Course Description: Examines models for presentation and processing of digital signals. Sampling theorem, correlation and convolution, time and frequency analysis of linear systems, Fourier transform, z-transform, design of digital filters structures for discrete time systems. Prerequisites: Algorithms (CSE 2320) and Linear Algebra (CSE 3380 or MATH 3330)

Learning Outcomes:

1. Understand what signals are.
2. Be able to analyze and process discrete signals.
3. Be able to go between frequency and time domains.
4. Be able to design simple FIR and IIR filters.
5. Become aware of some of the many applications of signal processing.

Textbook:

- Paul A. Lynn and Wolfgang Fuerst. *Introductory Digital Signal Processing*. John Wiley & Sons, New York, NY, 2nd edition, 1998. This is by far my favorite DSP book. It covers essential topics for a first course with lots of explanations. There is still math and it includes code for programs to perform the calculations, but the emphasis is on understanding why things are the way they are. ISBN: 978-0471976318

Homework Policy: I’m a strong believer that the best way to learn math is by doing, so you should expect plenty of homework. Calculators will not be allowed on exams, so you probably should not become dependent on them when doing your homework. Using a calculator to check your work is fine; having the calculator do all of the work isn’t.

Grading Policy:

- There will be three exams plus weekly homework assignments. Your final grade will be calculated as \( \min(\text{homework average, exam average}) \) where the homework average is the arithmetic mean of the homework grades and the exam average is the arithmetic mean of the exam grades.
- Exams:
If your lowest exam grade is one of the first two exams, then I will replace that exam grade with the grade you receive on the final exam. This will only be applied to one exam (in case of a tie) and will not be applied if you receive a grade of zero on an exam due to cheating.

- **Homework:**

1. Homework can be submitted late by 5 days (i.e., 120 hours). The cost is 25 points and is the same no matter when in the late period you finally submit the homework. The 25 points are deducted before the grading begins, so it is possible to lose 125 points. **Note that the last assignment of the semester cannot be submitted late.**
2. A scanned copy of the written portion of homework doesn’t count as submitting on time.
3. I never give extra credit work.
4. No homework grades will be dropped.
5. I am going to enforce readability of what you submit. The homework should have a clear structure (in my opinion) and the answer should be easy to identify.

- Final grades are based on the ranges of A: 88–100, B: 78–87, C: 68–77, D: 58–67, F: 0–57. I round to the nearest integer, so 87.4 is a B and 87.5 is an A.

- As someone taking an engineering course, I assume that you can keep up with the grades I provide to you and can calculate your current grade in the course. If you want me to calculate your average, tell you what you need to get a certain grade in the class, or tell you again what your grade on something was, then the cost is one point off of your overall course grade per request for this information.

**Important Dates:**

- Monday, August 21  
  first day of class
- Monday, September 2  
  Labor Day (holiday)
- Monday, September 30  
  exam 1
- Wednesday, October 23  
  exam 2
- Wednesday, December 11  
  exam 3

**Institution Information** UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the Institutional Information page (http://www.uta.edu/provost/administrative-forms/course-syllabus/syllabus-institutional-policies.php) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

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**Attendance:** At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator in student success. Each faculty member is free to develop his or her own methods of evaluating students academic performance, which includes establishing course-specific policies on attendance. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients “begin attendance in a course.” UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Blackboard. This date is reported to the Department of Education for federal financial aid recipients.

As the instructor of this section, I will not take attendance except when required to determine if you have attended the class. While attendance of the lectures is not required, you should not expect me to catch you up if you choose not to come to class nor is not attending the lectures necessarily good for your grade.

**Tentative Schedule** Note that this is subject to change, but here are the topics I intend to cover in their approximate order (the calendar on the course website gives more details).

<table>
<thead>
<tr>
<th>number of lectures</th>
<th>topic</th>
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<tbody>
<tr>
<td>2</td>
<td>Introduction, Python and NumPy</td>
</tr>
<tr>
<td>4</td>
<td>chapter 2: Time-Domain Analysis</td>
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<tr>
<td>4</td>
<td>chapter 3: Frequency-Domain Analysis: The Discrete Fourier Series and the Fourier Transform</td>
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<td>4</td>
<td>chapter 4: Frequency-Domain Analysis: the z-Transform</td>
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<td>4</td>
<td>chapter 5: Design of Nonrecursive Digital Filters</td>
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<tr>
<td>4</td>
<td>chapter 6: Design of Recursive Digital Filters</td>
</tr>
<tr>
<td>4</td>
<td>chapter 7: The Discrete and Fast Fourier Transforms</td>
</tr>
</tbody>
</table>

**References**
These are books that I have found helpful in learning DSP. They are in order of mathematical difficulty.

- Richard G. Lyons and D. Lee Fugal. *The Essential Guide to Digital Signal Processing*. Prentice Hall, Englewood Cliffs, New Jersey, 2014. This is a relatively short book with about 166 pages of content. You can’t learn to apply signal processing from this book, but it gives a great overview that would be a good place for most people to start.


- James D. Broesch. *Digital Signal Processing–Instant Access*. Newnes, Burlington, MA, 2009. This book only has 146 pages of content, but the ratio of information to page count is very high. There is enough math to help you begin to see the relevance of the math to DSP, but not enough details to do a lot. It’s great for getting the big picture quickly.
James H. McClellan, Ronald W. Schafer, and Mark A. Yoder. *DSP First: A Multimedia Approach*. Prentice Hall, Upper Saddle River, New Jersey, 1998. This is the book that I used the first time I taught Signal Processing and therefore much of what I know came from it. The authors believe this could be the first course taken by electrical engineering students. I don’t agree, but they do assume less at the beginning than traditional texts which means they explain more than traditional texts. Like all academic textbooks for DSP, it’s heavy on the math.