AE 3531 – Control System Analysis and Design
Course Syllabus – Fall 2026

INSTRUCTOR

Dr. Jose Magalhaes – Office MK 447A
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Office Hours: TBD
TBD
Other times available under request

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I will do my very best to answer all e-mails and texts within 24 hours. If you have not heard back in this time frame, please do not be afraid to reach out a second time in case your e-mail was misfiled or undelivered. I strongly recommend using your campus e-mail for communication, as external e-mail addresses may cause your note to be flagged as spam and not delivered. Please be professional and respectful in all communications.

TEACHING ASSISTANT: TBD - Office Hours: TBD

PREREQUISITES:

AE 3530 – System Dynamics;
Differential Equations (MATH 2403 or equivalent)

COURSE GOALS AND TOPICS COVERED

This course covers control system performance analysis and specifications, classical methods of control system analysis and design, introduction to modern control methods – with a focus on aerospace applications. By the end of this course, you should be able to:

1) Create mathematical models of physical systems and use those models to analyze the system's dynamic behavior
2) Design and evaluate control systems for a dynamic system of interest to achieve the desired performance from that system using both classical and modern control methods
3) For a given system of interest, mathematically describe the system and develop an appropriate model, choosing the correct laws, relationships, and equations to appropriately analyze the system and obtain desired information about its behavior and stability
4) Correctly produce and insightfully interpret the results of an analysis of a control system

In support of these goals, we will cover the following general topics:

1) Control system introduction and types of control systems
2) Laplace transforms and their role in solving linear, time-invariant systems
3) Modeling systems with block diagrams
4) Modeling in the state space
5) Transfer functions
6) Transient and steady state response analysis
7) Root locus analysis
8) Frequency-response analysis
9) Stability and control system design
10) Linear-quadratic regulator

COURSE SCHEDULE

AE3531 (Tentative)		
Week	**Date**	**Description**
Week 1: Intro to Control		
Week 2: Dynamic System Modelling and Block Diagram		
		Quiz-1 posted
Week 3: Block Diagram and Intro to PID control		HW1 posted
Week 4: Transiente Response - Analysis		Quiz-2 posted
Week 5: Transiente Response Cont and Root Locus		HW1 deadline - HW2 posted
Week 6: Root Locus Cont		Quiz-3 posted
Week 7: Steady State Error		HW2 deadline - HW3 posted
Week 8: Lead Lag (Fall Break - N/A)		Quiz-4 posted
Week 9: Bode and System ID		HW3 deadline - HW4 posted
Week 10: Nyquist		Quiz-5 posted
Week 11: State Space Control		HW4 deadline - HW5 posted
Week 12:State Space Control (Cont.)		Quiz-6 posted
Week 13: Intro to Project (Simulation)		HW5 deadlline - HW6 posted
Week 14: Project in Class (Hardware)		
Week 15: ThanksGiving Break		HW6 deadline / No Class
		No Class
Week 16: Reading Period		Project Report - Deadline
Week 17: Final Exam - End of term		
Week 18: Grade Submission		

COURSE TEXTBOOK, SOFTWARE, AND WEBSITE

System Dynamics (4th ed.), Ogata (ISBN: 9780131424623)
Modern Control Engineering (5th ed.), Ogata (ISBN: 9780136156734)

References:
There exist many excellent books on the subject. Below is a partial list. Please feel free to consult these and any other books you may want that will assist you in comprehending the class material. These books have been placed on reserve at the Engineering Library and should be available during the semester.

a) **Control Systems Engineering,** by N. S. Nise, John Wiley, New York, 2008, (5^{th} edition).
b) **Modern Control Systems**, by R. Dorf and R. Bishop, Addison-Wesley, 2000, (9^{th} edition).
c) **Feedback Control of Dynamic Systems**, by G. F. Franklin, J. D. Powell, and A. Emami-Naeini, Prentice-Hall, 2002, (4th edition).
d) **Feedback Systems: An Introduction for Scientists and Engineers**, by K. J. Astrom and R. Murray, Princeton University Press, 2008.

Acknowledgements: course content includes a few sources, but primarily Ogata (we'll be moving around quite a bit in Ogata). Some notes will be provided electronically, but the majority will be hand-written in lecture.

Matlab and Simulink will be used in this course. Canvas will be used as the course website. Please check it regularly.

COURSE COMMUNICATION

Canvas will be the primary mode of communication for this course. **Please make sure your Canvas is set up so that you receive announcements to your e-mail.** You will be responsible for keeping track of all information disseminated over Canvas.

CLASS STRUCTURE

Regular Lectures: Lectures will be given during scheduled class time, in-person.

Homework: Homework assignments designed to help you practice applying the course material will be given regularly over the course of the semester. You can expect about 6-8 assignments, generally assigned over a 1-2 week time period. Homework can be turned in during class time or dropped into the box at office MK-447A.

Quizzes: In lieu of midterms, this class will use regular quizzes to help you stay caught up with the material and to help check your understanding. These will be timed and administered bi-weekly. They will primarily consist of concept questions and quick calculations. More complex mathematical problems will be covered via homework.

Final Exam: This course will have a final project. More details will be provided during the semester.

GRADING

The concepts covered in this course require practice to master, and the grading system is set up to make sure your final grade reflects the level of mastery you achieve by the end of the term.
Grades will be calculated as follows:

- Homework: 60%
- Quizzes: 30% (lowest grade will be dropped)
- Project: 10%

If you have a question about grading, please approach the teaching assistant and instructor within one week of having the assignment returned to you. Canvas will be used as the primary means of communicating grades on individual assignments.

Total Points	Grade
89.5 – 100	A
79.5 – 89.4	B
69.5 – 79.4	C
59.5 – 69.4	D
< 59.5	F

Extensions and Late Assignments: Assignments turned in after the published due date/time on Canvas will be penalized **10 points per 24 hours late**. If you have any issues around the submission deadline, you should immediately e-mail your instructor and the TA with a brief explanation of the issues.

Extensions may be granted in cases where extenuating circumstances prevented the student from reasonably completing an assignment on time. Examples include illness, emergencies, family situations, and institute excused absences. For simple matters, you may request these extensions by directly contacting the instructor. If you have a more complex situation or one which you wish to keep private, you should work with the Office of the Vice President and Dean of Students. They can assist students with documented emergencies by contacting professors on behalf of the student. You can get more information on this process here: https://studentlife.gatech.edu/content/class-attendance

It is expected that students will notify the instructor ahead of the deadline if the student requires an extension, unless there is an extraordinary circumstance that prevents the student from doing so, in which case the student will notify the instructor as soon as it is feasible.

Attendance: In-person attendance will not be taken. However, you are expected to be familiar with all lecture content.

NOTE: **If you are ill, please do not come to class.** Your health takes priority and your fellow students will thank you for not exposing them. Please e-mail me as soon as possible to arrange to learn what you missed and come up with a plan to get back on track.

Students may need to miss classes due to personal emergencies such as being hospitalized, experiencing ongoing medical issues, or being in a car accident. The Office of the Vice President and Dean of Students can assist with contacting professors in these situations via the link provided in the previous section. These absences will not be considered unexcused, and the instructor will make reasonable accommodation to help get you back on track.

If you ever find yourself in any situation in which an unexpected personal challenge is preventing you from performing your best in the course, please reach out so we can come up with a plan for you.

COURSE ETHICS

I value honesty and integrity in all members of our community. An important element of this value is the academic honor code.

Georgia Tech Honor Challenge Statement: I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Georgia Tech community.

Honor Code: http://policylibrary.gatech.edu/student-affairs/academic-honor-code#Article_I:Honor_Agreement
Students are expected to uphold high ethical standards including adherence to the Georgia Institute of Technology Honor Code, Academic Regulations and Student Regulations.

Below are some guidelines to help you understand what constitutes appropriate academic behavior in this course:

- Students are expected to do their own work. Students are not permitted to review or use materials from previous semesters or solutions that can be found online or passed down from prior students. This includes the use of old homework.
    - **Uploading problems from this class and/or using/copying solutions found on Chegg.com (or any similar site) is strictly prohibited.** This applies to all homework, quiz, and finals problem. If you are found in violation of this policy it will be reported directly to the Office of Student Integrity, with no exceptions.
- Students are permitted and encouraged to work collaboratively on homework assignments and seek help from one another, but the work that is turned in must be the student's own work. Simply copying another student's work is not permitted.
- Plagiarism of any kind is not permitted.

Please include and sign the Georgia Tech Honor Pledge in all your homework and project submissions. It is:

"I commit to uphold the ideals of honor and integrity by refusing to betray the trust bestowed upon me as a member of the Georgia Tech Community"

TIPS FOR SUCCESS

Successful learning requires significant effort from both the instructor and the student. I will do everything in my power to make this course a success and provide you with the resources you need to learn. However, being successful will require you to do your part as well. Here are a few tips to help you be successful in this course.

- **Come to class (in-person)!** (And also come on time)
- **Engage with the material.** Understanding the concepts in statics comes as a result of working through examples problems and stretching your understanding. Don't be tempted to shortcut your learning process by looking up solutions online or copying from a friend. If you are stuck, ask for help, but don't be tempted to just copy the answer. Your learning will come through the (sometimes painful) process of working through the connections.
- **Ask for help when you need it.** Office hours are a great time to get help with homework, ask questions about the material covered in class, discuss your own performance in the course, or just to come and chat. These are a resource for you, and I encourage you to use it!
- **Your peers are a resource**. Talking out a problem with a classmate can be a fantastic tool to enhance learning for all parties. Explaining your thought process to someone else is often all it takes to get un-stuck. Plus, your current peers are the start of your professional network.
- **Focus on your problem-solving process.** Rather than focusing on simply learning the equations or memorizing a set of problems, focus on learning an approach to use when faced with a new problem. This skill will serve you well in all your courses and beyond.

STUDENTS WITH DISABILITIES

Your experience in this class is important to me. If you have already established accommodations with the Offices of Disability Services, please communicate your approved accommodations to me at your earliest convenience so we can discuss your needs in this course. The testing center will be utilized to accommodate students with exam accommodations.

If you have not yet established services through Disability Services, but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), please contact the Office of Disability Services at 404.894.2563 or dsinfo@gatech.edu or disabilityservices.gatech.edu.

Disability Services offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions. Reasonable accommodations are established through an interactive process between you, your instructor(s) and Disability Services. It is important to the Georgia Institute of Technology to create inclusive and accessible learning environments consistent with federal and state law.

MENTAL HEALTH RESOURCES FOR STUDENTS

I understand that many students experience stress through a variety of academic, financial and personal experiences. I value you and want to make you aware of resources available to you should you need them. Your well-being and mental health are important, and I am here for you.

Center for Assessment, Referral, and Education (CARE): https://care.gatech.edu/
Tech Ends Suicide Together: https://endsuicide.gatech.edu/
Counseling Center: https://counseling.gatech.edu/
Collegiate Recovery Program: https://counseling.gatech.edu/content/collegiate-recovery-program
Stamps Psychiatry: https://health.gatech.edu/services/psych
Vice President and Dean of Students Office and Student Referral Form: https://referral.studentlife.gatech.edu/
Georgia Tech CARE: 404.894.3498
Georgia Tech Counseling Center: 404.894.2575
Georgia Tech Police Department: 404.894.2500
Georgia Crisis and Access Line: 1.800.715.4225
National Suicide Prevention Lifeline: 1.800.273.TALK (8255)
National Hopeline Network: 1-800.784.2433

SOCIAL JUSTICE

The School of Aerospace Engineering values social justice for all members of the Georgia Tech community and the larger society. Social justice means that everyone's human rights are respected and protected. We stand committed in the fight against racism, discrimination, racial bias, and racial injustice. Our shared vision is one of social justice, opportunity, community, and equity. We believe that the diversity and contributions from all of our members are essential and make us who we are. We believe that our impact must reach beyond the classroom, research labs, our campus, and the technology we create, but must also improve the human condition where injustice lives. We will continue to work to understand, value, and celebrate all people and create an inclusive educational and work environment that welcomes all.

As a matter of policy, Georgia Tech is committed to equal opportunity, a culture of inclusion, and an environment free from discrimination and harassment in its educational programs and employment. Georgia Tech prohibits discrimination, including discriminatory harassment, on the basis of race, ethnicity, ancestry, color, religion, sex (including pregnancy), sexual orientation, gender identity, national origin, age, disability, genetics, or veteran status in its programs, activities, employment, and admissions. http://policylibrary.gatech.edu/equal-opportunity-nondiscrimination-and-anti-harassment-policy