ITT Technical Institute

ET415T

Process Control

Onsite Course

SYLLABUS

Credit hours: 4

Contact/Instructional hours: 60 (36 Theory Hours, 24 Lab Hours)

Prerequisite(s) and/or Corequisite(s):

Prerequisites: ET245T Electronic Devices II or equivalent

Course Description:

This course involves the study of the fundamentals in automatic process control of industrial systems. Areas of instruction include signal conditioning, sensors, and the controllers using analog and digital techniques.

Syllabus: Process Control

Instructor:	_____
Office hours:	_____
Class hours:	_____

Major Instructional Areas

1. Process-control system
2. Process measurement
3. Signal conditioning
4. Measurement and instrumentation sensors
5. Final control actuators
6. Computer-based control
7. Control-loop tuning

Course Objectives

1. Describe the basic components of a process-control system.
2. Choose a passive or active signal conditioning method that will enable signals to interface with other elements of a process-control loop.
3. Design an analog-to-digital (A/D) conditioning system or a digital-to-analog (D/A) conditioning system, given an analog input signal and an analog device to be driven.
4. Design op amp, voltage divider, and Wheatstone bridge circuits that will convert the output of various thermal and mechanical sensors to voltage signals.
5. Design op amp, voltage divider, and Wheatstone bridge circuits that will convert the output of various optical sensors to voltage signals.
6. Describe the use of electrical, pneumatic, electromagnetic, and hydraulic final control devices to suit the requirements of a given process.
7. Analyze the controller output behavior toward a specific error input for a controller mode of operation.
8. Design op amp circuits that will help perform error detection and analog control mode operation.
9. Identify the characteristics of computer-based control.
10. Describe the characteristics of a process-control loop and process-control loop tuning.

SCANS Objectives

SCANS is an acronym for Secretary's Commission on Achieving Necessary Skills. The committee, created by the National Secretary of Labor in the early 1990s, created a list of skills and competencies that the committee feels are necessary for employees to function in a high-tech job market.

1. Apply new knowledge and skills in both familiar and changing situations.
2. Explain trends in technological change and deduce how the change will impact the status quo.
3. Demonstrate critical thinking skills through a detailed analysis of a situation and use sound logic to resolve the situation.
4. Demonstrate competence in configuring, installing, and integrating various hardware and software systems.
5. Identify how technological systems operate effectively.
6. Demonstrate competence in selecting appropriate technology, which includes determining desired outcomes and applicable constraints.

Course Outline

Note: All graded activities, except the Projects and Final Exam, are listed below in the pattern of <Unit Number>.<Assignment Number>. For example, Labs: 2.1 refers to the first lab activity in Unit 2.

Unit	Activities
1—Introduction to Process Control	• Content Covered: *Process Control Instrumentation Technology*: o Chapter 1, "Introduction to Process Control," pp. 1-14 • Labs: 1.1 • Exercises: 1.1
2—Analog Signal Conditioning	• Read from *Process Control Instrumentation Technology*: o Chapter 2, "Analog Signal Conditioning," pp. 53-102 • Labs: 2.1 • Exercises: 2.1
3—Digital Signal Conditioning	• Read from *Process Control Instrumentation Technology*: o Chapter 3, "Digital Signal Conditioning," pp. 115-150 and pp. 160-167 • Labs: 3.1 • Exercises: 3.1
4—Thermal and Mechanical Sensors	• Read from *Process Control Instrumentation Technology*: o Chapter 4, "Thermal Sensors," pp. 175-204 o Chapter 5, "Mechanical Sensors," pp. 223-246 and pp. 267-274 • Labs: 4.1 • Project 1 Part 1 • Exercises: 4.1
5—Optical Sensors	• Read from *Process Control Instrumentation Technology*: o Chapter 6, "Optical Sensors," pp. 285-289 and pp. 296-311 • Exams: 5.1 • Project 1 Part 2 • Exercises: 5.1
6—Final Control	• Read from *Process Control Instrumentation Technology*: o Chapter 7, "Final Control," pp. 333-358 and pp. 371-380 • Project 1 Part 3 • Exercises: 6.1
7—Controller Principles	• Read from *Process Control Instrumentation Technology*: o Chapter 9, "Controller Principles," pp. 439-451 and pp. 457-475 • Labs: 7.1 • Exercises: 7.1
8—Analog Controllers	• Read from *Process Control Instrumentation Technology*: o Chapter 10, "Analog Controllers," pp. 481-499 and pp. 504-508 • Labs: 8.1 • Exercises: 8.1
9—Computer-Based Control	• Read from *Process Control Instrumentation Technology*: o Chapter 11, "Computer-Based Control," pp. 519-549 • Exams: 9.1 • Project 2 Part 1 • Exercises: 9.1
10—Control-Loop Characteristics	• Read from *Process Control Instrumentation Technology*: o Chapter 12, "Control-Loop Characteristics," pp. 559-590 • Project 2 Part 2 • Exercises: 10.1

Unit	Activities
11—Course Review and Final Exam	• Final Exam

Instructional Methods

The purpose of this course is to examine the elements and methods of the control system operation used in various industries to control industrial processes. This course strives to use multiple styles to deliver content—such as lectures, collaborative learning options, and hands-on laboratory activities. This course presents lectures, discussions, and labs in a classroom environment, which will keep you actively engaged in the learning process. Difficult concepts will be reinforced through labs immediately after these are covered in the classroom lecture. You will also be working in groups on projects to tie together multiple fundamental concepts and to experience the actual practice of process control.
The course is composed of both theory and laboratory components; therefore, before coming to each class, prepare for the theory portion of the lessons by reading the assigned chapters. Complete all weekly assignments to ensure that you fully understand the material.

You will be assessed on the basis of your performance in labs, exercises, projects, exams, and the final exam.

Instructional Materials and References

Student Textbook Package

Johnson, Curtis D. *Process Control Instrumentation Technology*. Custom 8th ed. Boston, Massachusetts: Pearson Custom, 2006.

References

ITT Tech Virtual Library

Log on to the ITT Tech Virtual Library at http://www.library.itt-tech.edu/ to access online books, journals, and other reference resources selected to support ITT Tech curricula.

Books

You may click “Books” or use the Library Catalog function on the home page to find the following books.

Ebrary>

- Dunn, William. *Fundamentals of Industrial Instrumentation and Process Control*. Blacklick, OH: McGraw-Hill Companies, 2005.
- McMillan, Gregory K. and Douglas M. Considine. *Process/Industrial Instruments and Controls Handbook*. Blacklick, OH: McGraw-Hill Professional Publishing, 1999.

Course Evaluation and Grading

Evaluation Criteria Table

The final grades will be based on the following categories:

CATEGORY	WEIGHT
Exercises	15%
Labs	25%
Project 1	15%
Project 2	10%
Exams	15%
Final Exam	20%
Total	**100%**

Note: Students are responsible for abiding by the Plagiarism Policy.

Grade Conversion Table

The final grades will be calculated from the percentages earned in the course, as follows:

A	90–100%	4.0
B+	85–89%	3.5
B	80–84%	3.0
C+	75–79%	2.5
C	70–74%	2.0
D+	65–69%	1.5
D	60–64%	1.0
F	<60%	0.0

(End of Syllabus)