

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 6th Edition* by Franklyn W. Kirk, Thomas A Weedon, and Philip Kirk
 - a. ISBN number is 978-0-8-26934442-0
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.
2. Understand and describe control loops.
3. Understand the control and detection of pressure, temperature, level, flow, pH, etc.

Course Outline

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| A. Introduction | 2. Pressure Instruments |
| 1. Introduction of faculty and students | 3. Pressure Measurement Applications |
| 2. Review Syllabus | E. Level |
| 3. Review Class Policies | 1. Level |
| 4. Review Lab Assignment | 2. Mechanical Instruments |
| B. Introduction to Instrumentation | 3. Electrical Instruments |
| 1. Instrumentation | 4. Ultrasonic, Radar, and Laser Instruments |
| 2. Fundamentals of process control | 5. Nuclear Level Instruments |
| 3. Piping and Instrument Diagrams | 6. Weigh Systems |
| 4. Industry Standards and Organizations | 7. Level Measurement Applications |
| C. Temperature | F. Flow |
| 1. Temperature, Heat, and Energy | 1. Fluid Flow |
| 2. Thermal Expansion Thermometers | 2. Differential Pressure Flow meters |
| 3. Electrical Thermometers | 3. Variable-Area Flow meters |
| 4. Infrared Radiation Thermometers | 4. Mechanical Flow meters |
| 5. Heat Sensitive Materials | 5. Mass Flow meters |
| 6. Calibration | 6. Accessory Flow Devices |
| D. Pressure | 7. Open-channel Flow Measurements |
| 1. Pressure | 8. Solid Flow meters |

Grade Scale

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

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.
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.

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>

Student Code of Conduct Statement

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in

the *LIT Catalog and Student Handbook*. The *LIT Catalog and Student Handbook* may be accessed at www.lit.edu or obtained in print upon request at the Student Services Office.

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 • Lab: Examine cutaways of various instruments (To actually see how device works) and workbook exercises 	Chapter 1
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	Chapters 3

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Course Syllabi

	<ul style="list-style-type: none">• Lecture• Lab: Workbook Exercises Set- up and calibration of differential pressure transmitters for level measurement.• Test 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
