The Ohio State University
Department of Electrical & Computer Engineering

ECE 3557: *Control Systems Laboratory*

808 Dreese Laboratory

Content: This course is meant to accompany ECE 3551 as an introduction to control systems applications. MATLAB, *Simulink*, and *dSPACE* is used to build feedback controllers for real plants (e.g., motors, joints, and links). The course covers data acquisition (DAQ), digital signal processing (DSP), gain compensation, lead-lag compensation, proportional-integral-derivative (PID) and state-space feedback control.

Text: Students are required to purchase the lab book, *Control Systems Technology Lab* by Yurkovich and Abiakel. It is available at most university bookstores. Its content has not changed significantly since 1998, and so most used or borrowed copies will be sufficient.

Data Storage: Local hard disk space is available for in class use at each bench. However, data will need to be gathered for each lab report. Machines are on the department network, and so network file transfers can be a good solution. Otherwise, students should have a means of transporting the data.

Grading: The numeric grade for the course is weighted as follows:

- Pre-lab assignments (individual): 30%
- Lab reports (group): 30%
- Lab activity/clean-up (group): 10%
- Final exam (individual): 30%

Pre-lab Assignments: Each lab includes a *Laboratory Preparation* section that must be completed **individually** (i.e., not in the lab groups) by **each** student. Pre-lab assignments are due at the beginning of the corresponding lab. Late submissions will not be accepted.

Daily Lecture: There will be a short (i.e., approximately 30 minutes or less) lecture at the beginning of each class. The purpose of the lecture is to explain content relevant to the completion of the lab and subsequent lab report.

Lab Reports: Each lab **group** must submit a single lab report at the beginning of the next class after the lab is completed. Lab reports will be penalized 10% per day late.

Groups: Each lab group will be made up of **two students**. Lab groups are responsible for lab reports. Individual students are responsible for pre-lab assignments.

Final Exam: The final exam has both a written theoretical portion and a practical laboratory portion. The final exam will take place during the last day of scheduled classes. Exams will be completed **individually**, and so all students should know how to use **both** the software and the hardware in the lab.

Attendance: Students are responsible for all assignments, change of assignments, announcements, and other course-related materials. If a lab needs to be missed, arrangements should be made with me at least 24 hours prior to the lab so that the lab work can be made up. I reserve the right to determine when make-up work is allowed.

Honor System: The ECE Honor System rules apply to all student work. All lab reports must reflect the understanding of the lab group. All other written work must reflect the understanding of the individual student. Otherwise, discussions on course material are encouraged.

Tentative Schedule: Due to limited hardware, Labs 8, 9, 11, and 12 will be alternated by lab groups:

Lab 1: Introduction to Data Acquisition (DAQ), dSPACE, and Simulink
Lab 2: Introduction to Digital Signal Processing (DSP)
Lab 3: Time Domain System Identification for a DC Servo
Lab 4: Gain Compensation and Feedback for a DC Servo
Lab 5: Lag Compensation for Speed Control of a DC Servo
Lab 6: Lead Compensation for Position Control of a DC Servo
Lab 7: Tuning a PID Controller for a DC Servo Position Control
Lab 8: Tuning a PID Controller for Position Control of a Flexible Joint
Lab 9: Tuning a PID Controller for Position Control of a Flexible Link
Lab 10: State Feedback Controller for Position Control of a DC Servo
Lab 11: State Feedback Controller for Position Control of a Flexible Joint
Lab 12: State Feedback Controller for Position Control of a Flexible Link
Final Exam: In-class final exam: theory and practice

Make-up schedule: If labs cannot be completed on time by a significant portion of the class, instructor *may* work with the class to schedule a special lab make-up time before the next lab. Students are strongly encouraged to finish labs during the normal lab time. Students should not expect that additional time will be available.

Disability services: Students with disabilities that have been certified by the *Office for Disability Services* will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located at 150 Pomerene Hall, 1760 Neil Avenue. They can be reached by telephone (614-292-3307) or TDD (614-292-0901) or the web (`http://www.ods.osu.edu/`).