Course Outline for ENGR 411: Instrumentation and Process Control Laboratory

Elective
Electrical and Mechanical Engineering*

Bulletin Description
ENGR 411: Instrumentation and Process Control Laboratory. (1 unit)
Prerequisites: ENGR 410 (may be taken concurrently).
Basic individual instrumentation used for temperature and level measurement.
Experiments on industrial flow and temperature control systems. Simulation and control
of process systems using P, PI and PID controllers. Field trips.

Textbooks
2. Additional reading material on standards and codes will be provided during
   laboratory briefing sessions.

References
   1980.

Coordinator
V. V. Krishnan, Professor of Mechanical Engineering

Prerequisites by Topic
1. Engineering experimentation fundamentals
2. Linear systems analysis
3. Process instrumentation and control theory

*ENGR 411 is a requirement for mechanical engineering students who do not take ENGR 446 as a requirement.
Course Objectives

1. This course is designed to give engineering seniors the ability to design basic process controls using standard algorithms and process instrumentation typically used in industry. [B.1]
2. Give students hands-on experience with industrial instrumentation. [B.3]
3. Provide a working knowledge of the basic control strategies used in the control of industrial processes. [B1, B2]
4. Enable students to develop P&ID and spec sheets for simple control systems in the form of P&ID. [B3, B4]

Topics

1. Calibration of sensors
2. Calibration of final control elements
3. Commissioning a flow control loop with analog controller
4. Commissioning a flow control loop with digital controller
5. Tracing control loop wiring to produce loop wiring diagrams
6. Level control using ‘P’ and ‘PI’ controllers
7. Variations of temperature control loop
8. Control loop-tuning dynamics

Professional Component

Engineering Science  0%
Engineering Design    100%

Evaluation

1. Laboratory assignments
2. Biweekly quizzes

Performance Criteria

Objective 1

The students will demonstrate the:
1.1 Ability to calibrate an instrument and transmitter. [1]
1.2 Ability to describe the operating principles of common instruments. [2]
1.3 Ability to specify appropriate instrumentation. [1, 2]

Objective 2

The students will develop the:
2.1 Knowledge of controller algorithms and outputs. [2]
2.2 Familiarity with the operation of analog and digital controllers. [1]
2.3 Ability to tune P-, PI-, and PID controllers for simple loops. [1]

Objective 3

The students will develop the:

1 Numbers in brackets refer to the educational objectives and outcomes of the School of Engineering.
2 Numbers in brackets refer to the evaluation methods used to assess student performance.
3.1 Ability to draw a P&ID for a simple control system. [1]
3.2 Familiarity with standard spec sheet formats. [1, 2]

Spring Semester, 2005
Instructor: B. Rasenow
Office: SCI 112A
Phone: (415) 338-1228

Class/Laboratory Schedule
One 2-hour-45-minute lab session/week

Prepared by
B. Rasenow, Spring, 2005