**Outcome:** Students will be introduced to the most common process control strategies utilized in the process industries; including manual, discrete, feedback, cascade, and feedforward control. The students will be able to recognize, define and explain the function of these control strategies from a P&ID. The students will be able to describe the operation of the various control strategies and the benefits and limitations of each control strategy. The students will utilize the Simtronics Process Simulator to study and reinforce their understanding of the various control strategies. The students will be introduced to basic process troubleshooting methodology.

**Lecture:** Lecture to review:

1. Control Strategies
   1. Manual Control
   2. Discrete (on/off, Gap) Control
   3. Feedback Control
   4. Cascade Control
   5. Feedforward Control
   6. Feedforward Control with Feedback trim.
2. Strategy Requirements
   1. Input/output requirements
   2. Process & operations benefits and limitations
   3. Simple cost analysis
3. Introduction to process troubleshooting
4. ISA symbology

**Demo(s):**

Location: Hot Unit (GRHS)

1. Identify the various control strategies utilized on the Hot Unit
2. Demonstrate the performance between control strategies.
3. Introduce the Data Historian and demonstrate its functionality to operators.

**Lab:**

Simtronics Lab

1. Simtronics SPM-1600 Basic Control Concepts
   1. All four models
      1. Exercise #1 Normal Operation
         1. Practice navigating the system
         2. Document and explain the function of the control strategy that is implemented.
         3. Make changes to the setpoint of the cold fluid flow rate in each module.
            1. Document the process responses.
            2. Explain the reason(s) for the different system responses.
         4. Make changes to the setpoint of the hot fluid flow rate in each module.
            1. Document the process responses.
            2. Explain the reason(s) for the different system responses.
   2. Process models 2 and 4
      1. Exercise #1 Normal Operation
         1. Make changes to the setpoint of the Temperature controller and document the results.
         2. Explain the effects of the different control strategies on the process and how the results performed
      2. Exercise #2 Startup
         1. Practice starting up the process utilizing the documented procedure.
         2. Create a new startup procedure that accomplishes the following:
            1. No process alarms during startup
            2. Decreases the time required to start up the process.

**Homework:**

Process control cost-benefit analysis

**Documentation:**

1. Control Strategies .ppt
2. Fundamentals of Process Control Theory
   1. Murrill
   2. Units 2, 3-1,2 &3, 10, 11
3. Simtronics operator manuals
   1. SPM-1100
   2. SPM-1600

**Assessment:**

1. Homework
2. Lab Work
3. Lab Safety
4. Quiz(s) & Final Exam

**Homework Details**

You are part of a team investigating options to improve the efficiency of an operating production process. The process currently utilizes simple feedback control. Your team will review current production costs and quality data and using this data and the process response data, you have collected on cascade and feedforward with feedback control your team will create an estimate on the cost to implement and improved control strategy and estimate the payback to the business. The report is due\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and we will critique as a group.

Reference Simtronics SPM-1600

I will provide production costs, production goals, and quality data.

Presentations & critique should take approximately 20 minutes (give or take).

Please include the following items in your report:

1. Current monthly and annual production costs.
2. Current monthly and annual lost revenues.
3. Current monthly and annual profit.
4. Projections for production costs, revenues, and profit:
   1. Utilizing Cascade control
   2. Utilizing Feedforward with Feedback control
5. The projection for the construction costs to implement:
   1. Cascade control
   2. Feedforward control with Feedback trim.

**Grading Details**

This presentation will go towards your Lab grade and is worth 100 points

**Grade Breakdown**

* **\_\_\_/60 points:** Completeness and organization report, calculations and inclusion of the various variables.
* **\_\_\_/10 points:** Completeness of report.
* **\_\_\_/10 points:** Utilization of Excel spreadsheets.
* **\_\_\_/10 points:** Neatness and organization
* \_\_\_/**50 points:** Bonus points for accuracy. (How close did you come to the actual numbers)
  + - Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_\_\_\_
    - Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score: \_\_\_\_\_\_\_\_