ECE 4122: Systems Laboratory

Credits and contact hours: 3 Credits (One 1-hour lecture and a 4-hour lab per week)

Instructor: Shalabh Gupta, Abhishek Dutta, Ashwin Dani

Textbook: none

a. *Other supplemental materials*: lab manuals

***Specific course information*:**

a. *Catalog Description*: Real-time digital control and signal processing systems. Typical topics include liquid level control, velocity and position control, digital filters, image processing, and power control electronics. Written and oral presentations of laboratory results.

b. *Prerequisite*: ECE 3111

c. *Required, elective, or selected elective:* Selected elective (EE)

***Specific goals for the course*:**

a. *Specific outcomes of instruction*: The students will be able to apply the principles of Systems theory (from ECE 3111) to the analysis and control of various electromechanical systems used in diverse fields such as robotics, aerospace systems, etc.

b. *ABET Criterion 3 Student Outcomes addressed by the course*:

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

Students learn to apply techniques of Systems theory to engineering problems.

(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

n/a

(3) an ability to communicate effectively with a range of audiences

Students write a report of the description and results of each experiment and maintain a lab notebook, thereby develop an ability of written communication.

(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

n/a

(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

Students participate in various lab experiments as teams where they design, and test control systems for different electromechanical devices to meet the specified performance metrics.

(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

Students learn to conduct experiments, interpret data, plot the results and apply the techniques of Systems theory for control

(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Students learn to identify the Systems' aspects of typical engineering problems in new electromechanical systems and formulate control solutions to meet the desired performance.

Topics covered:

1. Position and Velocity Control of a Mechanical Cart
2. Lead/Lag Control of a Mechanical Cart
3. Control of a Single Pendulum Gantry
4. Control of a Single Inverted Pendulum
5. Control of a Seesaw
6. Control of Magnetic Levitation
7. Control of a Qbot