER COOLING WATER | PLANTS E (Distillation) & F (pH Control), BATH TUB, PROCESS CONTROL EXERCISE |
| **2** | **PLANT A** | **PLANT A-1 (Process Control) (pg. 117)**<br>**PRELAB (pgs. 122-125)**<br>**START-UP EXERCISE (pgs. 127-129)** |
| **3** | UNITS 5 & 6 AIR/INSTRUMENT, UTILITY & BREATHING-N2, NAT & FUEL GAS | |
| **3** | **REVIEW PROCESS CONTROL EXTRACTION** | **GLASS UNIT/PLT B (Extraction)** |
| **4** | UNITS 7, 8, 9 RELIEF & FLARE, ELECTRIC GEN & DIST-MAT STORAGE | |
| **4** | **EXAM PROC CONTROL, STUDY--REACTIONS** | **PLT B (Extraction) & C (Reactor) GOALS** |
| **5** | UNITS 10-14 REFRIG & STEAM GEN AND DIST | |
| **5** | **EXAM 2/DISTILLATON TAPE/OVERHEADS** | **GLASS UNIT/DRAW PLT E (Distillation)** |
| **6** | FINISH DRW PLT E, pH CONTROL, E & F GOALS | |
| **6** | **FINISH UNITS** | **RUN PLT E – 3 LOOPS** |
| **7** | | |
| **7** | **EXAM 3 PLT E & F** | **RUN PLT E** |
| **8** | | |
| **8** | REVIEW E/F EXAM | RUN PLTS B & F |
| **9** | | RUN PLTS A-E |
| **10** | | RUN PLTS A-E |
| **11** | | |
| **11** | | RUN PLTS A-E |
| **12** | | |
| **12** | | RUN PLTS A-E |
| **13** | | |
| **13** | | RUN PLTS A-E |
| **14** | | |
| **14** | | RUN PLTS A-E |
| **15** | | |
| **15** | | RUN PLTS A-E |

| | | |
|---|---|---|
| **16** | | |
| **16** | | FINAL EXAM |

**Important Semester Dates:**
Last Day to Withdraw from Classes– Check BC Academic Calendar at http://catalog.brazosport.edu/index.php

**Office Hours:**
For fulltime faculty, office hours may change from semester to semester. Current faculty office hours are included on the syllabus, see link: https://brazosport.edu/faculty-and-staff/resources/course-syllabi-instructor-information/

For an adjunct faculty, no office hours are required, and they are not assigned an office. To set up an appointment with an adjunct, contact the instructor as per the email address on the syllabus, see link: https://brazosport.edu/faculty-and-staff/resources/course-syllabi-instructor-information/

## V. LAB REQUIREMENTS

**YOU MUST MAKE AT LEAST A "D" IN THE LABORATORY PORTION OF THIS COURSE IN ORDER TO PASS THE COURSE**.

Each class session will begin with a lecture portion, followed by a lab session. For the shop session, students will follow a rotation schedule for its activities during the semester.

**Protective Eyewear with side shields or mono goggles, long pants, no shorts or dresses, closed toe shoes in labs (no sandals).**

## VI. STUDENTS WITH DISABILITIES

Brazosport College is committed to providing equal education opportunities to every student. BC offers services for individuals with special needs and capabilities including counseling, tutoring, equipment, and software to assist students with special needs. For student to receive any accommodation, documentation must be completed in the Office of Disability Services. Please contact Phil Robertson, Special Populations Counselor at 979-230-3236 for further information.

## VII. TITLE IX STATEMENT

Brazosport College faculty and staff are committed to supporting students and upholding the College District's non-discrimination policy. Under Title IX and Brazosport College's policy FFDA (Local), discrimination based on sex, gender, sexual orientation, gender identity, and gender expression is prohibited. If you experience an incident of discrimination, we encourage you to report it. While you may talk to a faculty or staff member at BC, please understand that they are "Responsible Employees" and must report what you tell them to college officials. You can also contact the Title IX Coordinators directly by using the contact information below. Additional information is found on the Sexual Misconduct webpage at www.brazosport.edu/sexualmisconduct.

## VIII. ACADEMIC HONESTY

Brazosport College assumes that students eligible to perform on the college level are familiar with the ordinary rules governing proper conduct including academic honesty. The principle of

academic honesty is that all work presented by you is yours alone. Academic dishonesty including, but not limited to, cheating, plagiarism, and collusion shall be treated appropriately.

Academic dishonesty violates both the policies of this course and the Student Code of Conduct. In this class, any occurrence of academic dishonesty will be referred to the Dean of Student Services for prompt adjudication, and may, at a minimum, result in F, in this course. Sanctions may be imposed beyond your grade in this course by the Dean of Student Services. Please refer to the Brazosport College Student Guide for more information. This is available online at http://brazosport.edu/students/for-students/student-services/.

## IX. ATTENDANCE AND WITHDRAWAL POLICIES

Class attendance contributes to your final grade, but you must attend class to successfully complete the course. If you are unable to complete this course, you must complete and submit a withdrawal form with the registrar's office. If the student decides to drop out of the class, it is the responsibility of the student to initiate a withdrawal before the withdrawal deadline in order to get a "W" on their transcript. If this is not done the student will receive a grade based on test grades and class grades earned during their attendance and absence (i.e., zeros on all missed materials, exams, skills tests, and final exam). Students may be withdrawn by the faculty member for excessive absence, more than 6 absences from class are considered excessive. Absences should be discussed with the instructor before start of class being missed. Student may not be penalized (Instructor's discretion) for absences if notified prior to class for a legitimate reason.

## X. COURSE REQUIREMENTS AND GRADING POLICY
## TESTING MAKE-UP POLICY

Exams will be given to test for knowledge of safety, equipment, and plant operations. Lab practicals will be given in lab to evaluate a student's ability to operate plant and trouble shoot. A general evaluation will be made on student participation which will be based on the student's participation in lab activities. The course grade will be determined from the following:

| | |
|---|---|
| Homework Assignments | 16% |
| Lab Activities | 17% |
| Exams | 50% |
| Final Exam | 17% |

Grades are assigned as follows:

| Grade | Final Average |
|---|---|
| A | 90-100 |
| B | 80-89 |
| C | 70-79 |
| D | 60-69 |
| F | Below 60 |

Each instructor will announce the exact percentages to be used at the beginning of the course.

Laboratory exercises will be done in teams with each student being evaluated according to their self-initiative and team skills and competency. Projects assignments will be evaluated using the same criteria.

## XI. STUDENT CONDUCT STATEMENT

Students are expected to be aware of and follow the Brazosport College Student Code of Conduct. Students have violated the Code if they "fail to comply with any lawful directions, verbal or written, of any official at BC." Lawful directions include precautions and requirements taken to prevent the spread of COVID-19 at Brazosport College. Students who do not follow safety requirements, including the wearing of a mask, may be removed from class by their instructor and referred to the Dean of Student Services.

## XII. COVID-19 STATEMENT

At Brazosport College, all of us, including faculty, staff and students, share a common goal this spring semester, to keep our classes running in the safest manner possible and avoid any disruption to your progress in achieving your educational and career goals. To that end, we ask and encourage you to conduct yourself in the following manner while on campus this semester:

- Every day, perform a self-health check prior to coming to campus and stay home if sick.
- To the greatest extent possible, maintain your distance between you and other students, faculty, and staff while on campus.
- Wear a properly fitted face covering over your mouth and nose while indoors on campus. If you do not have a mask, they will be available to you in all classrooms this spring.
- Practice good hygiene, washing your hands regularly and/or using hand sanitizer.
- The most effective way to protect yourself from Covid-19 is through vaccination. The vaccine is readily available and at no cost to you. Vaccine information and availability can be found at https://brazosport.edu/coronavirus/vaccine/.

If at any time this semester you begin to experience Covid symptoms, or if you are exposed to someone who has tested positive for Covid-19, please take the following steps:

- Stay home if you're feeling sick and minimize your contact with others.
- Alert the College by completing the Covid-19 Exposure Report Form online at https://brazosport.edu/coronavirus/report/. Be sure to provide accurate contact information, including a working phone number that you will answer.
- After submitting the report, you will be promptly contacted by a member of our Rapid Response Team, who will ask you some specific questions about your situation and provide you with guidance moving forward.
- If it is determined that you should not come to class, your instructor will be notified. **Please know that your instructor will consider course adjustments and potential make-up work only if your case has been reported to Brazosport College, and they've been notified by our response team.** Your instructor will work with you to determine how to manage any make-up work.

The Community Health Network (CHN) Clinic at Brazosport College is located in BC Central B-Wing. While walk-ins are available, your visit will be easier if you pre-register by creating an account at www.mychn.org. In addition to providing health and behavioral services, CHN also provides COVID vaccinations and testing. All insurance is accepted, and healthcare is provided on a sliding scale including no cost for those who need it.

Throughout the semester, please regularly check the College's Covid-19 information page at https://brazosport.edu/coronavirus/, where the latest updates and guidelines will be posted. As members of the BC community, all of us share a responsibility to each other to be as safe as possible.

## XIII. CAMPUS CLOSURE STATEMENT

Brazosport College is committed to the health and safety of all students, staff, and faculty and adheres to all federal and state guidelines. The College intends to stay open for the duration of the semester and provide access to classes and support services on campus in the safest way possible. The College will also comply with lawful orders given by applicable authorities, including the Governor of Texas, up to and including campus closure. It is possible that on campus activities may be moved online and/or postpone if such orders are given.

## XIV. STUDENT RESPONSIBILITIES

Students are expected to fully participate in this course. The following criteria are intended to assist you in being successful in this course:

1. Understand the syllabus requirements
2. Use appropriate time management skills
3. Communicate with the instructor
4. Complete course work on time, and
5. Utilize online components (such as Desire2Learn) as required.

### a. Class Attendance

Much of the learning occurs in the classroom setting and cannot be made up by reading the textbook. Therefore, class participation is essential to your learning and attendance will be taken.

### b. Homework

As a standing homework assignment, students should review the scheduled sections of the textbook before coming to class and prepare questions for class discussion. Students should again review the scheduled section following the class (review forward, read, review back)

### c. Class Participation

Your participation grade is based on the quality (not frequency) of your contribution. Those receiving high grades in class participation will be those who:

- Are prepared for class
- Arrive to class on time
- Have excellent attendance
- Make comments and ask questions that significantly contribute to the learning environment of the class
- **Participate in lab exercise and demonstrations.**

**d. Lab Exercises**

For Lab exercises, students will be divided into teams with 3 – 5 students per team. Each team is required to maintain complete and accurate activities books recording items such as data, drawings, or notes, for all class activities. The exercise should be signed by all team members.

## XV. OTHER STUDENT SERVICES INFORMATION

Information about the Library is available at http://brazosport.edu/students/for-students/places-services/library/about-the-library/ or by calling 979-230-3310.

For assistance with online courses, an open computer lab, online and make-up testing, audio/visual services, and study skills, visit Learning Services next to the Library, call 979-230-3253, or visit http://brazosport.edu/students/for-students/places-services/learning-services/.

For drop-in math tutoring, the writing center, supplemental instruction and other tutoring including e-tutoring, visit the Student Success Center, call 979-230-3527, or visit http://brazosport.edu/students/for-students/student-success-center/math-center/

To contact the Physical Sciences and Process Technologies Department call 979-230-3618

The Student Services provides assistance in the following:

| | |
|---|---|
| Counseling and Advising | 979-230-3040 |
| Financial Aid | 979-230-3294 |
| Student Life | 979-230-3355 |

To reach the Information Technology Department for computer, email, or other technical assistance call the Helpdesk at 979-230-3266.

Get the information you need – when you need it. Click http://geni.us/BRAZO to install **BC Connect** on your mobile device to receive reminders, explore careers, map your educational plan, be in the know about events, find out about scholarships, achieve your goals and much more.