



**Introduction to Linear Control Systems**  
**ECE 4090, Section 001**  
**Spring 2022**

**Meeting Time and Location:** MWF, 10:10AM-11:00AM in Riggs Hall, Room 307

**Instructor:** Richard E. Groff, Riggs Hall, Room 302, 864-656-5906

**Office Hours:** See the “Office Hours and Contact Info” page under Modules on Canvas for the office hours schedule. Any temporary changes in office hours will be posted at that same location on Canvas. Available via Zoom during scheduled office hours without an appointment. Available by appointment for outside of scheduled office hours and/or in-person (schedule an appointment via email).

**Email:** [regroff@clemson.edu](mailto:regroff@clemson.edu) In the subject line of any email related to the course, please use “ECE4090:” as a prefix to your specific subject and include a short, descriptive subject. For example, a good subject line might be “ECE4090: Question regarding HW4 P3”. I will attempt to respond to email inquiries with 48 hours.

**Course Modality:** in-person

**Course Description:** Introduction to classical linear control systems. Topics include continuous and discrete descriptions of systems, time and frequency response, stability, system specification, system design of continuous and discrete systems.

**Prerequisites:** ECE 3300 with a grade of C or better

**Required Materials:**

Recommended Text:

- R. Dorf and R. Bishop, *Modern Control Systems*, 12<sup>th</sup> 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 and Simulink will be used regularly on homework assignments. Any recent version is acceptable (e.g. last 5 years). MATLAB and Simulink may be downloaded and installed on a personal computer using the Clemson license [www.cecas.clemson.edu/matlab](http://www.cecas.clemson.edu/matlab). You can also use Matlab Online <https://matlab.mathworks.com/>, though this may be a bit clunkier.

You are required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone. You are required to have a process to scan and submit documents using your phone (see the separate document “ECE4090 Homework Submission Guidelines” for further details.)

**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. State Space Analysis
9. Practical Issues in Control Design (Time permitted)

**Grading:**

Homework/Projects/Activities	15%
Midterm Exams	60%
Final Exam	25%

Letter grades are based on numeric course grade calculated using the above weights. The numeric grade to letter grade conversion is 90-100 A, 80-90 B, 70-80 C, 60-70 D, 0-60 F.

**Attendance and Cancellation Policy:** Regular attendance is strongly recommended. You are responsible for all material covered, all announcements made, and all assignments given in class. Please use the Canvas “Notification of Absence” system for excused absences, especially for quarantine or isolation. Lectures will be recorded in Zoom and available on Canvas. Every attempt will be made to announce class lecture cancellations or postponements in advance. A time for make-up lectures will be determined and announced in Canvas. Students may leave after 15 minutes if no one shows up to teach a scheduled lecture.

**Homework/Projects/Activities Policy:**

- Homework
  - Homework problems will be assigned and collected for credit via Canvas.
  - Homework (as opposed to Projects and Activities) will be graded on completion basis.
  - You are responsible for submitting solutions to all problems except those listed as “Exercise” or “Advanced”.
    - You are responsible for knowing how to work problems marked “Exercise,” but you should NOT submit solutions for grading.
    - You are not responsible for problems marked “Advanced.”
  - Solutions for homework problems (except for some exercises and advanced problems) will be posted before the homework is due.
  - Homework will be must be prepared and submitted in accordance with the “**ECE4090 Homework Submission Guidelines**” document posted on Canvas.
  - Homework submitted 12-48 hours late will be penalized 40%. Homework submitted after 48 hours will not be accepted.
- Projects
  - Projects are essentially longer, more heavily weighted homework assignments with significant simulation component. Grading is based on performance. Solutions will not be posted in advance. A few projects will be assigned during the semester.
- Activities
  - Other activities may be occasionally graded (such as the Student Survey and the Welcome Post). If you are absent during a graded in-class activity, you must have submitted a Notification of Absence in order to eligible to make up the activity.

**Exam Policy:** Make-ups for an in-class exam will only be allowed for urgent reasons. Make-up exams must be requested before the scheduled exam time. The final exam must be taken at the university's scheduled time, Tuesday 3:00-5:30PM during finals week.

**Inclement Weather or Emergency:** Any in-class exam that was scheduled at the time of a class cancellation due to inclement weather will be given at the next class meeting unless contacted by the instructor.

**Accessibility:** Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848

by emailing [studentaccess@lists.clemson.edu](mailto:studentaccess@lists.clemson.edu). Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here:

<http://www.clemson.edu/campus-life/campus-services/sds/>.

**Title IX:** Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware. There are two important exceptions to this requirement about which you should be aware:

Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is [alesias@clemson.edu](mailto:alesias@clemson.edu).

**Safe Campus:** Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

**Academic Integrity:** As members of the Clemson University community, we have inherited Thomas Green Clemson’s vision of this institution as a ‘high seminary of learning.’ Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

**Copyright:** Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

**Modification:** The instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations.