**Outcome:** Students will be able to define and explain the function and operation of three mode Proportional, Integral, and Derivative (PID) controllers. The students will be able to describe the operation of various PID controller configurations as well as the benefits and limitations of each controller configuration. The students will be introduced to the reasoning behind, and concepts of loop tuning. The students will utilize the Simtronics Process Simulator to study and continue to reinforce their understanding of process loop dynamics, PID controller application, and characteristics.

**Lecture:** Lecture to review:

1. Process Controllers
   1. Definition
2. PID controller modes
   1. Proportional / Gain
   2. Reset / Integral
   3. Rate / Derivative
3. PID controller configurations
   1. PO
   2. PI
   3. PID
4. Controller actions
   1. Proportional / Gain
      1. Proportional offset
   2. Reset / Integral
   3. Rate / Derivative
5. Controller tuning
   1. Reasons for tuning
   2. Basic tuning concepts & rules
      1. Calculated (e.g., Lambda, Zigler-Nichols)
      2. Trial & Error (e.g., Quarter amplitude)
6. ISA symbology

**Demo(s):**

1. Hot Unit (GRHS)
   1. Controller actions
   2. Controller tuning

**Lab:**

Location: HOT Unit (GRHS)

1. Controller actions
2. Bump test process loops
   1. Level, temperature, and flow loops
   2. Observe responses
   3. Modify controller tuning
   4. Observe results.

Location: Simtronics Lab

1. Simtronics SPM – 1100 Process Characteristics
   1. All four process models
      1. Exercise #’s 3 though 6
         1. Observe the process; document your observations and possible causes for the process issue.
         2. Place loops in manual and document the results.

**Homework:**

1. Fundamentals of Process Control Theory
   1. Murrill
   2. Units 1, 2, 6 & 8

**Documentation:**

1. Process controllers .ppt
2. Fundamentals of Process Control Theory
   1. Murrill
   2. Units 1, 2, 6 & 8

**Assessment:**

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