



Wireless Communications: Systems and Network Design Principles

ENPM616 Fall 2022

Course Overview

This course focuses on technology concepts, solutions and design principles in modern wireless communication standards, systems, and networks. Starting with wireless communications use cases and standardization process, the course focuses on key characteristics and modeling mobile wireless channels including radio propagation, path loss, fading and interference effects. The discussion then follows with describing different wireless communication techniques including channel coding, modulation, resource allocation, link adaptation and diversity schemes as well as advanced multi-antenna, i.e. multiple input multiple output (MIMO) solutions.

The course then goes into radio channel sharing and multiple access control scheme, where frequency, time and code division multiple access FDMA/TDMA/CDMA and orthogonal frequency division multiple access (OFDMA) are discussed in detail. In the same context various resource allocation schemes for broadcast, multicast, and side-link communications as well as contention-based channel access schemes to shared or unlicensed spectrum are also discussed. We will also use an example of a basic cellular communications system to introduce notions of system/network architecture, channelization schemes, downlink/uplink synchronization, system access, mobility, and power management procedure along with relevant system design issues.

Applying some of the key principles discussed earlier in the course, students will be tasked with a mini project for a cellular network design. The project involves radio path loss model tuning, coverage and capacity analysis using link budget calculations and traffic dimensioning concepts.

Tentative Schedule:

- Week 1: Overview of Wireless Communication Systems, Applications, Spectrum Regulations, and Standards Roadmap
- Week 2&3: Fundamental of Radio Propagation and Fading Effects and Models
- Week 4: Cellular Channel Reuse and Interference Types and Effects
- Week 5: Exam 1
- Week 6 & 7: Wireless Communication Techniques: Coding, Modulation, Link Adaptation, Diversity and MIMO, Beamforming
- Week 8: Multi. Access Systems: FDMA/TDMA/CDMA
- Week 9: Multi. Access Systems: OFDMA, Broadcast, Contention Based Access
- Week 10: Exam 2
- Week 11, 12: Basic Cellular Communication Systems and Protocols
- Week 13 & 14: Link Budget, Coverage and Capacity Analysis and Network Dimensioning
- Week 15: Exam 3/Project

Course Grading:

Two Exams: Exam 1 (%40), Exam 2 (%40) and Project (%20) of total grade.

References Books/Reading:

Recommended: Wireless Communications & Networking, by Vijay Garg, 2007, ISBN-13: 978-0123735805

Detailed Slides/Class Notes will be provided.

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Class Meets

Mondays 4-6:40pm

Location: TBA

Office Hours

Fridays 1-3pm

Phone (301) 538-7180

or Webex/Zoom:

and by appointment

Teaching Assistants

N/A

Prerequisites

N/A

Course Communication

Emails and File Sharing
Through ELMS/Canvas.