Electrical and Computer Engineering Course Syllabus

Instructor:	Prof. Henry Pfister	**E-mail:**	hpfister@tamu.edu
Office / Hour:	ZEC 237M / TH 3-4 PM	**Phone:**	(979) 862-3198
Class Room:	HALB 105	**Class Time:**	TTH 12:45 PM - 2:00 PM

Course Name:	**ECEN 455**
Course Title:	**Digital Communications**
Prerequisite(s):	ECEN 303, ECEN 314
Required Text(s):	Course Notes: "A First Course in Digital Communications" (FCDC) Course Notes: "Undergraduate Probability I" (PI)
Other Text(s):	Communication Systems Engineering (2/E) by Proakis and Salehi (CSE) Digital Communications: Fundamentals and Applications (2nd Ed.) by Sklar (Sklar) Schaum's Outline of Analog and Digital Communications by Hwei Hsu

Course Objectives:

At the end of the course, the student should be able to:

1. Identify the various components of a digital communication system. Discuss the purpose of source coding, channel coding, and modulation. Become familiar with commonly encountered digital communication systems, and discuss how these systems can be decomposed into the same abstract constituent parts.
2. Discuss the purpose of information theory and calculate the entropy of simple information sources. Understand practical methods of compression such as Huffman and Lempel-Ziv codes.
3. Describe the process of analog to digital conversion and the relationship between bandwidth, sampling rate, and aliasing. Compute the amount of quantization noise introduced by uniform and non-uniform quantization.
4. Understand the notion of error correcting codes. Encode and decode simple linear block codes. Compute the probability of decoding failure for simple codes.
5. Derive simple modulation schemes, signal waveforms, and their vector space representations. Characterize the structure of optimal receivers, and compute the probabilities of symbol and bit errors at the output of the demodulator.
6. Discuss the properties of bandlimited channels. Study the causes and implications of intersymbol interference, and understand the Nyquist criterion for ISI-free signaling.

Student Evaluation:

Midterm	25%	Homework	5%
Final	30%	Quizzes	20%
Labs	20%		

- Exams will be closed book without calculators. Only pencils or pens are required.
- Quizzes are used to verify that you can solve the homework problems on your own.

Rules and Guidelines:

The class shall follow all established policies of TAMU. This includes the Aggie Honor Code and the Americans with Disabilities Act (ADA). The honor code is "An Aggie does not lie, cheat, or steal or tolerate those who do." and more information is available from `http://www.tamu.edu/aggiehonor`. The ADA is a federal anti-discrimation statute that provides comprehensive civil rights prtotection for persons with disabilities and more information is available from `http://disability.tamu.edu`. Links to these and other policies can be found at `http://www.ece.tamu.edu/~hpfister/courses.html`.

Course Topics:

Unit	Topics	Hours
1	Introduction and Review	3
2	Source Coding	4
3	Continuous Distributions	4
4	Discrete-Time Communications	5
5	Probability Review 3	4
6	Sampling and Quantization	5
7	Channel Coding	5
8	Modulation and Detection 1	4
9	Random Processes	4
10	Modulation and Detection 2-3	4
	Total Hours	42

Schedule:

Week	Date	Tuesday	Thursday	Lab	Notes
1	1/16	1	2	X	
2	1/23	3	4	0	
3	1/30	5	6	1	
4	2/6	7	8	1	Guest TTH
5	2/13	9	10	2	
6	2/20	11	12	2	
7	2/27	13	14	3	
8	3/5	15	Midterm	3	
X	3/12	X	X	X	Spring Break
9	3/19	16	17	4	Guest TH
10	3/26	18	19	4	
11	4/2	20	21	5	Mon. Last Q-Drop
12	4/9	22	23	5	
13	4/16	24	25	6	
14	4/23	26	27	6	
15	4/30	X	X	6	Mon. Last Lab

Final Exam: Friday, May 4, 12:30 PM - 2:30 PM

Lecture Topics:

(1-3) Introduction and Probability Review (FCDC: 1, PI: 2-7), opt: (CSE: 1)

(4-7) Source Coding (FCDC: 2), opt: (CSE: 6.1-6.3, Sklar: 13)

(8) Continuous Probability Review (PI: 8)

(9-11) Discrete-Time Digital Communications (FCDC: 3) opt: (Sklar: 2.8, App. B)

(12-13) Fourier Review (FCDC 4), opt: (CSE: 4.1)

(14-16) Sampling and Quantization (FCDC 4-5, CSE: 6.5-6.6, Sklar: 13)

(17-19) Channel Coding (FCDC: 6), opt: (CSE: 9.5, Sklar: 6)

(20-21) Random Processes (FCDC: 4), opt: (CSE: 4.1-4.4, Sklar: 1.5-1.7)

(22-24) Modulation and Detection (FCDC: 7.1), opt: (CSE: 7.1-7.3, Sklar: 3)

(25-27) Time-Shift Waveforms (FCDC: 7.2), opt: (CSE: 7.5, Sklar: 3)

Lab Schedule:

(1) Simulation of Random Events

(2) Source Coding

(3) Discrete-Time Communications

(4) Quantization

(5) Channel Coding: Block Codes and Coding Gain

(6) Waveform Communication