Mechanical Engineering and Mechanics

MEM 351 Dynamic Systems Lab

Winter 2007/Spring 2007/Summer 2007

Designation:	Required
Catalog Description:	Covers advanced experimental methods in mechanical engineering in the areas of dynamic systems and control. Includes experiments on sensors, actuators, microcomputer data acquisition and control, and the analysis and design of feedback control systems.
Prerequisites:	MEM 255 Introduction to Control Systems

Textbook(s) and other required material:

Recommended: LabVIEW 7 Express Student Edition by Robert Bishop (with CD-ROM) Web Page: http://files.irt.drexel.edu/courseweb/mem310-00/

Course Objectives:

Reinforce concepts covered in junior-level mechanical engineering courses in systems and controls through a series of experimental investigations and analysis.

- 1. Analyze and create LabVIEW programs using sub VI, loops, and shift registers for microcomputer-based data acquisition.
- 2. Identify and model first- and second-order systems like DC motors
- 3. Design, simulate and implement closed-loop control systems for linearized first- and second-order systems

Topics:

- 1. LabVIEW programming
- 2. Data acquisition and virtual instrumentation design
- 3. System modeling: equations of motion of dynamic systems
- 4. Identification of 1^{st} and 2^{nd} order systems
- 5. Matlab SIMULINK programming
- 6. Control system design and simulation: pole placement and PID

Class Schedule: 1 hour/week lecture and 3 hours of lab/ week (2 credit)

Contribution to Professional Component:

Contributes toward the 1¹/₂ year of engineering topics appropriate to developing the ability to work in the dynamics systems area. Prepares students for classes in control systems design.

Relation to ABET Criteria 3 Outcomes

(0 = No content; 1 = some content; 2 = significant content)	
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Criteria a - k	Content	Explanation	Evidence
a . An ability to apply knowledge of mathematics, science and engineering	2	Relevant physics, equations of motion, state space realizations and control techniques are derived	In-class lectures, lab exercises and homework
b . An ability to design and conduct experiments as well as to analyzed and interpret data	2	Students write software and interface hardware to acquire and process experimental data. They are also required to analyze and interpret the experimental data in the report.	Lab exercises
c. An ability to design a system, component or process to meet desired needs	2	Controllers are both simulated and implemented experimentally.	Lab Exercises
d. An ability to function on multidisciplinary teams	2	Three or four students work as a team to use their knowledge in electronics, and computers to achieve the objective of each experiment in this course.	Lab Exercises
<i>e.</i> An ability to identify, formulate and solve engineering problems	2	The students are required to formulate and solve the control problem based on theory and to verify their experimental results with expected theoretical results.	Lab exercises and homework
f. An understanding of professional and ethical responsibility	1	This is emphasized as part of the design engineer's overall responsibility.	Guest Lecturers
g. An ability to communicate effectively	2	Oral and written presentations of the experimental procedure and results are required.	Lab reports and final report
<i>h.</i> The broad education necessary to understand the impact of engineering solutions in a global or societal context	1	The impact of engineering design on the environment (pollution, greenhouse effect, etc.) and society are covered.	Handout notes and Guest Lecturers
<i>i.</i> A recognition of the need for and an ability to engage in lifelong learning	1	Improvements in control come from innovations and advanced technology. Need for lifelong learning is recognized.	Handout notes and Guest Lecturers
j. A knowledge of contemporary issues	1	Design of control systems is related to contemporary issues	Handout notes and Guest Lecturers
k. An ability to use the techniques, skills and	2	Students use modern engineering instrumentation	Lab exercises

modern engineering	and software	
tools necessary for		
engineering practice		

Prepared by: Dr. Paul Oh, December 8, 2006