PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE
COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRICAL ENGINEERING
ABET COURSE SYLLABI

IEE2683 AUTOMATIC CONTROL LABORATORY

Credits and contact hours: 5 UC credits / 5 hours (5h. Laboratory experiences)

Instructor's name: Guillermo García Bunster

Course coordinator's name Miguel Torres

Textbook:
- Laboratory Activities Guide, Course Notes and Laboratory Equipment Manuals.
- Modern Control Systems. R.Dorf, R.Bishop, Prentice Hall, 2004.
- Feedback Control of Dynamic Systems. G.K.Franklin, J.D.Powell, A. Emami-Naemi, Prentice Hall, 2006.

Course Catalog Description: Experiments-based learning concerning control techniques and automaion devices. The course consists of one theory review lecture, seven laboratory experiments and a final project in which students have to design and implement an automated device. Each laboratory experience begins with a short quiz before beginning the experiments that are carried out by each group of three students. The topics covered include data acquisition, AD/DA conversion, graphical operator interfaces, DC motor/generator discrete-time PID control, programmable logic controllers (PLC), LQR control of MIMO plants, magnetic levitation analog PID control, simulation and control of robot arms.

Prerequisite Courses: IEE 2613 Automatic Control

Co-requisite Courses: To be defined

Status in the Curriculum: Elective

Course Learning Outcomes:

1. Implement data acquisition and input/output hardware-software interfacing for measurement and control purposes, understanding the use of instrumentation hardware, including sensors, actuators, D/A & A/D converters, applied to the measurement of physical variables typically controlled in industrial processes and automated systems.
2. Identify and understand the strengths and limitations of theoretical models as descriptors of the behavior and dynamics of real systems to be controlled.
3. Implement and validate state estimation and control techniques applied to real processes.
4. Design and off-line tuning of process controllers.
5. Programming and commissioning of process controllers.
6. Analyze and interpret data measurements, formulate and support

conclusions, as well as develop an engineering reasoning about magnitude orders and conversions.

7. Develop creativity and design skills in the development of controllers and their application to real-life problems as part of the final course project.
8. Learn to recognize unsatisfactory controller performance due to hardware and software components failure, plant model mismatch, poor controller tuning and learn how to implement appropriate solutions.
9. Develop teamwork skills, learning to fulfill deadlines by adequate individual task and responsibility assignment, group coordination, results integration, and full joint knowledge of the implemented solutions.
10. Develop communication skills in the context of automation projects through the writing of reports and oral presentations.
11. Develop an appreciation of contemporary challenges and issues that can benefit from the application of control and automation systems and techniques.

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
b. Design and conduct experiments: analyze and interpret data
c. Design a system, component, or process
d. Multidisciplinary teams
e. Identify, formulate, and solve engineering problems
f. Professional and ethical responsibility
g. Effective communication
h. Broad education necessary for global, economic, environmental and societal context
i. Recognition of the need for, and an ability to engage in life-long learning
j. Knowledge of contemporary issues
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. Data acquisition, data hardware-softwarre input-output interfacing, A/D and D/A conversion, graphical user interface implementation.
2. Discrete PID control design and tuning applied to a DC motor-generator plant.
3. Programmable logic controlers (PLC) and its application to smart traffic lights that respond to traffic load and special emergency calls.
4. Linear quadratic regulators and Kalman filtering for MIMO plants applied to the stabilization and state estimation of the twin-rotor plant.
5. Analog PIC control design and tuning applied to the magnetic levitation problem.
6. Simulation and control of robotic arms.
7. Open topic final course project.. Application of automation and control techniques to real-life problems.