

# Fundamentals of Measurement and Process Control (INCR 1442)



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

**Prerequisite/Co-requisite:** INCR 1402 and CETT 1405

## Course Description

A study of the basic principles of process automation and their applications including basic control concepts, feedback control, sensors and transmission systems, controllers, control valves, process dynamics, tuning control systems, and cascade ratio.

## Required Textbook and Materials

1. *Instrumentation 5<sup>th</sup> Edition* by Franklyn W. Kirk, Thomas A Weedon, and Philip Kirk, American Technical Publishers
  - a. ISBN number is 978-082-693-43-07
2. Scientific Calculator
3. Notebook.

## Course Objectives

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

1. Demonstrate an understanding of process dynamics.
2. Illustrate basic control concepts.
3. Tune control systems

## Course Outline

- |   |                                   |
|---|-----------------------------------|
| A. Introduction                         | 3. Dampers                        |
| 1. Introduction of faculty and students | 4. Actuators and Positioners      |
| 2. Review Syllabus                      | 5. On/Off Control Actions         |
| 3. Review Class Policies                | 6. Variable-Speed Drives          |
| 4. Review Lab Assignment                | 7. Electric Power Controllers     |
| B. Automatic Control                    | D. Safety Systems                 |
| 1. Process Dynamics                     | 1. Safety Systems                 |
| 2. Control Functions                    | 2. Individual Safety Devices      |
| 3. Control Strategies                   | 3. Hazardous Atmosphere Detectors |
| 4. Controller Tuning                    | 4. Electrical Safety Standards    |
| 5. Digital Controllers                  | 5. Safety Instrumented Systems    |
| 6. Pneumatic Controllers                | E. Applications                   |
| 7. Electric Controllers                 | 1. Instrument Applications        |
| 8. Operator Interfaces                  | 2. General Techniques             |
| 9. Configuration Formats                | 3. Temperature                    |
| 10. Advanced Control Strategies         | 4. Pressure                       |
| C. Final Elements                       | 5. Level                          |
| 1. Control Valves                       | 6. Flow                           |
| 2. Regulators                           | 7. Analysis                       |

Approved mm/yyyy

8. Multivariable

**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%
<b>Total</b>	<b>100%</b>

**Course Requirements**

1. Develop understanding of Process Dynamics.
2. Operate a Smart Communicator.
3. Use a Smart Communicator to calibrate a Smart Transmitter.
4. Configure a Digital Controller.
5. Configure a Digital Recorder.
6. Wire an instrument loop with a transmitter, controller and digital recorder.
7. Operate the Instrument Loop on manual and automatic.
8. Tune the controller using Gain, Integral, and Derivative.

**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 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](http://www.lit.edu) or obtained in print upon request at the Student Services Office.

### **Course Schedule**

<b>Week</b>	<b>Topic</b>	<b>Reference</b>
1	Course introduction, policies and Lab panels <ul style="list-style-type: none"><li>• Lecture</li><li>• Lab: Layout of Lab panels</li></ul>	Handouts
2	Automatic Control and Process Dynamics <ul style="list-style-type: none"><li>• Lecture</li><li>• Lab: Sketch the Lab panel assigned and become familiar with equipment</li></ul>	Chapter 35
3/4	Control Functions <ul style="list-style-type: none"><li>• Lecture</li><li>• Lab: Describe in detail four common control strategies and workbook exercises.</li><li>• Test 1</li></ul>	Chapter 36
5/6	Controller Tuning <ul style="list-style-type: none"><li>• Lecture</li><li>• Lab: Tuning coefficients and Performance Standards and Workbook exercises.</li></ul>	Chapter 37

7	Digital Controllers <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Configure a Digital Controller.</li> </ul>	Chapter 37
8	Pneumatic/ Electric Controllers <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Chapter and workbook Exercises</li> </ul>	Chapter 38
9	Configuration Formats <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Configure a Smart Transmitter for the Process Panel assigned</li> </ul>	Chapters 38
10	Advanced Control Strategies <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Workbook Exercises</li> <li>• Set up Loop for Process Panel</li> <li>• Test 2</li> </ul>	Chapter 38
11	Final Elements <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Run Process panel on Manual and Auto.</li> </ul>	Chapter 39
12	Actuators and Positioners <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Tune Controller on Process Panel assigned</li> <li>• Test 3</li> </ul>	Chapter 41
13	Safety Systems <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Change assignment to another Process Panel</li> </ul>	Chapter 43
14	Electrical Safety Standards <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Run new panel assignment on auto</li> </ul>	Chapter 44
15	Safety Instrumented Systems <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Workbook Exercises</li> <li>• Test 4</li> </ul>	Chapter 45
16	Applications <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Workbook Exercises</li> </ul>	Chapter 46