

### Course Description

Have you ever wondered what technologies go into your mobile phone, an Internet of Things (IoT) network 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 introduces the concepts for the next laboratory, as well as reviewing and expanding the concepts learned in the previous laboratory.

Co-requisite(s): (COMP 1021 OR COMP 1022P) AND (MATH 1003 OR MATH 1014 OR MATH 1020 OR MATH 1024)

### Lecture Topics

- 1 Course Introduction
- 2 Signals
- 3 Real World Channels
- 4 Linear Time Invariant Systems
- 5 Transmitting Data
- 6 Inter-symbol Interference and Eye Diagram
- 7 Feedback Model of the Channel
- 8 Channel Equalization
- 9 Noise
- 10 Error Correcting Codes
- 11 The Frequency Domain
- 12 Filters and Frequency Response
- 13 Time-Frequency Analysis/Source Coding
- 14 Signal Transmission – Multiplexing
- 15 Signal Transmission – Demultiplexing
- 16 Introduction to Networks
- 17 Link Layer
- 18 Network Layer
- 19 Transport Layer
- 20 Application Layer

### Laboratory Topics

1. Introduction to MATLAB
2. Characterizing and Modeling a 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. Frequency Division Multiplexing

### Intended Learning Outcomes

- Examine a voice communication system to identify the practical context of key theoretical concepts in ECE.
- Identify typical problems and tradeoffs encountered in electronic and computer engineering systems.
- Analyze simple approaches to address a range of problems and tradeoffs.
- 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.
- Work in a cooperative setting by simulations where the simplifying assumptions used in theoretical analysis may be violated, and assess the benefits and limitations of such analysis.

### Reference Book(s):

[\(F\) 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](#)

### Grading Policy

Lab	15%
Homework	10%
Midterm Exam	25%
Project	20%
Final Exam	30%