IIQ 2313 PROCESS DYNAMICS AND CONTROL

Credits and contact hours:	10 UC credits /10 hours (3 h. Lectures; 1,5 h. Labs; 5,5 h. Independent learning experiences)
Instructor's name:	Ricardo Perez
Course coordinator's name	To be defined
Textbook:	Bequette, W., "Process Control: Modeling, Design, and Simulation", Prentice Hall, 2003.
Course Catalog Description:	The modern process industry needs to adapt to the growing quality and competitiveness demands imposed by the market. Therefore, production processes must operate in optimal, safe and without harming the environment conditions, ensuring the products remain within specification. In this course the engineering tools that achieve these goals are given.
Prerequisite Courses:	IIQ2112 Reactor Design
Co-requisite Courses:	None
Status in the Curriculum:	Minimum course
Course Learning Outcomes:	At the end of the course the student will be able to:

1. Develop strategies for monitoring and control of process plants of medium complexity (objectives 1, 2 and 5).
2. Specify measurement instruments for process equipment (objectives 2 and 5).
3. Specify control valves (objectives 2 and 5).
4. Develop dynamic models of process equipment and perform simulations (objectives 2, 3 and 4).
5. Develop linear dynamic models using transfer functions (objectives 2 and 3).
6. Applying Laplace transforms to analyze the dynamics of linear systems (objectives 2 and 5).
7. Contents bifurcation analysis of simple nonlinear, continuous and discreet systems (objective 2).
8. Perform linear stability analysis of closed loop systems (objectives 2 and 5).
9. Tuning PID controllers in real processes using different techniques

(objectives 2 and 5).
10. Designing control structures for systems of more than one input and one output (objectives 2 and 5).
11. Designing control systems based on models (objetive 5).

Relation of Course to ABET Criteria:

a. Knowledge of mathematics, science and engineering
c. Design a system, component, or process
e. Identify, formulate, and solve engineering problems
g. Effective communication
k. Techniques, skills, and modern tools for engineering practice.

Topics covered:

1. <u>Chapter I</u>: Introduction (4 classes, 3 Workshops 1 Laboratory)
1.1. Course description and administrative aspects, Class
1.2. Introduction to Matlab / Simulink, Class
1.3. Introduction to Matlab / Simulink Workshop
1.4. Fundamental concepts of automatic control and instrumentation Class
1.5. Fundamental concepts of automatic control and instrumentation Workshop
1.6. Characterization of the response of instruments
1.7. Control valves, Class / Workshop
2. <u>Chapter II</u>: Dynamic models (5 Class, 5 Workshops, 1 Laboratory)
2.1. Dynamic process modeling, linear models, Laplace transforms, transfer functions, class
2.2. Dynamic process modeling, linear models, Laplace transforms, transfer functions, Workshop
2.3. Forcing functions, dynamic systems response, first and second order, Class
2.4. Forcing functions, dynamic systems response, first and second order, Workshop
2.5. Transfer function identification
2.6. Linear dynamic models of higher order, nonlinear recursions, Class
2.7. Linear dynamic models of higher order, nonlinear recursions, Workshop
2.8. Equations and continuous nonlinear systems, class
2.9. Equations and continuous nonlinear systems, Workshop
2.10. Chaos, Class / Workshop
3. <u>Chapter III</u>: Automatic Control (4 classes, 4 workshops, 1 Lab)
3.1. Feedback, proportional control, PI control, elements of stability, class
3.2. Feedback, proportional control, PI control, elements of stability, Workshop
3.3. Selection and tuning of PID controllers, Class /Workshop.
3.4. Tuning PID control
3.5. Other control structures, Class
3.6. Other control structures, Workshop
3.7. IMC control, Class
3.8. IMC control, Workshop

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