EE426/506 COMMUNICATION THEORY

Summer 2008

Instructor
John Stensby, EB 217I, Office Hours: Mon, Wed 1:00-2:00 PM, Fri 10-11 AM or by Appointment (stensby@ece.uah.edu)

Course Material
1. R. Ziemer, W. Tranter, *Principles of Communications*, Fifth Edition, John Wiley & Sons.
2. Information Presented During Class
3. Class Notes Available online at

http://www.ece.uah.edu/courses/ee426/

4. References #1 and #2 given below.

Course Outline
Material from Chapters 1 - 3 of the text will be covered in class. I will supplement this with material from other sources (see my class notes)

Prerequisites
To be successful in this course, you must have a good background in classical continuous-time signals and systems. More specifically, a good understanding of the material in EE382 should be sufficient.

Grading

Midterm	30%
Short Tests (about one a week)	30%
Homework	10%
Final	30%

1. Two types of homework assignments will be made. *Type-I* homework will be collected and selectively graded. *Type-II* homework will not be collected. Solutions to **all** homework assignments will be posted on the bulletin board outside of Room 217 of the Engineering Building.

2. The short tests will come from the homework and/or example problems worked in class (I will supply one problem and allow 10-15 minutes for its completion). Expect one every week. I will drop the lowest short-test grade (to compensate for absences).

3. The midterm and final will be closed book since they will be homework-based. That is, the majority of midterm/final problems will be **modified** homework problems, or they will come from problems that I worked in class.

References

1. H.P. Hsu, *Signals and Systems*, Schaum's Outline Series, McGraw Hill, 1995.
2. H.P. Hsu, *Analog and Digital communications*, Schaum's Outline Series, McGraw Hill, 1993.
3. F.G. Stremler, *Introduction to Communication Systems*, Third Edition.
4. B.P. Lathi, *Signals, Systems and Communication*. John Wiley & Sons, New York, 1965.
5. A. Papoulis, *The Fourier Integral and Its Applications*, McGraw-Hill, 1962.
6. S. Haykin, *Communication Systems*, Fourth Edition, John Wiley, New York

EE 426/506 - Communication Theory

Textbook: R. Ziemer, W. Tranter, *Principles of Communications, Fifth Edition,* John Wiley

References

[1] H.P. Hsu, *Signals and Systems*, Schaum's Outline Series, McGraw-Hill, 1995
[2] H.P. Hsu, *Analog and Digital Communications*, Schaum's Outline Series, McGraw-Hill, 1993

Goals

Teach the fundamentals of classical communication theory and systems. Relate these fundamentals to basic signal and system concepts that students have learned in other courses.

Prerequisites

EE382 (or equivalent) is the main prerequisite; the student must have a good understanding of elementary Fourier/Laplace analysis and classical linear system theory. In addition, he/she must know how to analyze simple first-and-second-order RLC circuits. The student must be well-versed in the integral/differential/functional techniques covered in calculus. The student must recall how to apply standard techniques to solve first-and-second-order linear differential equations with constant coefficients. Finally, the student should be able to use a computer to solve simple problems and print/plot output data (Matlab is the suggested environment).

Topics

1. Delta, unit step functions and other commonly-used signals
2. Power and energy signals
3. Generalized Fourier series
4. Parseval's theorem
5. Fourier transforms
6. Relationship of Fourier and Laplace transforms
7. Energy and power density spectrums
8. Convolution
9. Correlation
10. Systems and system attributes: linearity, time invariance, causality and BIBO stability
11. Ideal lowpass, bandpass and highpass filters
12. Butterworth n^{th}-order lowpass filters
13. Hilbert transforms
14. Analytic signals
15. Wiener Kinchine theorem
16. Cross correlation of a system's input and output
17. Relate the autocorrelation of a system's output to the autocorrelation of the system's input
18. General bandpass signal and system theory
19. The lowpass equivalent of a bandpass signal
20. Symmetric bandpass signals and filters
21. Carrier and phase delay of a bandpass filter/system
22. Double sideband modulation/demodulation
23. Amplitude modulation/demodulation
24. Single sideband modulation/demodulation
25. Frequency and phase modulation/demodulation
26. Transmission bandwidth of modulated signal
27. Carson's rule
28. Superheterodyne receiver architecture
29. Basic electronic oscillator applications/theory/circuits
29. Basic phase-locked loop applications/theory/circuits
30. Frequency feedback FM demodulator