

School of Management, Engineering and Technology  
Department of Electrical Engineering and Renewable Energy  
EE 456: Control System Design

Catalogue Description (2009/2010):	Continuous-domain systems and Laplace transform review. System modeling, identification and linearization. System response and stability analysis. Classical tracking and regulating controller design using computers. PID tuning. Lab exercises in modeling, design and implementation. Student must register for a laboratory section.
Hours/Credits: (Lecture-Lab-Total)	(2-3-3)
Class Schedule:	One weekly 110 minute lecture, one term
Lab Schedule:	One weekly 170 minute lab, one term, corequisite with lecture
Prerequisites:	EE 225, EE 321 both with grade 'C' or better
Required Text:	B.W. Bequette, "Process Control: Modeling, Design, and Simulation," Prentice Hall, 2003
Reference Text:	None
Course Coordinator:	Frank Rytkonen
Regular Instructors:	Frank Rytkonen, Kimberly Wang
Course Objectives - Lecture:	<p>Upon completion of the lecture, a student should be able to:</p> <ul style="list-style-type: none"> <li>• Develop models of dynamic systems using physical principles</li> <li>• Explain the process involved in system identification (empirical modeling) from data.</li> <li>• Draw and analyze system control diagrams.</li> <li>• Evaluate system behavior, including stability and the time-domain response of systems to input stimuli.</li> <li>• Design controllers using classical control techniques, including PID tuning.</li> <li>• Design higher-level control schemes.</li> <li>• Use computers to model and simulate systems and design controller algorithms.</li> </ul>
Course Objectives - Lab:	<p>Upon completion of the lab, students should be able to:</p> <ul style="list-style-type: none"> <li>• Develop models of an industrial process using physical principles and system identification (empirical modeling) from data.</li> <li>• Produce control system design documentation.</li> <li>• Implement control system designs in hardware and software using PLCs and HMIs.</li> </ul>
Topics Covered:	<ul style="list-style-type: none"> <li>• System modeling and identification</li> <li>• Transfer function time and frequency response and stability</li> <li>• Principles of feedback control, including transfer functions and stability</li> <li>• SISO controller design, including PID tuning</li> <li>• Higher-level control schemes, including MIMO and model-based methods</li> <li>• Control system design, including documentation development</li> <li>• Ethical responsibilities of control system design, including industrial accident case studies and selection of valve failure positions for safety</li> </ul>
Relevant Program Outcomes:	<p>(a) an ability to apply knowledge of mathematics, science, and engineering  (b) an ability to design and conduct experiments, as well as to analyze and interpret data  (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability  (d) an ability to function on multi-disciplinary teams  (e) an ability to identify, formulate, and solve engineering problems</p>

	(f) an understanding of professional and ethical responsibility (g) an ability to communicate effectively (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice		
Required or Elective:	Required		
Criterion 5:	Engineering Topics		
Prepared By:	Frank Rytkonen	Updated:	5/7/10