

Process Instrumentation I (PTAC 1332) Online



Credit: 3 semester credit hours (2 hours class lecture, 2 hours lab)

Prerequisite/Co-requisite: Complete the Online Orientation and answer yes to 7+ questions on the Online Learner Self-Assessment:

<http://www.lit.edu/depts/DistanceEd/OnlineOrientation/OOStep2.aspx>

Course Description

Study of the instruments and instrument systems used in the chemical processing industry including terminology, primary variables, symbology, control loops, and basic troubleshooting. *This course is time-bound, structured, and completed totally online.*

Required Textbook and Materials

- Instrumentation 2010 by Pearson Custom Publishing
(ISBN number is 0-13-700413-3) - optional
- Access to the internet and LIT's learning management system - Blackboard

Course Objectives

Upon completion of this course, the student will be able to:

1. Identify and explain the function of instruments used in the chemical processing industry. (SCANS: C3.4, C4.3, 8.4, 9.3, C11.5, C12.4, 13.4, C14.3, C15.4, C19.5, 20.3, F1.5, F2.3, F3.3, F4.5, F6.5, F7.5, F8.5, F9.5, F10.5, F11.5, F12.5)
2. Diagram the process control elements in a loop. (SCANS: C3.4, C4.3, 8.4, 9.3, C11.5, C12.4, 13.4, C14.3, C15.4, C19.5, 20.3, F1.5, F2.3, F3.3, F4.5, F6.5, F7.5, F8.5, F9.5, F10.5, F11.5, F12.5)
3. Define and apply terms and symbols used in instrumentation. (SCANS: C3.4, C4.3, 8.4, 9.3, C11.5, C12.4, 13.4, C14.3, C15.4, C19.5, 20.3, F1.5, F2.3, F3.3, F4.5, F6.5, F7.5, F8.5, F9.5, F10.5, F11.5, F12.5)

SCANS Skills and Competencies

Beginning in the late 1980's, the U.S. Department of Labor Secretary's Commission on Achieving Necessary Skills (SCANS) conducted extensive research and interviews with business owners, union leaders, supervisors, and laborers in a wide variety of work settings to determine what knowledge workers needed in order to perform well on a job. In 1991 the Commission announced its findings in *What Work Requires in Schools*. In its research, the Commission determined that "workplace know-how" consists of two elements: foundation skills and workplace competencies.

Course Outline

- A. Introduction and Orientation
 1. Review Syllabus
 2. Review Class Policies
3. Review Lab Assignment

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Course Syllabi

- B. Introduction to Instrumentation Objectives
 - 1. Evolution of Process Instrumentation
 - 2. Process Variables
 - 3. Process Variable Relationships
- C. Process Variables, Elements, and Instrument: PRERSSURE
 - 1. Pressure Defined
 - 2. Calculating Pressure
 - 3. Pressure Measurement
- D. Process Variables, Elements, and Instrument: TEMPERATURE
 - 1. Temperature Defined
 - 2. Effects of Heat Energy on Molecular Movement
 - 3. Temperature Measurement
 - 4. Temperature Conversion
- E. Process Variables, Elements, and Instrument: LEVEL
 - 1. Introduction to Level and Terms
 - 2. Level-Sensing and Measurement Instruments
 - 3. Level, Temperature, Density, and Volume
- F. Process Variables, Elements, and Instrument: FLOW
 - 1. Introduction to Flow
 - 2. Flow-Sensing and Measurement Instruments
 - 3. Total Volume Flow, Flow Rate, and Volumetric Flow
- G. Miscellaneous Process Variables, Elements, and Instruments: Analytical, Vibration, and Speed
 - 1. Introduction to Analytical Instruments and Terms
 - 2. Analytical-Sensing and Measurement Instruments
 - 3. Analytical Instruments and the Role of the Process Technician
 - 4. Process Variables
 - 5. Vibration
 - 6. Speed
- H. Introduction to Control Loops: Simple Loop Theory
 - 1. Process Control and Control Loops
 - 2. Components and Signals
- I. Control Loops: Primary Sensors, Transmitters, and Transducers
 - 1. Purpose and Operation
 - 2. Transmitter Signals and Scaling
 - 3. Transducers and Signals
 - 4. Pneumatic and Electrical Signals
- J. Control Loops: Controllers and Final Control Elements (Part 1)
 - 1. Controller Characteristics
 - 2. Controller Switching
 - 3. Types of Controllers
 - 4. Final control Element overview
- K. Control Loops: Controllers and Final Control Elements (Part 2)
 - 1. The Control Valve
 - 2. Control Valve Failure conditions
 - 3. Control Valve Actuators
 - 4. Valve Positioners, Output Signal
 - 5. Types of Control Valves
 - 6. Instrument Air Regulators
- L. Diagrams, Symbols, and Sketchings
 - 1. Introduction to Diagrams
 - 2. Introduction to Symbology
 - 3. Instrumentation Symbols chart
- M. Instrumentation Troubleshooting
 - 1. Typical Malfunctions
 - 2. Troubleshooting Methods
 - 3. Communication During Troubleshooting
 - 4. Troubleshooting Tools
 - 5. Safety and Environmental Issues
 - 6. Calibration and Troubleshooting
 - 7. Troubleshooting “Smart” Instruments

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Grade Scale

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
0 – 59	F

Course Evaluation

Final grades will be calculated according to the following criteria:

<i>Activity</i>	<i>Percentage</i>
Assignments	20%
Quizzes	20%
Exams	30%
Final Exam	30%
<i>Total</i>	<i>100%</i>

The instructor will respond to e-mail and voice mail communication within 24 hours Monday through Friday. Assignment grades will be published within 48 hours of the assignment due date. The instructor will log into the course and have office hours 10:30 to 11:30 am Monday through Thursday, for the online students.

Course Requirements

1. The student will post assignments by the due dates as shown on the course calendar.
2. The student will complete quizzes by the due dates as shown on the course calendar.
3. The student will complete assessments by the due dates as shown on the course calendar.
4. The student will complete proctored exams. Exams will be proctored by the LIT Testing Center or another center upon arrangement with the LIT instructor.

Course Policies

1. You must log onto and access the course a minimum of three times per week.
2. No Cheating of any kind will be tolerated. Students caught cheating or helping someone to cheat can and will be removed from the class for the semester. Cheating can result from expulsion from LIT.
3. If you wish to drop a course, the student is responsible for initiating and completing the drop process. If you stop coming to class and fail to drop the course, you will earn an 'F' in the course.
4. Internet Usage
 - a. Classroom computers have access to the internet.
 - b. Student usage of the internet will be monitored.
 - c. Proper usage of the internet will be allowed. Used for classroom research or as directed.
 - d. Any unauthorized use of the internet will not be tolerated.

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- e. Improper usage of the internet, such as profanity, pornography, gambling, etc... will result in disciplinary action not limited to expulsion from LIT.

Technical Requirements

The latest technical requirements, including hardware, compatible browsers, operating systems, software, Java, etc. can be found online at:

<http://kb.blackboard.com/pages/viewpage.action?pageId=25368512>

A functional broadband internet connection, such as DSL, cable, or WiFi is necessary to maximize the use of the online technology and resources.

Disabilities Statement

The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodations for their disabilities. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the online resource:

<http://www.lit.edu/depts/stuserv/special/defaults.aspx>

Course Schedule

Week	Topic	Reference
1,2	Course introduction and policies <ul style="list-style-type: none">• Online Orientation• Practice Quiz Module 1: Introduction to Instrumentation	Handouts Module 1
3	Modules 2 & 3 <ul style="list-style-type: none">• Pressure• Temperature Quiz 1 Assignments 1 & 2 Due	Modules 2 & 3 Modules 1-3
4	Exam 1 Modules 4 - Level Assignment 3 Due	Modules 1-3 Module 4
5	Module 4 <ul style="list-style-type: none">• Level Assignment 4 Due	Module 4
6/7	Modules 5 & 6 <ul style="list-style-type: none">• Flow• Analytical	Modules 5 & 6

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8	Quiz 2 Module 7 <ul style="list-style-type: none"> Control Loops Introduction Assignment 5 Due	Modules 4-6
9	Exam 2 Module 8 <ul style="list-style-type: none"> Primary Sensors Transmitters Transducers Simple Loop Theory 	Modules 4-6 Module 8
10	Modules 9 <ul style="list-style-type: none"> Control Loops Controllers Quiz 3 	Module 9 Modules 7-9
11/12	Exam 3 Modules 10 & 11 <ul style="list-style-type: none"> Control Valves Final Control Elements Control Valves and Regulators 	Modules 7-9 Modules 10 & 11
13	Module 12 <ul style="list-style-type: none"> Process Diagrams Instrument Sketching 	Module 12
14	Module 13: Instrumentation Troubleshooting Quiz 4	Module 13 Modules 11-13
15	Exam 4 Start Finals Review	Modules 11-13 Modules 1-13
16	Finals Review Finals Practice Quiz	Modules 1-13
17	Finals Week	

Contact Information:

Instructor: Paul Rodriguez
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E-mail: psrodriguez@lit.edu
Office Hours: **For Online Students:** 10:30-11:30 Monday – Thursday
Any Students: as posted on my office door