

Prerequisite: ECE 511, ECE 513

Course Description: Review of modulation and coding. Trellis coded modulation. Digital signaling over fading multipath channels. Spread spectrum signals for digital communications. Multiple access systems, time-division multiple access, code-division multiple access, frequency-division multiple access. OFDM communications systems.

Course Outline:

Review of Modulation and Coding Theory
  - Review of the main components of a Digital Communication System
  - Review of Block Codes - Convolutional codes
  - Lattices

Trellis Coded Modulation (TCM)
  - Introduction and Fundamentals
  - Trellis Representation
  - Set Partitioning
  - Examples of TCM schemes
  - Decoding TCM
  - Performance Evaluation in AWGN channel
    - Upper Bound to Error Probability
    - Lower Bound to Error Probability
    - Examples
    - Computation of $d_{free}$

Digital Signaling over Fading Multipath Channels
  - Characterization of Fading Multipath Channels
  - The Effect of Signal Characteristics on the Choice of a Channel Model
  - Diversity Techniques for Fading Multipath Channels
Digital Signaling over a Frequency-Selective, Slowly Fading Channel
Binary and M-ary Signaling over a Frequency-Nonselective, Slowly Fading Channel
Coded Waveforms for Fading Channel
   Probability of Error. Hard and Soft Decision
   Performance of Convolutional Codes
   Constant Weight and Concatenated Codes
   Analysis and Performance of TCM for Fading Channels

Multichannel and Multicarrier Systems
   Multichannel Digital Communications in AWGN
   Multicarrier Communications

Spread Spectrum Signals for Digital Communications
   Model of a Spread Spectrum Communications System
   Direct Sequence Spread spectrum Signals
      Rake Receivers
      Multi-user Detection
   Frequency Hopped Spread Spectrum Signals
   Other types of Spread Spectrum Signals
   Spread Spectrum in multipath channels

Multiuser Communications
   Multiple Access Techniques (CDMA, TDMA, FDMA, SDMA, PDMA)
   Capacity of Multiple Access Systems.

OFDM
   Introduction
   Transmitter and Receiver Structure
   Performance Analysis

Grading.

Coursework will be graded as follows:
1. Homework 15% (every week, due Mondays)
2. Exams 1 25% (09/24/08)
3. Exams 2 25% (10/29/08)
4. Final exam 35% (12/11/08; 10:30 AM to 12:30 PM)

Homework solutions will be posted in the Blackboard on Wednesdays. HW should be submitted (hard copies) at the beginning of the class on Mondays (MC section) or using the Digital Dropbox (Blackboard) for other sections. No late HW will be accepted without previous instructor consent.

Grade scale:
   A:  86 – 100
   B:  71 – 85
   C:  60 – 70
Reasonable accommodations will be made for students with documented disabilities. In order to receive accommodations, students must obtain a letter of accommodation from the Center for Disability Resources and make an appointment to speak with me as soon as possible. The Center for Disability Resources is located in the Life Sciences Building, room 218, 312-567-5744 or disabilities@iit.edu.