

# ECE614 Communications over Fading Dispersive Channels

(Fall 2020)

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**Course Website:** <https://learn.uwaterloo.ca>

**Lectures:** [REDACTED] virtual lectures, with lecture notes and weekly lecture videos available at the course website

**Course Description:** This course focuses on fundamentals of wireless communications and networking for systems such as cellular networks and wireless local area networks (WiFi). It extends the studies of digital communications over an additive white Gaussian noise (AWGN) channel to a fading dispersive channel in a mobile environment. After an overview of wireless communication systems, we model a wireless propagation channel as a linear time variant system, and study digital modulation schemes for data transmission. We then study how to mitigate channel impairments in transceiver design, such as using diversity to overcome channel fading, which is the basis for multiple-input-multiple-output (MIMO) systems in LTE and 5G cellular systems. After that, we will study the fundamentals of cellular systems and the properties of frequency reuse to enlarge system capacity. To support multiple mobile users, we will study how to permit multiple access of the common radio resources (i.e., to avoid interference in simultaneous transmissions from multiple users), using techniques such as code-division multiple access (CDMA).

## Sequence of Lecture Presentation:

1. Overview of wireless communications;
2. Characterization of wireless channels;
3. Bandpass transmission over wireless channels;
4. Channel impairment mitigation techniques;
5. Fundamentals of cellular communications;
6. Multiple access techniques.

**Prerequisites:** ECE206, and ECE318 or equivalent (subject to the approval of instructor)

**Lecture Notes and reference research papers:** Available at course website

**Project:** Each student should choose a topic related to the course subject (with an approval from the instructor), submit a project report, and give a 15-minute presentation at the end of the term.

**Grading:** Project=50%; homework/quizzes/final exam=50%.