

Physics of Instrumentation (INCR 1402)



Credit: 4 semester credit hours (3 hours lecture, 4 hours lab)

Prerequisite/Co-requisite: None required

Course Description

An introduction to simple control loops. Introduction to pressure, temperature, level, and flow transmitters. Introduction to transducers used in the detection of changes in process variables.

Required Textbook and Materials

1. *Instrumentation 5th Edition* by Franklyn W. Kirk, Thomas A Weedon, and Philip Kirk
 - a. ISBN number is 978-0-8-2693430-7
2. Scientific Calculator
3. Notebook.

Course Objectives

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

1. Demonstrate an understanding of process instruments and devices. (SCANS C5.4, C19.4, C20.3, F1.4, F2.3, F4.3, F5.3, F6.3, F9.4, F10.3, F11.3, F12.4, F15.4)
2. Understand and describe control loops. (SCANS C5.4, C19.4, C20.3, F1.4, F2.3, F4.3, F5.3, F6.3, F9.4, F10.3, F11.3, F12.4, F15.4)
3. Understand the control and detection of pressure, temperature, level, flow, pH, etc. (SCANS C5.4, C19.4, C20.3, F1.4, F2.3, F4.3, F5.3, F6.3, F9.4, F10.3, F11.3, F12.4, F15.4)

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 | B. Introduction to Instrumentation |
| 1. Introduction of faculty and students | 1. Instrumentation |
| 2. Review Syllabus | 2. Fundamentals of process control |
| 3. Review Class Policies | 3. Piping and Instrument Diagrams |
| 4. Review Lab Assignment | |

Approved 4/2013

INCR 1402

Course Syllabus

- 4. Industry Standards and Organizations
- C. Temperature
 - 1. Temperature, Heat, and Energy
 - 2. Thermal Expansion Thermometers
 - 3. Electrical Thermometers
 - 4. Infrared Radiation Thermometers
 - 5. Heat Sensitive Materials
 - 6. Calibration
- D. Pressure
 - 1. Pressure
 - 2. Pressure Instruments
 - 3. Pressure Measurement Applications
- E. Level
 - 1. Level
 - 2. Mechanical Instruments
- 3. Electrical Instruments
- 4. Ultrasonic, Radar, and Laser Instruments
- 5. Nuclear Level Instruments
- 6. Weigh Systems
- 7. Level Measurement Applications
- F. Flow
 - 1. Fluid Flow
 - 2. Differential Pressure Flow meters
 - 3. Variable-Area Flow meters
 - 4. Mechanical Flow meters
 - 5. Mass Flow meters
 - 6. Accessory Flow Devices
 - 7. Open-channel Flow Measurements
 - 8. Solid Flow meters

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>
Homework/Labs	10%
Quizzes	10%
Major Test	50%
Final	30%
Total	100%

Late Penalties will be assessed on all work turned in late. 5 points per day

Course Requirements

- 1. Identifying industrial instruments from Piping and Instrument Diagrams
- 2. Tracing Temperature, Pressure, Level, and Flow Loops
- 3. Converting from one unit of measurement to another
- 4. Implementing Boyle's, Charles, Gay-Lussacs's gas laws
- 5. Five point Calibration of Temperature, Pressure, Level, and Flow Transmitters
- 6. State details of instrument protection such as chemical seals, wet legs, valve manifolds, and snubbers.

INCR 1402

Course Syllabus

7. Compensation to calibration for installing transmitters at different locations and environments.
8. Creating Temperature, Pressure, Level, and Flow loop drawings from written and verbal instructions

Attendance Policy

1. Missing more than 20% of classes will result in an automatic “F” for the course.
2. Absences are counted for unexcused, excused and coming to class late.
3. Missing more than 20% of a class period will count as an absence.
4. Being tardy 3 times equals 1 absence.

Course Policies

1. No food, drinks, or use of tobacco products in class.
2. No foul or harsh language will be tolerated
3. Turn off all cellphones during lectures
4. Headphones may be worn only upon Instructor approval
5. Do not bring children to class.
6. 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.
7. 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.

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 office in Student Services, Cecil Beeson Building.

Course Schedule

Week	Topic	Reference
1	Course introduction, policies and workbench <ul style="list-style-type: none">• Lecture• Lab: Layout of gauges on workbench	Handouts
2	Introduction of Instruments and Temperature conversions. <ul style="list-style-type: none">• Lecture	Chapter 1

INCR 1402
Course Syllabus

Week	Topic	Reference
	<ul style="list-style-type: none"> Lab: Examine cutaways of various instruments(To actually see how device works) and workbook exercises 	
3/4	Overview of industrial instrumentation and the principles of instruments, instrumentation diagrams, control and Temperature measurement <ul style="list-style-type: none"> Lecture Lab: Describing in detail three common control strategies and workbook exercises. Temperature conversions. Test 1 	Chapter 1
5/6	Pressure <ul style="list-style-type: none"> Lecture Lab: Chapter Exercises and Workbook exercises 	Chapter 2
7/8	Pressure <ul style="list-style-type: none"> Lecture Lab: Temperature conversions. Set- up and calibration of differential pressure transmitters. Test 2 	Chapter 2
9/10	Level <ul style="list-style-type: none"> Lecture Lab: Chapter and workbook Exercises 	Chapter 3
11/12	Level <ul style="list-style-type: none"> Lecture Lab: Workbook Exercises Set- up and calibration of differential pressure transmitters for level measurement. Test 3 	Chapters 3
13	Flow <ul style="list-style-type: none"> Lecture Lab: Workbook Exercises\ 	Chapter 4
14/15/16	Flow <ul style="list-style-type: none"> Lecture Lab: Workbook exercises and set-up of flow transmitters. Implementation of temperature transmitters to measure flow. Test 4 	Chapter 4