

ECE 429/529: Digital Signal Processing

1 Course Details

Instructor	Gregory Ditzler (Dept. of ECE)
Instructor Email	ditzler@email.arizona.edu
Course Websites	https://d2l.arizona.edu piazza.com/arizona/fall2020/ece429
Lecture Times	Tu/Th 11:00AM–12:15PM
Lecture Room	Speech & MUS RM146
Instructor Office Hour	Online via Zoom F 11:30–12:30PM All other times are by appointment only.

2 Catalog Description

Discrete-time signals and systems, z -transforms, discrete Fourier transform, fast Fourier transform, digital filter design.

§ Textbook

- “Discrete-Time Signal Processing,” Alan V. Oppenheim and Ronald W. Schaffer, Prentice-Hall Signal Processing Series, 2010, 3rd Edition.

I will supply lecture notes that are specifically to the course content that may not be covered in the textbook. Students should use both the text and the lecture notes as reading material for the course.

3 Software

You will be required to use Matlab to work on assignments throughout the course. Matlab is freely available for your local computer through the University and it is very likely that computers in the campus labs will have it installed; however, given the impact of SARS-CoV-2, you will be required to follow UArizona and CDC guidelines when in a communal space.

4 Grading

Your final numerical grade will be computed as follows.

Homework (≈ 6)	30 points
Mid-term Exams (3)	40 points
Project	30 points
Total	100 points

Your course letter grade will be assigned based on your final numerical grade as follows.

90	100	A
80	89	B
70	79	C
60	69	D
0	59	E

5 Topics (subject to change)

- Introduction to DSP, classification of signals, digital frequency, sampling, aliasing, quantization noise, discrete-time system components, system properties, filter realizations, impulse response, convolution, correlation (9 lectures)
- Forward z-transform, time-shifting, DTFT existence, signal type from ROC, inverse z-transform, applying z-transform properties, poles & stability, system analysis using z-transform (5 lectures)
- Forward discrete-time Fourier transform (DTFT), symmetry, frequency shifting, modulation, filter design from lowpass prototypes, synthesis of filters using DTFT properties, DTFT analysis of downsampling/upsampling and expansion/compression operations, DTFT systems analysis, phase and group delay of filters, frequency response from poles & zeros, minimum-phase filters, forward DFT and inverse DFT, relationship to DTFT, applying DFT properties, convolution and correlation using DFT, DFT symmetry, sinusoidal analysis and frequency resolution, zero-padding and windowing, spectral analysis (16 lectures)
- Filter architectures and limit cycles (if time permits), linear-phase FIR filter types, FIR design by windowing, IIR design using bilinear transformation, decimation-in-time FFT, decimation-in-frequency FFT (9 lectures).

6 Homework Submission Policy

Some of the homework assignments will include MATLAB and/or C/C++ programming exercises. Homework must be turned in during class or via D2L (but not both) at the specified due date and time. Homework delivered late, or to any other location, will receive a grade of zero. The lowest homework grade will be omitted before computing the average homework grade for the semester. When submitting papers during class, please staple (do not fold). *Requests for a change in a homework grade must be made in writing no later than one week after the graded homework papers are made available.* Only a subset of the homework problems in a given assignment will be graded. Therefore, when studying for exams, you should rely on the homework solutions rather than the graded homework.

7 Academic Integrity

Students are responsible for completing homework assignments by themselves, but may work on strategies to complete the assignments with other students. You are encouraged to work in teams on homework assignments, but copying a completed assignment of another student

and submitting it as your own is considered a violation of academic integrity—and it will hurt you when it comes to the exams. Any take-home examinations *may not consist of any group work, even for problem strategies*.

Additional exceptions to this policy will be plainly marked in the requirements for that exercise or project. Any violations of this policy will be dealt with to the full extent permitted by the University of Arizona, and *may result in suspension or expulsion from the university, in addition to a failing grade*. Please familiarize yourself with the Code of Academic Integrity if you have any questions (see <http://deanofstudents.arizona.edu/codeofacademicintegrity>).

8 Threatening Behavior by Students

The University seeks to promote a safe environment where students and employees may participate in the educational process without compromising their health, safety, or welfare. The Arizona Board of Regents (ABOR) Student Code of Conduct, ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to one's self. Threatening behavior can harm and disrupt the University, its community, and its families. Threatening behavior is prohibited.

9 Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520-621-3268) to explore reasonable accommodation.

Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

The Disability Resource Center is available to explore face coverings and accessibility considerations if you believe that your disability or medical condition precludes you from utilizing any face covering or mask option. DRC will explore the range of potential options as well as remote course offerings. Should DRC determine an accommodation to this directive is reasonable, DRC will communicate this accommodation with your instructor.

10 COVID-19 Notes

- After the Thanksgiving holiday, we are scheduled to move to remote teaching.
- Remain flexible: If pandemic conditions warrant, the University may require that we return to remote operations. If that is the case, we will notify you by D2L Announcement and email that we are moving to remote operations.

- Meeting times for remote teaching: We will be meeting remotely until the University notifies us that in-person meetings may commence.
- Classroom attendance
 - If you feel sick, or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
 - Notify your instructors if you will be missing an in person or online course.
 - Campus Health is testing for COVID-19. Please call (520) 621-9202 before you visit in person.
 - Visit the UArizona COVID-19 page for regular updates.

11 Face Coverings are Required in Our Classroom

Per [UArizona's Administrative Directive](#), face coverings that cover the nose, mouth, and chin are required to be worn in all learning spaces at the University of Arizona (e.g., in classrooms, laboratories and studios). Any student who violates this directive will be asked to immediately leave the learning space, and will be allowed to return only when they are wearing a face covering. Subsequent episodes of noncompliance will result in a Student Code of Conduct complaint being filed with the Dean of Students Office, which may result in sanctions being applied. The student will not be able to return to the learning space until the matter is resolved.

12 Physical Distancing is Required in Our Classroom

During our in-person class meetings, we will respect CDC guidelines, including restricted seating to increase physical distancing and appropriately-worn face coverings. Per UArizona's Administrative Directive, face coverings that cover the nose, mouth, and chin are required to be worn in all learning spaces at the University of Arizona (e.g., in classrooms, laboratories and studios). Any student who violates this directive will be asked to immediately leave the learning space, and will be allowed to return only when they are wearing a face covering. Subsequent episodes of noncompliance will result in a Student Code of Conduct complaint being filed with the Dean of Students Office, which may result in sanctions being applied. The student will not be able to return to the learning space until the matter is resolved.

13 Academic Advising

If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed.

14 Life Challenges

If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu.

15 Physical and mental-health challenges

If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.

16 Subject Change

The contents of this syllabus are subject to change at the instructor's discretion.