

# CS 547: Wireless Networking

## Objectives

- Ubiquitous access to information, anywhere, anyplace, and anytime, will characterize whole new kinds of information systems in the 21st Century.
- These are being enabled by rapidly emerging wireless communications systems.
- These systems have the potential to dramatically change society as workers become “untethered” from their information sources and communications mechanisms.
- This course introduces broadcast radio networks, cellular networks, ad hoc wireless networks, and satellites systems.
- It explains in detail and depth the design and optimizations of these wireless communications systems.
- As an advanced graduate course, this one will combine extensive reading and discussion of the research literature with in-depth research.
- As prerequisites, the students should have basic knowledge of various wireless systems, fundamentals of graph theory, algorithm designs, geometry, and probability.

## Prerequisites

- CS 455.

## Syllabus

- Signal-to-Interference Ratio
  - Path Loss Model
  - Cells and Voronoi Diagram
  - Monotonic Property of SIR
  - Extremes of SIR
- Broadcast (Radio, TV) Networks
  - Standards for Radio and TV systems
  - Model of Interferences by Disk Graphs
  - Heuristics for Channel Assignment
- Cellular Networks
  - Cellular Concept and Architecture
  - Cellular Hexagonal Geometry
  - Minimizing Channel Assignment Subject to Co-channel Separation
  - Tiling with Maximal Co-channel Separation
  - Maximal Adjacent-Channel Separation subject to Maximal Co-Channel Separation
  - Weighted Channel Assignment
  - Capacity Expansion by Reuse Partitioning
  - Capacity Expansion by Sectorization
- Ad Hoc (Multihop Packet radio) Wireless Networks
  - Asymptotic Critical Transmission Range for Connectivity
  - Asymptotic Critical Nodal Degree for Connectivity
  - Distributed Construction and Maintenance of Virtual Backbone
  - Energy Efficient Routing
    - Asymmetric vs. Symmetric
    - Unicast
    - Broadcast
    - Multicast
  - Topology Control and Localized Routing
  - Node Scheduling and Link Scheduling
  - Distributed Scatternet Formation in Bluetooth Networks
- Satellite Networks (optional)
  - Satellite Orbits and Systems
  - Switching in the Sky: Satellite Switched TDMA