ELEC1200	A System View of Communications: From Signals to Packets	Spring 2024	Credits: 4

Course Description

Have you ever wondered what technologies go into your mobile phone or a WiFi hotspot? Through hands on work with a simple but fully functional wireless communication system, you will understand the basic engineering tools used and tradeoffs encountered in the design of these systems. This course is centered on weekly laboratories, each designed to introduce an important concept in the design of these systems. The lab sessions are supported by two one-hour lectures and a tutorial that introduce the concepts for the next laboratory, as well as reviewing and expanding the concepts learned in the previous laboratory.

List of Topics

Lecture Outline

Week 1	Course Introduction
Week 2	Signals; Real World Channels
Week 3	Linear Time Invariant Systems
Week 4	Transmitting Data; Inter-symbol Interference and Eye Diagram
Week 5	Feedback Model of the Channel; Channel Equalization
Week 6	Noise
Week 7	Noise; Error Correcting Codes
Week 8	Error Correcting Codes; Midterm Exam
Week 9	The Frequency Domain
Week 10	Filter and Frequency Response; Time-Frequency Analysis/source Coding
Week 11	Signal Transmission – Multiplexing; Signal Transmission – De-multiplexing;
Week 12	Introduction to Networks; Link Layer
Week 13	Network Layer; Transport Layer
Week 14	Application Layer; Course Review

Laboratory Outline

1. Introduction to MATLAB
2. Characterizing and Modeling an IR Channel
3. Communication Protocol and Bit Error Rate
4. Eye Diagram and Equalization
5. SNR and Bit Error Rate
6. Time-Frequency Analysis of Signals
7. Signal transmission using Frequency Division Multiplexing

Intended Learning Outcomes:

CO1:	Examine a voice communication system to identify the practical context of key theoretical concepts in ECE.
CO2:	Identify typical problems and tradeoffs encountered in electronic and computer engineering systems.
CO3:	Analyze simple approaches to address a range of problems and tradeoffs.
CO4:	Use software tools, such as MATLAB, to investigate potential solutions to problems and tradeoffs in order to validate an analysis, and to handle cases not amenable to simple analysis.
CO5:	Work in a cooperative setting on real hardware where the simplifying assumptions used in theoretical analysis may be violated, and assess the benefits and limitations of such analysis.

Textbook(s):

N/A

Reference Book(s)/Materials:

(F) Frenzel, Louis E, "Principles of electronic communication systems." 5th Edition, McGraw-Hill, 2023 (ebook).

(OWN) Alan V. Oppenheim, Alan S. Willsky and S. H. Nawab, Signals and Systems, 2nd Ed., Prentice Hall, 1997

Relationship of Course to Program Outcomes:

PO1	An ability to apply knowledge of mathematics, science and Electronic and Computer Engineering. (CO1, CO2, CO3, CO4)
PO2	An ability to design and conduct experiments, as well as to analyze and interpret data. (CO5)
PO3	An ability to design efficient and economical Electronic and Computer Engineering systems, components or process subject to practical constraints.
PO4	An ability to function in a multi-disciplinary environment through teamwork.
PO5	An ability to identify, formulate and solve Electronic and Computer Engineering problems. (CO1, CO2, CO3, CO4)
PO6	An ability to understand professional practices and ethical responsibilities.

PO7	An ability to communicate effectively.
PO8	An ability to understand contemporary global, regional, economic, environmental, and social issues, and the corresponding role and the impact of Electronic and Computer engineers.
PO9	An ability to recognize the need for, and to engage in life-long learning.
PO10	An ability to use current techniques, skills and engineering tools necessary for solving Electronic and Computer Engineering problems. (CO4)
PO11	An ability to use the computer/IT tools relevant to the Electronic and Computer Engineering along with an understanding of their processes and limitations. (CO4, CO5)

Grading Scheme:

Homework	10%
Lab	25%
Midterm Exam	25%
Final Exam	40%