Course Description

Wireless communications faces a rapid growth in communications industry, mainly due to its high speed and quality capability of information exchange between portable devices. Emerging applications envisioned for such a technology include multimedia Internet enabled cell phones, smart homes and appliances, automated highway systems, structural health monitoring system, video teleconferencing and distance learning, and autonomous sensor networks, to name just a few. However, supporting these applications using wireless techniques poses a significant technical challenge.

This course will cover basic concepts and advanced topics in wireless communications for voice, data, and multimedia. We begin with a brief overview of current wireless systems and standards. We then characterize the wireless channel, including path loss for different environments, random log-normal shadowing due to signal attenuation, and the flat and frequency-selective properties of multipath fading. Our next focus will be on practical digital modulation techniques and their performance under wireless channel impairments. The course covers an overview of wireless networks, including multiple and random access techniques, WLANs, cellular system design, and ad-hoc network design. Applications for these systems, including the evolution of cell phones and PDAs, smart homes and appliances, sensor networks, automated highways and skyways, and RFID systems will also be discussed.

Upon successful completion of this course, students will be able to understand the main concepts of wireless technologies such as channel model, fading, diversity, power control, MIMO systems, multiple-access techniques and core protocols and standards that are widely used in WLANs and WPANs and the way that these network interact with the Internet and how they integrate across all layers of protocol stack.

Grading

Homework: 10%
Midterm exam: 40%
Final project/survey: 50%
Textbooks


-Required? (N)

Course Outline

- Overview of wireless communications
- Path loss, shadowing, and fading models
- Capacity of wireless channels
- Digital modulation and its performance
- Adaptive modulation
- Diversity
- MIMO systems
- Multicarrier modulation
- Spread spectrum
- Multiuser communication and wireless networks
- Wireless systems and standards
  - Cellular systems and 4G standards
  - WiFi networks and WLAN standards IEEE 802.11n
  - ZigBee Radios and IEEE 802.15.4
  - RFID systems and EPCglobal UHF Class 1 Generation 2
- Emerging wireless systems
  - Ad-hoc/Mesh wireless networks
  - Sensor networks
  - Distributed Control Networks
  - Cognitive Radios
  - Biomedical Networks and In-body networks