

EE381K-2 Digital Communications

Instructor:	Prof. Jeff Andrews
Lecture Hours:	TTh 5:00–6:15 PM, ENS 116
Office Hours:	Wed 1-3pm
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Unique Course Number:	15855
Grader:	TBD
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Prerequisites

The following prerequisites are required. If you don't have these prereqs but think you can handle the course, please see me to discuss it.

1. Graduate Level Probability (EE 381J or equivalent)
2. An undergraduate course in communications
3. Some experience with digital signal processing, e.g. discrete Fourier transform.

Topical Outline

This course is meant to provide a strong foundation for graduate study and research in the area of communications. The main objective of the course is to teach the students the engineering principles and analytical techniques required to design and understand digital communication systems. In particular, how to reliably send finite-alphabet (i.e. digital) symbols over noisy channels with a delay spread that exceeds the symbol time.

Primary topics for the course:

- Digital Signal Construction and Detection
- Bandpass and Complex Baseband Signal Representation
- Intersymbol Interference Channels
- Equalization: MLSE, linear, and decision feedback
- Multicarrier Modulation: Channel partitioning, vector coding, orthogonal frequency division multiplexing (OFDM)
- Convolution coding
- The Viterbi algorithm for Maximum Likelihood sequence detection/estimation and optimal decoding of convolutional codes.
- Synchronization (As time allows)

Required Textbook (Course Reader)

J. Cioffi, *Digital Communications*.

This unpublished book was chosen because it is rigorous and systematic, and also much less expensive than any of the alternatives. You can get a copy of the current version from Eta Kappa Nu, they should be available by the end of the first week of class, hopefully earlier. Please get a copy ASAP, so if they run out more can be ordered and printed in time for your first homework set. Please be aware that there are still an unfortunate number of typos in this manuscript.

Supplemental Textbooks

J. Proakis, *Digital Communications*. This is a thorough book that is a great research reference, but in my opinion is more difficult to teach/learn from than Cioffi.

Web Resources

The class webpage is accessible at:

<http://www.ece.utexas.edu/wncg/ee381k2/>

Here, you will be able to find all handouts for the class, except homework and exam solutions, for which only hardcopies will be available.

The online class system is called Blackboard. Most handouts will be distributed on the public web page (above), but we'll send group e-mails and do online grading through Blackboard (so you can view your grades there). Please make sure you know how to access Blackboard and that you are listed there as a student.

Grading

22.5% Exam 1

22.5% Exam 2

15% Homework

35% Final

5% Class Participation and quizzes

Other Information

Homework will typically be assigned Thursday, due the following Thursday by 5pm (the start of class) either in class or to a drop box outside Prof. Andrews's office. Students are encouraged to try the homework problems on their own, and then refine their understanding and solution with another student or group of students. Unfortunately, there is no TA for the course and my time out of class that can be spent helping on HWs is limited to e-mail exchanges and office hours. Hence, it is very important that you identify a study group of fellow students to discuss the homework problems with, as the homework in this class will frequently be challenging (or so I hope!).

You must write the names of all the students you collaborated with at the top of your homework, and turn in your own version. Simply copying another student's paper is not acceptable though, even if referenced as such. Copying without referencing will be treated as especially serious. Late homework will be accepted only in the most extraordinary of circumstances (if you aren't sure that your excuse is extraordinary, then it isn't). This said, please note that homework is worth only 15% of your grade. Your best strategy is probably to treat the homework as a study tool so

that you can excel on the exams, which are what will determine your grade.

Short (10 minute) pop quizzes will be given most weeks. They will not figure heavily in your grade (about 5%), but will help both you and the professor assess whether you are learning the key concepts presented in lecture. Typically, the quizzes will be worth 10 points and your lowest quiz grade will be dropped when computing the final grades (there are no make-up quizzes). They will typically be given on Thursday at the end of class and discussed on Tuesday and the beginning of class.

It is probable that there will be 1-2 mini-projects where you will design a digital communication system for a channel model that we give you. It will probably take longer than a normal homework, and be worth 2-3 times as much. Exact details will be given later.

Regrade Policy

All requests for regrades, on homework or exam, must be submitted in writing within a week of their return to you. No verbal complaints will be considered. Mistakes can be made in the grading process and we will correct those, but it is unlikely that more partial credit will be given. The basic idea here is that we don't want to indirectly penalize those students who don't ask for regrades. Also be aware that the result of a regrade can actually be a lower score as we will regrade the entire problem being protested.

College Drop/Add Policy

An engineering student must have the Dean's approval to add or drop a course after the fourth class day of the semester.

Students with Disabilities

The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the College of Engineering Director of Students with Disabilities at 471-4382.