I. OVERVIEW

The following information will appear in the 2009 - 2010 catalog

ELTEC 221 Instrumentation Devices and Systems 3 Units

Also offered as: INTEC - 221: Instrumentation Devices and Systems
Formerly listed as: ELTEC - 221: Instrumentation Devices and Systems
Prerequisite: Satisfactory completion of ELTEC 208

An introduction to industrial instrumentation devices and systems. The principles and operation of mechanical and electrical transducers. Analysis of industrial instrumentation and control systems. This course is approved by the State of California for the DAS Electricians Training program. Field trips are not required. Course is applicable to the associate degree.

II. LEARNING CONTEXT

Given the following learning context, the student who satisfactorily completes this course should be able to achieve the goals specified in Section III, Desired Learning:

A. COURSE CONTENT

1. Required Content:

   a. The content listed below is presented in a fashion that provides the student with both theoretical and practical skills using instrumentation and instrumentation systems. An equal amount of class time is devoted to each topic listed below.

      A. Introduction to Controls
      B. Instruments, Meters
      C. Meter Measurements
      D. Actuators
      E. Voltage dividers
      F. Op Amps
      G. Comparators, DC bridge circuits
      H. Force, Strain
      I. Temperature Measurement
      J. Thermocouples, Thermistors, RTDs
      K. Pressure
      L. Proximity Sensors
      M. Photoelectric sensors
      N. Flow Meters
      O. Level Sensing
      P. Current loops
      Q. Controller operation
      R. P I D Control, Loop Tuning

2. Required Lab Content:

   a. Introduction to Controls
      Instruments, Meters
      Meter Measurements
      Actuators
      Voltage dividers
      Op Amps
      Comparators, DC bridge circuits
      Force, Strain
      Temperature Measurement
      Thermocouples, Thermistors, RTDs
      Pressure
      Proximity Sensors
      Photoelectric sensors
      Flow Meters
B. **ENROLLMENT RESTRICTIONS**

1. **Prerequisites**

   Satisfactory completion of ELTEC 208.

2. **Requisite Skills**

   *Before entering the course, the student will be able to:*
   
   a. Identify and use common electrical and electronic instruments; digital multimeter, voltage sources, oscilloscope.
   
   b. Describe and measure the characteristics of direct current circuits.
   
   c. Describe the characteristics of series and parallel circuits and properly use Ohm’s Law, Kirchoff’s Laws, and the formulas for calculating equivalent resistance in series and parallel circuits.

C. **HOURS AND UNITS**

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<th>INST METHOD</th>
<th>TERM HOURS</th>
<th>UNITS</th>
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<tr>
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<td>18.00</td>
<td>1.00</td>
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<tr>
<td>Lab</td>
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3 Units

D. **METHODS OF INSTRUCTION (TYPICAL)**

   *Instructors of the course might conduct the course using the following method:*
   
   1. Related material will be presented by means of class lecture, lecture/demonstrations, and laboratory experiments.
   
   2. Special multiple-week lab analysis and measurement project with formal report is assigned.
   
   3. Instructor creates laboratory exercises and demonstrations using sensors, controls, electronic components and test instrumentation that provide hands-on familiarity with course topics.

E. **ASSIGNMENTS (TYPICAL)**

1. **EVIDENCE OF APPROPRIATE WORKLOAD FOR COURSE UNITS**

   *Time spent on coursework in addition to hours of instruction (lecture hours)*
   
   Daily reading assignments from the text and handouts provided.
   
   Daily homework problems and research from the handouts.
   
   One formal report on the flow apparatus in the lab per semester.

2. **EVIDENCE OF CRITICAL THINKING**

   *Assignments require the appropriate level of critical thinking*
   
   Assignments:
1. List the nine parts of a closed-loop control system.

2. What type (mode) of photoelectric sensor would work best counting boxes at a distance of 50 feet?

Exam Questions:

1. List the six major types of photoelectric sensors.

2. Which temperature sensor creates a tiny voltage in proportion to temperature?

F. TEXTS AND OTHER READINGS (TYPICAL)


2. Other: OMEGA ENGINEERING HANDBOOKS

3. Other: Handouts as necessary

III. DESIRED LEARNING

A. COURSE GOAL

As a result of satisfactory completion of this course, the student should be prepared to:

Properly identify, select, install, and operate industrial instrumentation and sensors. Students should also be prepared to set up and adjust simple control systems for industrial automation installations.

B. STUDENT LEARNING GOALS

Mastery of the following learning goals will enable the student to achieve the overall course goal.

1. **Required Learning Goals**

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

   a. Identify and explain the basic parts of open and closed loop control systems.

   b. Explain the operation of a voltage divider circuit.

   c. Identify individual transducers in the following areas, and explain their unique characteristics:

      1. Proximity
      2. Temperature
      3. Strain
      4. Level
      5. Pressure
      6. Fluid flow
      7. Photoelectric

   d. Calculate the gain of typical operational amplifier circuits including inverting, non-inverting, and buffer amps.

   e. Identify and select proper transducers and/or sensors for a particular situation using manufacturers transducer specifications.

   f. Explain the characteristics of the most common standard instrumentation signals.

   g. Given a typical industrial system, be able to specify and select appropriate transducers, signal transmission techniques, and signal conditioning requirements for the system.

2. **Lab Learning Goals**
Upon satisfactory completion of the lab portion of this course, the student will be able to:

a. Identify and construct basic open and closed loop control systems.

b. Construct and measure electrical characteristics of a voltage divider circuit.

c. Identify, connect, and operate sensors of the following types: Proximity, Temperature, Wheatstone bridge-based sensors, Level, Pressure, Fluid flowmeters, Photoelectric detectors.

d. Given a specific industrial system in the lab, be able to specify and select appropriate transducers and signal transmission techniques for the system.

IV. METHODS OF ASSESSMENT (TYPICAL)

A. FORMATIVE ASSESSMENT

1. Quizzes

2. Student participation in course topic discussions

3. Homework

4. Weekly Lab Exercises

B. SUMMATIVE ASSESSMENT

1. Mid Term

2. Final

3. Comprehensive lab projects