

# 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 6<sup>th</sup> Edition* by Franklyn W. Kirk, Thomas A Weedon, and Philip Kirk, American Technical Publishers
  - a. ISBN number is 978-082-693-442-0
2. Scientific Calculator
3. Notebook.

## Course Objectives

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

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

## Course Outline

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|---|-----------------------------------|
| 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 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.

**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></ul>	Chapter 35

	<ul style="list-style-type: none"> <li>• Lab: Sketch the Lab panel assigned and become familiar with equipment</li> </ul>	
3/4	<p>Control Functions</p> <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	<p>Controller Tuning</p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Tuning coefficients and Performance Standards and Workbook exercises.</li> </ul>	Chapter 37
7	<p>Digital Controllers</p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Configure a Digital Controller.</li> </ul>	Chapter 37
8	<p>Pneumatic/ Electric Controllers</p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Chapter and workbook Exercises</li> </ul>	Chapter 38
9	<p>Configuration Formats</p> <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	<p>Advanced Control Strategies</p> <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	<p>Final Elements</p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Run Process panel on Manual and Auto.</li> </ul>	Chapter 39
12	<p>Actuators and Positioners</p> <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	<p>Safety Systems</p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Lab: Change assignment to another Process Panel</li> </ul>	Chapter 43
14	<p>Electrical Safety Standards</p>	Chapter 44

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Course Syllabus

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- Lecture
  - Lab: Run new panel assignment on auto
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15 Safety Instrumented Systems Chapter 45

- Lecture
  - Lab: Workbook Exercises
  - Test 4
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16 Applications Chapter 46

- Lecture
  - Lab: Workbook Exercises
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