

ECE 459

Fall 2000

Handout # 1

August 24, 2000

ECE 459: COMMUNICATIONS III

Course Web Site: <http://www.comm.csl.uiuc.edu/~vvv/ece459/>

Prerequisite: ECE 361 (or equivalent) **Corequisite:** ECE 434

Class Time and Place: Tuesdays, Thursdays, 1:30pm – 2:50pm in 57 Everitt

Instructor: Prof. Venu Veeravalli, 128 CSRL, Ph: 3-0144, e-mail: vvv@uiuc.edu

Office Hours: Thursdays 3-5 (other times by appointment – e-mail)

Description: This is a graduate-level course on the principles and practice underlying the design and performance analysis of modern digital communication systems. Topics include complex baseband representation of bandpass communication systems; digital modulation schemes; digital communication on ideal additive white Gaussian noise (AWGN) channels; digital communication on narrowband channels with intersymbol interference (ISI); spread spectrum communication with multiple-access interference; modeling, system design and performance analysis for time-varying mobile communications channels and multiantenna communication channels.

Course Text: You are not required to buy a text for this course. A summary of class notes will be available on the course web site after each class. For those of you who would like to buy a book on the subject, the following book is recommended:

J. G. Proakis, *Digital Communications*, 3rd Edition, McGraw-Hill, 1995

Syllabus:

- Motivation, Overview, Probability Review (1 lecture)
- Complex baseband representation for passband signals and noise(1.5 lectures)
- Signal space representation (0.5 lecture)
- Overview of digital modulation schemes (2 lectures)
- Coherent and noncoherent demodulation for memoryless digital signaling on ideal AWGN channels (4 lectures)
- Modulation with memory and demodulation on ideal AWGN channels (1 lecture)
- Signaling on ISI channels and equalization (4 lectures)
- Spread spectrum, Code Division Multiple Access (CDMA) systems (6 lectures)
- Wireless channels, multiantenna systems (6 lectures)

Additional Reading:

- ★ R. E. Blahut, *Digital Transmission of Information*, Addison-Wesley, 1990.
- ★ S. Haykin, *Adaptive Filter Theory, 3rd Ed.*, Prentice-Hall, 1996.
- ★ G. L. Stuber, *Principles of Mobile Communication*, Kluwer, 1996.
- ★ H. L. Van Trees, *Detection, Estimation, and Modulation Theory*, Wiley, 1971.
- ★ S. Verdu, *Multiuser Detection*, Cambridge University Press, 1998.
- ★ A. J. Vitberbi and J. K. Omura, *Principles of Digital Communication and Coding*, McGraw-Hill, 1979.
- ★ A. J. Viterbi, *CDMA: Principles of Spread Spectrum Communications*, Addison-Wesley, 1995

All of these books have been put on reserve in the Grainger Library. Further supplemental reading material may be put on reserve during the course of the semester.

Other useful information, including all of the course handouts, will be available on the course web site (<http://www.comm.csl.uiuc.edu/~vvv/ece459/>)

Exams and Grading:

Class participation	5%
Home-work	20%
Exam 1	20%
Exam 2	25%
Final Project	30%

Class participation will be evaluated based on attendance, questions that you ask in class, after class or via e-mail. Using the Q&A page on the web site is strongly encouraged.

Homework problems will be assigned roughly every 10 days. Late material will not be accepted unless prior arrangements are made with me at least 1 day in advance.

Exam 1 (1.5 hrs) will be held on October 12 in class, and Exam 2 (2 hrs) will be held during finals week.

The final project for the course will consist of an oral presentation and a short written report. Detailed guidelines for the project will be available on the web site soon.

Background and Prerequisites:

The prerequisite for this course is ECE 361 or an equivalent undergraduate course on digital communications. It is expected that students in this class have a good background in probability and stochastic processes, and matrix analysis. Those who have not had a graduate-level course on stochastic processes must take ECE 434 in parallel with ECE 459.