EE 421/621: Communication Theory

SYLLABUS - Winter 2005

Instructor: Dr. George N. Karystinos
Office: 421 Russ Engineering Center
E-mail: g.karystinos@wright.edu
Office Hours: Tue 6:00 pm - 8:00 pm

Class Time and Place: Tue & Thu 4:10 pm - 5:50 pm, 236 Oelman Hall

Credits: 4.00

Teaching Assistant: Qian Huang (qhuang@cs.wright.edu), Office hours: Mon 12:00 pm - 2:00 pm, 233 Russ Engineering Center

Prerequisites by topic:

- Fourier series and transforms.
- Probability and random variables.
- Fundamental matrix theory and vector analysis.
- Linear system theory; impulse response and transfer functions.

Course Description: This course provides an introduction to communications systems and theory. Topics include: analog signal representation and filtering; analog modulation and demodulation techniques; digital signal representation and filtering; digital modulation and demodulation techniques; fundamentals of random variables and random processes, white Gaussian noise; effect of noise on digital modulation techniques.

Lab Description: This includes projects using MATLAB. The projects are closely related to the course topics. An introduction to MATLAB is included (Project 1).

Textbook: John G. Proakis and Masoud Salehi, "Communication Systems Engineering," *Prentice-Hall*, 2nd Edition, 2002.

Reference Books:

- Leon W. Couch II, "Modern Communication Systems," *Prentice-Hall*, 1995.
- B. P. Lathi, "Modern Digital and Analog Communication Systems," *Oxford University Press*, 3rd Edition, 1998.
- Simon Haykin, "Communications Systems," *John Wiley*, 4th Edition, 2001.
- M. Simon, S. Hinedi, and W. Lindsey, "Digital Communication Techniques," *Prentice-Hall*, 1995.

Grading:

Homeworks:	15%
Lab:	25%
Mid-term exam:	25%
Final exam:	35%

Course Outline:

I. Representations of Signals and Systems (4 lectures) - (Ch. 1 and 2)

- Introduction to communication systems
- Review of linear system theory, Fourier transform theory
- Bandpass systems, Hilbert transform

II. Analog Modulation Schemes (4 lectures) - (Ch. 3)

- Amplitude modulation (AM)
- Double sideband - suppressed carrier (DSB-SC) and single sideband (SSB) modulation
- Frequency and phase modulation (FM, PM)
- Frequency division multiplexing (FDM)

III. Random Processes (3 lectures) - (Ch. 4)

- Random variables
- Random processes, stationarity, wide sense stationarity
- Random processes through linear filters
- Gaussian random processes, linear filtering of Gaussian random processes
- Frequency analysis, power spectral density
- Noise, narrow-band noise

IV. Analog to Digital Conversion (3 lectures) - (Ch. 6)

- Sampling, pulse amplitude modulation (PAM)
- Quantization, pulse code modulation (PCM)

V. Digital Modulation Schemes and Performance in the Presence of Noise (5 lectures) - (Ch. 7)

- Representation of digital signal waveforms
- Basic digital modulation schemes: (B)ASK, (B)PSK, (B)FSK
- Digital demodulation and the optimal receiver
- Performance of digital communication systems in the presence of noise

VI. Exams (2 lectures)

Exam dates:
Mid-term: Feb. 10, 2005, in class.
Final: Mar. 15, 2005, in class.