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
   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:

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
   1. Introduction of faculty and students
   2. Review Syllabus
   3. Review Class Policies
   4. Review Lab Assignment

B. Automatic Control
   1. Process Dynamics
   2. Control Functions
   3. Control Strategies
   4. Controller Tuning

Approved 4/2013
INCR 1442
Course Syllabus

5. Digital Controllers
6. Pneumatic Controllers
7. Electric Controllers
8. Operator Interfaces
9. Configuration Formats
10. Advanced Control Strategies
C. Final Elements
   1. Control Valves
   2. Regulators
   3. Dampers
   4. Actuators and Positioners
   5. On/Off Control Actions
   6. Variable-Speed Drives
   7. Electric Power Controllers
D. Safety Systems

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:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework/Labs</td>
<td>10%</td>
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<tr>
<td>Quizzes</td>
<td>10%</td>
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<tr>
<td>Major Test</td>
<td>50%</td>
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<tr>
<td>Final</td>
<td>30%</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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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.

Course Schedule

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Reference</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Course introduction, policies and Lab panels</td>
<td>Handouts</td>
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<tr>
<td></td>
<td>Lecture</td>
<td></td>
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<tr>
<td></td>
<td>Lab: Layout of Lab panels</td>
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<tr>
<td>2</td>
<td>Automatic Control and Process Dynamics</td>
<td>Chapter 35</td>
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<tr>
<td></td>
<td>Lecture</td>
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<tr>
<td></td>
<td>Lab: Sketch the Lab panel assigned and become familiar with equipment</td>
<td></td>
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<tr>
<td>3/4</td>
<td>Control Functions</td>
<td>Chapter 36</td>
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<tr>
<td></td>
<td>Lecture</td>
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<tr>
<td></td>
<td>Lab: Describe in detail four common control strategies and workbook</td>
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## Week 5/6
**Topic:** Controller Tuning  
- Lecture  
- Lab: Tuning coefficients and Performance Standards and Workbook exercises.  
**Reference:** Chapter 37

## Week 7
**Topic:** Digital Controllers  
- Lecture  
- Lab: Configure a Digital Controller.  
**Reference:** Chapter 37

## Week 8
**Topic:** Pneumatic/Electric Controllers  
- Lecture  
- Lab: Chapter and workbook Exercises  
**Reference:** Chapter 38

## Week 9
**Topic:** Configuration Formats  
- Lecture  
- Lab: Configure a Smart Transmitter for the Process Panel assigned  
**Reference:** Chapters 38

## Week 10
**Topic:** Advanced Control Strategies  
- Lecture  
- Lab: Workbook Exercises  
- Set up Loop for Process Panel  
- Test 2  
**Reference:** Chapter 38

## Week 11
**Topic:** Final Elements  
- Lecture  
**Reference:** Chapter 39

## Week 12
**Topic:** Actuators and Positioners  
- Lecture  
- Lab: Tune Controller on Process Panel assigned  
- Test 3  
**Reference:** Chapter 41

## Week 13
**Topic:** Safety Systems  
- Lecture  
- Lab: Change assignment to another Process Panel  
**Reference:** Chapter 43

## Week 14
**Topic:** Electrical Safety Standards  
- Lecture  
- Lab: Run new panel assignment on auto  
**Reference:** Chapter 44

## Week 15
**Topic:** Safety Instrumented Systems  
- Lecture  
- Lab: Workbook Exercises  
**Reference:** Chapter 45
<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Reference</th>
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<tbody>
<tr>
<td>16</td>
<td>Applications</td>
<td>Chapter 46</td>
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<tr>
<td></td>
<td>• Lecture</td>
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<tr>
<td></td>
<td>• Lab: Workbook Exercises</td>
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