CS477 Course Outline
Analog and Digital Communications

Description:
This class provides an introduction to communication systems and techniques. Basically we try to answer the question ‘how information flows from one point to another at the most basic level?’ We start with a brief review of Fourier analysis and random processes. Basic analog communication systems, including AM and FM systems, are covered next. Then, digital communication systems, including MPSK, MQAM, and FSK, are covered. We conclude with some advanced techniques to mitigate channel impairments, including multicarrier modulation and spread spectrum CDMA. At each level, system design is given primary importance by using examples from practical systems.

Goals:

- To acquire a mathematical understanding of Analog and Digital Communication Systems.
- Be able to design a practical communication system at the block diagram level under certain constraints and requirements.

Prerequisites:
1. Introductory Probability Theory.
2. Circuits and Systems or Introduction to DSP.
3. Fourier Series and Transforms.

Talk to the instructor if you are not sure whether you have the right background for this course.

Detailed Contents:
1. Introduction
   (a) Signals and channels
   (b) Limitations of communication systems
   (c) Analog versus digital communication
2. Representation of Signals
   (a) Fourier series and spectra
   (b) Fourier Transforms and its type
3. Transmission and filtering
4. Correlation and power spectral density
5. Linear Continuous wave modulation
   (a) DSB+C and DSB-SC
   (b) SSB and VSB
   (c) Example Communication System (TV/Radio)
6. Exponential Continuous wave modulation
   (a) Frequency Modulation
   (b) Phase Modulation
7. Random signals and Noise
   (a) Noise in baseband
8. Passband Noise
   (a) Noise in linear CW systems
   (b) Noise in exponential CW modulation
9. Sampling and Baseband digital transmission
   (a) Digital PAM, PCM, and Delta modulation
   (b) Matched filtering
10. Bandpass digital transmission
    (a) Digital CW modulation
    (b) Coherent and non-coherent binary systems
    (c) QAM and QPSK
11. Spread Spectrum modulation
12. Multicarrier Modulation
13. Error detection and correction