

AE3530 Syllabus

System Dynamics, Section A, 3 Credits

Fall 2026

Instructor Information

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General Course Information

Description

Modeling and analysis of lumped- and distributed-parameter systems, free and forced vibration in mechanical systems, free vibration in structural systems.

Course Learning Outcomes

By the end of this course, students will be able to:

1. Identify and mathematically model mechanical elements and their corresponding forces and energies.
2. Derive governing equations of motion using Newton's second law and Lagrange's equation.
3. Analyze and compute the response of single-degree-of-freedom (SDOF) vibrating systems using the standard method and multi-degree-of-freedom vibrating systems using modal analysis.
4. Design and evaluate vibration mitigation strategies using damping, vibration isolators, and/or vibration absorbers.
5. Model, analyze, and compute dynamic responses of first, second, and higher-order dynamic systems using the Laplace transform to compute transfer functions.
6. Convert system equations into state-space form and compute their response using analytical and numerical techniques.
7. Interpret and modify system behavior and stability using frequency response, poles and zeros, and Bode diagrams.

Required Course Materials

K. Ogata, "System Dynamics," 4th Edition, Prentice Hall, 2004.

Grading Policy:

Homework: 20%; Classwork: 15%; Midterms: 20%, 20%; Final: 20%

A>90; B>80; C>70; D>60

Assignments:

Homework	20%
Classwork	15%
Midterm 1	20%
Midterm 2	20%
<u>Final Exam</u>	<u>25%</u>
Total	100%

Description of Graded Components

The classwork and exams are in class. One sheet (front and back) of notes plus the sheet from previous exams is allowed on each exam. Midterm 1: one sheet front and back.

Midterm 2: one new sheet plus the sheet from Midterm 1. Final: one new sheet plus the two sheets from the two midterms.

Course Policies

Attendance and/or Participation

Attendance will not be taken every class period, but it is ***strongly recommended*** that you attend every scheduled class. **You** (not the instructor) are responsible for any missed information concerning quiz and exam dates and coverage, class notes and information regarding the homework assignments. You will be given a zero for any missed exam or classwork unless advance notice is given to the instructor and arrangements can be made for any make-up work. If you miss an exam or quiz without giving prior notice, you will have to document the reason for your absence (doctor's excuse, etc.) if you expect to make up the work.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

[Core IMPACTS](#) is the University System of Georgia's General Education curriculum. If you are teaching a course that counts towards Core IMPACTS, you should include a syllabus statement about the Core area and associated [career competencies](#). [This resource](#) developed by the Center for Excellence in Teaching and Learning and Online Education at Georgia State University includes template syllabus statements for each of the Core IMPACTS areas that you may adapt for your course.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, [contact the Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. [The Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Pre- &/or Co-Requisites

AE 2220 and MATH 2552

Collaboration and Group Work

This course emphasizes cooperative learning. You will work in teams throughout the semester to build both your technical skills and your ability to communicate technical work.

1. **Team formation.** Teams of three to four students are formed using CATME, a research-based tool that builds balanced teams. You will complete a short CATME survey during the first week. Team assignments are posted on Canvas.
2. **Team name.** Each team submits a team name through the "Team Name" assignment on Canvas. One submission per team.

3. **Team communication.** Each team has its own channel on the course Microsoft Teams for discussion and coordination. These channels are also a good way to reach the instructors — post there and we will see it.
4. **What is graded as a team.** Homework is the only team-based component of your grade. Exams and all other assessments are individual.
5. **How homework works.** Attempt every problem on your own before your team meets. Do not divide the problems among team members. Then meet, compare your work, resolve disagreements, and submit one solution. Full details are in the Homework section of this syllabus.
6. **If your team isn't working.** Talk to your team first. If that doesn't resolve it, come see me — early, not at the end of the semester. Do not wait until a deadline is at risk. I can help mediate, and in rare cases I can move someone to a different team. Team composition changes require my approval.
7. **Team changes.** Teams stay together for the semester. If your team loses a member because someone drops the course, let me know and I will adjust as needed.
8. **Peer evaluation.** In the last two weeks of the semester you will complete a short CATME peer evaluation of your teammates. You receive credit for completing it; your teammates' ratings of you do not affect your grade.

Homework

Homework assignments will be distributed through Canvas and are due on the dates specified by the instructor. Each team submits a single PDF to Canvas.

Homework problems are sequenced deliberately, from foundational to challenging, and later problems build on the reasoning developed in earlier ones. Because of this, **you are required to attempt every problem individually before your team meets.** Do not divide the problems among team members. A student who works only one problem has not seen the progression the assignment was built around, and the exams assume you have.

After your individual attempts, meet as a team to compare work, resolve disagreements, and produce a single solution.

Each submission must include a cover page listing:

- Each team member's name and the problems they attempted individually before the team meeting.
- Two to three sentences from each member on which problem they found most difficult and what specifically made it difficult.
- A statement that every member has reviewed the final solution and can explain any part of it if asked.

Any team member may be asked to explain a step from a submitted solution. Being unable to do so affects that individual's grade, not the team's.

Solution requirements. Details are required for full credit: schematics, free-body diagrams, clearly defined coordinates, and the steps of the Problem-Solving Method. When numerical values are given, complete the symbolic solution first and substitute numbers only at the end. Some assignments are entirely symbolic.

AI & Generative Tools Policy

This course emphasizes understanding, modeling, and interpreting nonlinear dynamical systems and nonlinear vibrations using analytical methods and data-driven tools (MATLAB and Python). Students may use AI-based tools as assistive aids and all use must be cited (see Disclosure Requirement). The role that AI can play is as a learning partner and tool for enhancing your understanding of the course content. AI should not serve as a substitute for your own critical thinking or learning. All uses of AI must meet the following:

Explainability Standard: You must be able to explain everything you submit at a deep enough level for you to have been able to produce it yourself without assistance. If you use AI to contribute to your submission, then you need to investigate that contribution and build your understanding of it to meet this standard. If you cannot meet that standard, then that portion does not belong in your submission. The point of this policy is to provide a mechanism for you to retain control over critical thinking and to help mitigate dependence on AI.

Permitted Uses:

- Prototyping of codes and checking your own codes
- Help interpret error messages or debug code
- Suggest syntax, plotting routines, or numerical workflows
- Assist with documentation, commenting, or code organization
- Provide high-level explanations of mathematical or computational concepts for learning support

Prohibited Uses:

- Generate complete homework or worksheet solutions
- Perform derivations, proofs, or analyses that you cannot independently explain
- Replace required theoretical reasoning, interpretation, or critical analysis
- Bypass the learning objectives of an assignment or the course

Disclosure Requirement: If AI tools are used for an assignment, students must briefly disclose how they were used and which tool was used (e.g. “AI assistance through ChatGPT 5.6 was used to debug Python code for numerical integration.”). Failure to disclose constitutes an academic integrity violation.

Students are fully responsible for:

- The correctness of their submitted work
- Understanding and being able to explain any results, code, or analysis
- Ensuring compliance with Georgia Tech's academic integrity policies

Instructor Use of AI

I hold myself to the same standard I am asking of you. I have used Claude Opus 5 set to medium effort to help develop and improve this course. In developing this course, my use has focused on:

- Course organization and structure
- Identifying gaps in coverage and topics where my presentation can be simplified
- Checking course documents for inaccuracies
- Creating an overall plan for how to improve this course throughout the semester

Throughout this course, I will use AI for the following:

- Evaluating my explanations and presentations of course content
- Brainstorming applications of topics or ideas for how to demonstrate course topics

I have not and will not use AI for the following:

- Derivation of theoretical results
- Prototyping or creation of demonstration code
- Presentation of research results

I have verified and validated every aspect of this course, whether AI contributed to it or not, and I understand every aspect at the level needed to produce it on my own. Therefore, any errors you find—and you will—are produced by me. Please tell me about them.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

Homework will be accepted up to 24 hours after the deadline without penalty. Homework will not be accepted after those 24 hours. Make-up exams are given for illness, approved Institute activities or religious observances.

Inclement Weather and Digital Learning Days

If a weather-related event affects campus operations, we will pivot to either pre-recorded lectures or virtual class through MS Teams.

Student Use of Mobile Devices in the Classroom

Electronic devices used for taking notes are permitted in this class, but mobile devices (e.g., smartphones) not used for note taking are not permitted. Please refrain from using your smartphones during class.

Food and Drink in the Classroom

I encourage you to eat before or after class too minimize distractions in class; but if this is the only time you have to eat, it's fine to do so if you minimize the noise you create.

Campus Resources for Students

Undergraduate Student Academic Success Resources:

- Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A [comprehensive list](#) of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being ([student-resource-guide \(gatech.edu\)](#))