# Course Number and Title: ELC 270 Process Instrumentation I

**Campus Location:**
Stanton

**Effective Date:**
2018-51

**Prerequisite:**
ELC 101 and (PHY 111 or PHY 205 or PHY 281)

**Co-Requisites:**
none

**Course Credits and Hours:**
4.00 credits
3.00 lecture hours/week
2.00 lab hours/week

**Course Description:**
This course covers theory, application, tuning, and troubleshooting of industrial control using proportional-integral-derivative (PID) control algorithms. Topics include pressure, level, and temperature devices and their measurement.

**Required Text(s):**
Obtain current textbook information by viewing the campus bookstore - https://www.dtcc.edu/bookstores online or visit a campus bookstore. Check your course schedule for the course number and section.

**Additional Materials:**
TI-84+ or TI-89 Calculator

**Schedule Type:**
Classroom Course

**Disclaimer:**
None

**Core Course Performance Objectives (CCPOs):**

1. Evaluate feedback techniques used in control systems. (CCC 1, 2, 6; PGC 1, 3)
2. Analyze process characteristics and controllability. (CCC 1, 2, 6; PGC 1, 3)
3. Evaluate pressure devices and their measurement. (CCC 1, 2, 6; PGC 1, 3)
4. Describe how transducers and control valves are used in control loops. (CCC 1, 2, 6; PGC 1, 3)
5. Evaluate level and density measurements in control loops. (CCC 1, 2, 6; PGC 1, 3)
6. Examine flow measurement in control loops. (CCC 1, 2, 6; PGC 1, 3)
7. Examine how temperature measurements are obtained in control loops. (CCC 1, 2, 6; PGC 1, 3)
8. Analyze the operation of a process control instrument or loop. (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3)
9. Install and maintain instruments and control devices used in the process industry. (CCC 1, 2, 3, 5, 6; PGC 1, 2, 3)

See Core Curriculum Competencies and Program Graduate Competencies at the end of the syllabus. CCPOs are linked to every competency they develop.

**Measurable Performance Objectives (MPOs):**
Upon completion of this course, the student will:

1. Evaluate feedback techniques used in control systems.
    1. Illustrate four major elements of a feedback control loop.
    2. Explain common measurements used in the process industry.
    3. Explain different types of actuators used for supply regulation.
    4. Describe different types of processes that occur in industrial plants.
    5. Explain automatic controllers used in the process industry.
2. Analyze process characteristics and controllability.
    1. Discuss the characteristics of a controller response.
    2. Compare and contrast the different types of responses used to control a process.
    3. Describe the responses of a three-mode controller used in the feedback control of industrial measurements.
    4. Compare the effects of proportional, integral, and derivative control.
    5. Discuss the necessity for tuning a controller.
    6. Demonstrate a correct method for tuning a loop.
3. Evaluate pressure devices and their measurement.
    1. Define and calculate pressure.
    2. Define and explain different types of devices that measure pressure.
    3. Explain and compare the different types of pressure recorders and indicators.
    4. Identify applications of pressure instruments.
    5. Explain the procedure for calibrating pressure instruments.
4. Describe how transducers and control valves are used in control loops.
    1. Explain the purpose and operation of different types of control valves.
    2. Describe the process to choose the correct control valve.
    3. Describe the function of a transducer in relationship to control valves.
    4. Specify the proper type and size of a valve in a control loop.
5. Evaluate level and density measurements in control loops.
    1. Explain common methods employed for automatic continuous liquid level measurements.
    2. Define and explain common methods employed for automatic continuous density measurements.
    3. Describe the purpose and operation of various types of level-sensing devices.
    4. Describe the purpose and operation of various types of density-measurement devices.
    5. Compare direct and inferred methods of level measurements.
6. Examine flow measurement in control loops.
    1. Describe the purpose and operation of flow sensing/measurement devices used in process industry.
    2. Explain the differences among total volume flow, flow rate, and volumetric flow.
    3. Give examples of the different methods of fluid flow measurements.
    4. Explain the purpose and operation of different types of flow meters.
7. Examine how temperature measurements are obtained in control loops.
    1. Describe the purpose and operation of common temperature sensors used in process control.
    2. Convert between Fahrenheit and Celsius measurements.
    3. Distinguish among the different types of humidity measurements.
8. Analyze the operation of a process control instrument or loop.
    1. Explain the relationship of one piece of instrumentation to another on a piping and instrumentation diagrams (P&ID).
    2. Label parts of a control loop.
    3. Add control loops on a major system equipment drawing.
    4. Compare and contrast P&IDs and process flow diagrams (PFD).
    5. Locate and identify instruments on PFDs and P&IDs.
    6. Use terminology and symbology found in instrumentation industry manuals, catalogs, and prints.
    7. Explain the operation of a given control loop.
9. Install and maintain instruments and control devices used in the process industry.
    1. Explain the purpose of instrumentation calibration.
    2. Explain the methods used for determining if a sensing/measuring device is malfunctioning.
    3. Design and construct a control loop.
    4. Perform instrumentation calibrations.
    5. Troubleshoot control loops to determine whether the problem is related to the instruments or the process.

**Evaluation Criteria/Policies:**
Students must demonstrate proficiency on all CCPOs at a minimal 75 percent level to successfully complete the course. The grade will be determined using the Delaware Tech grading system:

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|---|---|---|---|---|
| 92 | – | 100 | = | A |
| 83 | – | 91 | = | B |
| 75 | – | 82 | = | C |
| 0 | – | 74 | = | F |

Students should refer to the Student Handbook - https://www.dtcc.edu/handbook for information on the Academic Standing Policy, the Academic Integrity Policy, Student Rights and Responsibilities, and other policies relevant to their academic progress.

**Core Curriculum Competencies (CCCs are the competencies every graduate will develop):**

1. Apply clear and effective communication skills.
2. Use critical thinking to solve problems.
3. Collaborate to achieve a common goal.
4. Demonstrate professional and ethical conduct.
5. Use information literacy for effective vocational and/or academic research.
6. Apply quantitative reasoning and/or scientific inquiry to solve practical problems.

**Program Graduate Competencies (PGCs are the competencies every graduate will develop specific to his or her major):**

1. Perform the duties of an entry-level technician using the skills, modern tools, theory, and techniques of the electronics engineering technology.
2. Apply a knowledge of mathematics, science, engineering, and technology to electronics engineering technology problems that require limited application of principles but extensive practical knowledge.
3. Conduct, analyze, and interpret experiments using analysis tools and troubleshooting methods.
4. Identify, analyze, and solve narrowly defined electronics engineering technology problems.
5. Explain the importance of engaging in self-directed continuing professional development.
6. Demonstrate basic management, organizational, and leadership skills which commit to quality, timeliness and continuous improvement.

**Disabilities Support Statement:**
The College is committed to providing reasonable accommodations for students with disabilities. Students are encouraged to schedule an appointment with the campus Disabilities Support Counselor to request an accommodation needed due to a disability. A listing of campus Disabilities Support Counselors and contact information can be found at the disabilities services - https://www.dtcc.edu/disabilitysupport web page or visit the campus Advising Center.