Syllabus: Linear Control Systems (ECE 4090)

Spring 2020

Time and Location

MWF, 10:10AM-11:00AM
Riggs Hall, Room 307

Instructor

Richard E. Groff
regroff@clemson.edu (Prefix subject line with "ECE4090:")
Office Location: Riggs Hall, Room 302
Office Phone: 864-656-5906
Office Hours: Scheduled hours are linked from the syllabus tab on Canvas.
Also available by appointment (Request time via email)

Prerequisites: ECE 3300 with a grade of C or better

Common Policies

See the ECE Common Course Syllabus for policies that apply to all ECE courses at Clemson.

Textbook

Recommended Text:

- R. Dorf and R. Bishop, *Modern Control Systems*, 12th ed., Pearson, 2010.

Supplementary Texts:

- R. Dorf and R. Bishop, *Modern Control Systems*, Pearson, any edition.
- Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini, *Feedback Control of Dynamic Systems*, Pearson, any edition.
- K. Ogata, *Modern Control Systems*, Pearson, any edition.
- A. Stubberud, I. Williams, and J. DiStefano, *Schaum's Outline of Feedback and Control Systems*, McGraw-Hill, any edition.

Software

MATLAB/Simulink and the Controls Toolbox will be used extensively on the homework and projects for design and analysis of control systems. Follow the link at www.cecas.clemson.edu/matlab to set up a Mathworks account and download Matlab/Simulink. (Any recent version will be fine for this course. You will likely need a specific version for ECE 4960.)

Canvas

Canvas (http://www.clemson.edu/canvas) is an electronic course management system that will be used to post class notes, assignments, homework clarifications and hints, supplemental readings, links to other resources, and grades. Canvas will also be used to collect homework assignments.

Course Description

ECE 4090 provides an introduction to the analysis and design of single-input, single-output linear control systems. Most of the techniques, classified as "classical controls," are based on transfer function representations of linear systems (i.e. Laplace and Fourier). A brief introduction to state space analysis of linear systems is also included. Techniques covered will include modeling, feedback, stability, dynamic performance, root locus analysis and design, and frequency-response analysis and design.

Topical Outline

1. Introduction to Control Systems
2. Modeling Systems in the Laplace Domain
3. Block Diagrams
4. Second-Order Systems Properties and Specifications
5. Properties of Feedback
6. Root Locus Analysis
7. Frequency Response Analysis
8. Practical Issues in Control Design (Time permitted)
9. State Space Analysis (Time permitted)

Attendance Policies

See the ECE Common Course Syllabus for general policies related to attendance. The additional guidelines below are specific to this course.

Lecture attendance is expected. Students are responsible for all material covered, all announcements made, and all assignments given in every lecture. Lecture PDFs will be posted on Canvas and the student is responsible for preparing the latest lecture slides for handwritten or electronic markup before coming to class. Some lectures may cover material not found in the textbook. It is the responsibility of each student to make up any deficiencies that result from a missed class (for example, by getting announcements and written notes from a classmate).

When you are in class, cell phones and audio devices (mp3 players, laptop audio) should be turned OFF. Since the notes are provided in electronic form, a laptop or tablet may be used for marking up the electronic version of the notes. Use of electronic devices for non-course activities distracts the students around you. If behavior is disruptive, the instructor reserves the right to ask the offending student(s) to leave the class.

Grading

Grading will be based on homework and projects, two or three midterm exams, and a final exam. The expected weights for these are:

Homework & Projects	20%
Midterm Exams	50%
Final Exam	30%

Final grades will be assigned based on the scale

$90 \le \text{score} \le 100$ == A
$80 \le \text{score} < 90$ == B
$70 \le \text{score} < 80$ == C
$60 \le \text{score} < 70$ == D
$\text{score} < 60$ == F

Exams

- All exams are closed book and closed notes. You are permitted a handwritten one-page (front and back, 8.5"x11") note sheet. Print your name in the upper right corner of the note sheet.
  - The note sheet may *NOT* contain worked problems.
  - The note sheet *MAY* contain definitions, formulas, equations, algorithms, procedures, etc.
- The (required) Final Exam will be held during the university required time, Tuesday April 28, 3:00PM-5:30PM.

- If the university is closed due to unforeseen circumstances (e.g. inclement weather, power outage) during a scheduled exam time, then the exam will be held during the next scheduled class period unless announced otherwise via email.
- If a student has an excused absence for a midterm exam, then the final exam grade will be substituted in place of the missed midterm exam grade. NO makeup exams will be given.
  - An excused absence for a midterm exam generally requires a very good reason, discussed with the instructor and agreed upon in advance.
  - If a student misses an exam for *any* unanticipated reason, please contact the instructor via email or phone as soon as possible.

Homework/Projects

- Homework problems will be assigned and collected for credit via Canvas.
- Homework will be must be prepared and submitted in accordance with the "**ECE4090 Homework Submission Guidelines**" document posted in the Syllabus tab on Canvas.
- You should attempt every problem on your own. You are encouraged to discuss homework with your peers, but you should start and finish problems yourself. All submitted work must be completed by you individually.
- You must cite any resources (other than class notes, handouts, and textbook) used while solving the homework.
- Several Projects (about 2) will be assigned during the semester. These are essentially longer, more heavily weighted homework assignments with a more formal write up. Unlike homework assignments, you are not allowed to discuss projects with your peers.
- Late homework/projects will be penalized 25% per 12 hour period after the Homework Deadline.

Academic Integrity

See the ECE Common Course Syllabus for general policies related to academic integrity. The additional guidelines below are specific to this course.

Collaboration between students on homework assignments is allowed under the guidelines presented above. Keep in mind that the exams will draw from the material covered in the homework, thus it is advantageous for each student to understand every homework assignment. Absolutely no collaboration is permitted on exams.

Note: Use of stored equations or other course material in a calculator during an exam is considered a violation of academic integrity.

Access Accommodations

See the ECE Common Course Syllabus for general policies related to access accommodations. The additional guidelines below are specific to this course.

Please submit accommodation letters for ECE2620 as soon as possible. In order to receive accommodations on an exam, an accommodations letter must be received by the instructor at least 10 days before the exam date.