

ECE 6271: Adaptive Filters

Summer 2026 Syllabus

Instructor: Prof. David V. Anderson **Office:** TSRB 543

e-mail: anderson@gatech.edu

Office Hours: TBD, or by appointment (e-mail to schedule).

Online Office Hours: TBD

WWW: <https://canvas.gatech.edu/>

Text: *Adaptive Filtering* by Ali H. Sayed is recommended for this class but not required. It is available electronically through the GT library. Class notes and papers will be handed out.

Prerequisites: Each student is expected to have had a course in digital signal processing (convolution, digital filters and digital filter design, discrete Fourier transforms), a course in basic probability theory (probability, random variables, probability distribution and density functions), and a familiarity with the basics of linear algebra (matrices, vectors, eigenvalues and eigenvectors). A basic review of probability theory and linear algebra will be included at the start of the course. Finally, students should also have basic MATLAB or Python programming skills.

Course Objectives:

- To learn what adaptive filters are and how they work.
- To understand the properties and limitations of adaptive filters.
- To see how adaptive filters are used in applications such as channel equalization, signal and system identification, interference cancellation, and echo cancellation.

Course Format:

This course will be offered in a flipped classroom format. Lectures are delivered via video uploaded to Canvas under the Modules section. The lectures are not delivered synchronously, but you should view the lectures for each week during that week, prior to

coming to class. The class period will be devoted to working examples, answering questions, and working on problems individually or as a group. There will be an online quiz at the end of each week covering that week's lecture material. There are also weekly homework assignments. There are no midterm exams but there are concept quizzes that you will take on your own time to demonstrate understanding of class principles. A final exam will be based on the concept quizzes.

Grading:

Your grade will be based on the following factors, with the following allocations:

- Homework (30%): There will be approximately 9 homework assignments. See further details below.
- Online mini quizzes (20%): Online quizzes will be due weekly covering that week's lecture materials. See further details below.
- Concept quizzes (25%): Quizzes you will take when you are ready to demonstrate understanding of a concept from the course.
- Final exam (25%): The final exam will be based on the Concept Quiz material and will occur on the date designated by the Institute for the final exam for ECE 6271A.

Letter grades are based on your unrounded total scores with guaranteed cutoffs: 90.0% = A, 80.0% = B, 70.0% = C, 60.0% = D.

Assignments

Homework will be assigned weekly (approximately). Homework will be turned in online as PDFs. The quality of the scans should be very good---if using a pencil, make sure the writing is dark enough to scan well. Use a flatbed scanner or scanning software on your phone so that the finished scan is printable and easy to read.

Late homework: not accepted except for documented, excused circumstances with prior approval.

Each homework assignment will be worth 100 points. Over the course of the semester, the maximum number of homework points that you can be credited is 100 less than the total available (e.g., if there are 11 assignments, then the maximum homework points will be 1000---this serves a similar role to allowing you to drop one homework assignment, but should encourage you to still submit a partially completed one (and avoid panic if there is occasionally a problem that you do not finish in time.)) This effectively drops one homework's worth of points.

Students are strongly encouraged to discuss homework problems with one another. However, each student must write up and turn in their own solutions written in their own

words. Cases where solutions appear to be identical or nearly identical will be immediately referred to the Office of Student Integrity.

Several of the assignments will involve writing code. You may use MATLAB, Python or C/C++ programming languages. Documentation of your code is very important. Your code should be well organized and documented well enough to allow easy assessment of its correctness and of your understanding of the problem. You may be docked points on coding assignments for (lack of) code organization or comments.

The homework assignments will be hard; many of them will require significant amounts of time and effort to complete. But this is really where most of the learning takes place. You will get out of the assignments what you put into them. Students who complete all of the assignments in full will be rewarded with a deep understanding of the role that linear algebra plays in modern signal processing (among other things).

Effectively, homework is worth much more than 30% of your grade. In teaching many graduate courses over the years, the instructor has never seen a case where a student does not put effort into the homework assignments but does well on the exams.

Online Quizzes

The weekly online quizzes are in Canvas and will help you assess your understanding of the lecture material. Each week is structured as a Module in Canvas with lectures, quizzes, and support material (reading). You may take a mini quiz three times before the due date/time and your grade will be the highest of your three attempts. These are usually due on Friday evening and cover the material from that week's lectures.

Concept Quizzes

This class has no midterm exams and instead has Concept Quizzes. Concept quizzes are taken on Canvas on your own time. These are used to demonstrate understanding of concepts from the course—they are pass/fail (a perfect score is required to pass off a concept). Your grade for the Concept Quizzes will be based on the number of concepts that you pass off. If you do not pass off a concept on a given attempt, you can try again the following week. The questions for the subsequent attempts may be different; they are randomized. You may only take each Concept Quiz once per week.

Concept Quizzes must be taken individually but they are open note. No internet resources and no AI tools may be used during Concept Quiz attempts.

Final Exam

The final exam questions will be taken from the Concept Quizzes and Weekly Quizzes with slight modifications (e.g., changes in numbers).

Attendance:

This class will be recorded for remote delivery; however, students are strongly encouraged to be present for the live lecture. Attendance is not graded, but in-class problem solving is a core part of the course. Students are responsible for all material covered in class, including changes in schedules announced in class. Students who come to class will be given priority during office hours; the professor is not responsible for repeating information already given in class.

Dead Week

As per Institute policy, we are required to inform you on the syllabus that there will be a homework assignment due during the last week of class.

Online Resources

The course webpage is here on Canvas. This page will provide general course information, copies of the lecture notes, and homework assignments. Homework assignments and solutions will also be posted in Canvas, as they become available.

Distance Learning

Distance learning students (Section Q) will be required to complete the same assignments as the on-campus students. Most due dates for distance learning students will be delayed several days relative to on-campus students. Lecture material and assignments will be made available at least a week in advance so that, if you have a planned interruption (such as travel or a work project), you can prepare by working ahead.

Use of Artificial Intelligence (AI) Tools:

Artificial intelligence (AI)–based tools (e.g., large language models, code assistants, symbolic math tools) are **permitted as learning resources** in this course, subject to the restrictions below.

Permitted Uses

Students **may use AI tools** for:

- Conceptual clarification (e.g., explanations of signal processing concepts, definitions, background theory)
- Studying and reviewing material (e.g., creating summaries, alternative explanations, or study outlines)

- Debugging student-written code or mathematics **after** attempting the problem independently
- Exploring extensions or “what-if” questions **not directly tied to graded submissions**

AI should be treated similarly to a textbook, reference material, or tutoring resource.

Prohibited Uses

Students **may not use AI tools** to:

- Generate, complete, or substantially assist with **homework, quizzes, or exam solutions**
- Derive final answers, code, figures, proofs, or write-ups for any graded assignment
- Circumvent the learning objectives of problem-solving, derivation, or implementation tasks
- Submit AI-generated content as their own work, whether partially or in full

Unless explicitly stated otherwise, **all graded work must reflect the student’s own reasoning and effort.**

Disclosure and Academic Integrity

- When AI tools are used for **permitted purposes**, students should be able to explain the underlying concepts and steps in their own words.
- Any misuse of AI tools will be treated as a violation of the course’s **academic integrity policy**, consistent with Institute guidelines.
- When in doubt about whether a particular use of AI is allowed, **ask the instructor before using it.**

Academic Honesty:

Honesty and transparency are important features of good scholarship. On the flip side, plagiarism and cheating are serious academic offenses with serious consequences. If you are discovered engaging in either behavior in this course, you will earn a failing grade on the assignment in question, and further disciplinary action may be taken.

For a clear description of what counts as plagiarism, cheating, and/or the use of unauthorized sources, please see the Student Code of Conduct:

<http://www.catalog.gatech.edu/rules/19b.php>.

I encourage you to work together to learn the course material. However, all students are expected to complete assignments and exams individually (unless otherwise stated), following all instructions stated in conjunction with the exam or assignment.

If you have questions about my integration of the university's honor code into this course, please do not hesitate to ask: my aim is to foster an environment where you can learn and grow, while ensuring that the work we all do is honest and fair. Additionally, it is expected that students will respect their peers and the instructor such that no one takes unfair advantage of anyone else associated with the course.

For more information about Georgia Tech's standards with respect to academic integrity, you can also check out the following link: <http://honor.gatech.edu/>

Although students are encouraged strongly to work together to learn the course material, all students are expected to complete assignments and exams individually (unless otherwise stated), following all instructions stated in conjunction with the exam. All conduct in this course will be governed by the Georgia Tech honor code. Additionally, it is expected that students will respect their peers and the instructor such that no one takes unfair advantage of anyone else associated with the course. Any suspected cases of academic dishonesty will be reported to the Dean of Students for further action.

Unauthorized use of any previous semester course materials, such as tests, quizzes, and homework, is prohibited in this course. Furthermore, redistributing materials from this semester (e.g., contributing to test banks, CourseHero, Chegg, or similar sites) is also prohibited. For any questions involving these or any other Academic Honor Code issues, please consult me or www.honor.gatech.edu

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