SYLLABUS

ECE 537 Digital Communication Systems II

Goals and Objectives

This is the second course in a two-course series covering the principles of digital transmission of information. ECE 537 extends the concepts learned in ECE 535, and introduces five new topics: transmission over band-limited and ISI channels, constrained coding, equalization, iterative decoding. We build analytical and simulation models for bandlimited systems in presence of noise, and define the performances of digital communication systems through a probability of reliable transmission of information.

Instructor: Dr. Bane Vasic, Professor
Grader: TBD
Course meets: MWF 1:00–1:50 p.m.
Office hours: MWF 2:00-3:00 p.m. (subject to change)
Textbook: *None required*

References:

- G. Proakis, *Digital Communications*, 4th Edition, McGraw-Hill, 2000.
- R. Blahut, *Digital Transmission of Information*, Addison-Wesley, 1990.
- E. Lee and D. Messerschmitt, *Digital Communications, 2nd ed.,* Kluwer-Academic, 1994.
- S. Lin and D. J. Costello, Jr., Error Control Coding: *Fundamentals and Application*, Prentice-Hall, 1989.
- D. A. Lind and B. Marcus , An Introduction to Symbolic Dynamics and Coding, Cambridge Univ Press, 1995.

Credits: ECE 537 is a three-unit course.

Administrative Details and Policies

Prerequisites: ECE 340 (Engineering Systems Analysis) (signal characterization in frequency domain, Fourier transform, discrete-time systems), ECE 529 (Digital Signal Processing), and ECE 503 (Random Processes for Engineering Applications).

Attendance: Optional, but recommended.

Punctuality: Entering the classroom after the instructor is strongly discouraged!

Participation: Students are encouraged to take part in general class discussions.

Student Questions: The instructor will not be able to answer questions submitted by e-mail or phone, nor to accept student visits out of the office hours.

Grading policy: Graded work will include computer projects. Homework problems if assigned will not be graded. The oral exams will be held during the last week of classes. Final grades will be determined by your total number of points compared to an absolute scale. The following weights will be used to determine your point total:

Projects:	50%
Final Exam:	20%
Final Oral Exam:	30%

Academic Integrity: All submitted work must be original. The minimum penalty for plagiarism and cheating on exams and quizzes is an E grade.

Important Dates

The final exam schedule can be found at:

http://www.registrar.arizona.edu/schedules/finals.htm

Exams may include material/topics not contained in the text, but which are discussed in class.

Course Outline

TOPICS

Fundamentals of Iterative Decoding
-Bayesian inference
-Factor graphs
-Message passing
-Belief propagation

Band-Limited Channels
-Characterization of band-limited channels
-Signal design for band-limited channels
-Nyquist criteria
-Modulation codes for spectrum shaping

Partial Response Channels
-Controlled ISI
-Partial response equaliation
-Data detection for controlled ISI channels
-Optimum maximum-likelihood receiver

Constrained (Modulation) Coding
-Symbolic dynamics basics
-Shannon noiseless capacity
-Sofic shifts of finite type
-Sliding window decoders
-State-splitting algorithm

Iterative Receivers for ISI Channels
-Iterative decoding principles
-Combined equalization and coding
-BCJR algorithm
-Message-passing algorithm