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.
2. Understand and describe control loops.
3. Understand the control and detection of pressure, temperature, level, flow, pH, etc.

Course Outline

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

Approved mm/yyyy

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:

Activity	***Percentage***
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.
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

Approved mm/yyyy

3. Turn off all Cell Phones 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.

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 • Lecture • Lab: Layout of gauges on workbench	Handouts
2	Introduction of Instruments and Temperature conversions. • 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	Chapter 1

	• Lecture • Lab: Describing in detail three common control strategies and workbook exercises. Temperature conversions. • Test 1	
5/6	Pressure • Lecture • Lab: Chapter Exercises and Workbook exercises	Chapter 2
7/8	Pressure • Lecture • Lab: Temperature conversions. Set-up and calibration of differential pressure transmitters. • Test 2	Chapter 2
9/10	Level • Lecture • Lab: Chapter and workbook Exercises	Chapter 3
11/12	Level • Lecture • Lab: Workbook Exercises Set- up and calibration of differential pressure transmitters for level measurement. • Test 3	Chapters 3
13	Flow • Lecture • Lab: Workbook Exercises	Chapter 4
14/15/16	Flow • Lecture • Lab: Workbook exercises and set-up of flow transmitters. Implementation of temperature transmitters to measure flow. • Test 4	Chapter 4