

## ECE 5660 Spread Spectrum Communications Spring 2008

**Course:** CRN 16577 TR 3:30 – 4:45 RAND 316

**Instructor:** Dr. R. Michael Buehrer 433 Durham Hall 231-1898

**Office Hours:** Tuesday 10-12; Thursday 1-2

**Textbooks:** R.M. Buehrer, Spread Spectrum Communications, unpublished manuscript. Will be made available for download. R.M. Buehrer, CDMA (Code Division Multiple Access), softcopies are available for free download at <http://dx.doi.org/10.2200/S00017ED1V01Y200508COM002> or <http://www.morganclaypool.com/doi/abs/10.2200/S00017ED1V01Y200508COM002>. Hardcopies are available for purchase for \$40 at <http://www.morganclaypool.com/> or amazon.com.

**Useful references:** Ziemer, Peterson, and Borth, Introduction to Spread Spectrum Communications A.J. Viterbi, CDMA: Principles of Spread Spectrum Communication; S. Verdu, Multiuser Detection;

**Prerequisites:** ECE 4634, ECE 5605 (ECE 5654 pre/co-requisite recommended)

**Website:** [http://www.mprg.org/people/buehrer/5660/ece\\_5660.htm](http://www.mprg.org/people/buehrer/5660/ece_5660.htm)

**Grading:**

Mini-projects (3)	75%
Research Project	25%

**Course Objectives:** To develop a fundamental understanding of spread spectrum communication systems. Of primary importance is an understanding of the ability of spread spectrum to combat jamming, combat fading and prevent intercept. We will also examine the use of these properties in the context of commercial systems as applied to Code Division Multiple Access or CDMA.

**Research Project:** The course will include a semester long group research project. Groups of 1-3 students will undertake a research project focusing on the application of spread spectrum principles in emerging systems (e.g., WiMax, LTE). A project proposal will be required early in the semester. An oral presentation and written report will be required later in the semester. Additional information on the projects will be made available as the semester progresses.

**Mini-projects:** In lieu of mid-term exams and homework, there will be a series of three mini-projects. These projects will typically be simulation-based and will require you to implement key concepts of spread spectrum systems in Matlab, verifying main results from the course. The mini-projects are your own work and are *not group projects*. If you have questions, please see me rather than discussing with your classmates.

**Honor Code:** All work submitted for mini-projects and exams must be your own work. You should sign the honor pledge on the exam: "I have neither given nor received unauthorized assistance on this assignment." You may not confer with your colleagues on the project problems, rather please see me. All external research of the design projects should be documented through citation of references in a manner consistent with academic standards.

**Accommodations:** Any student who feels that he or she may need an accommodation because of a disability (learning disability, attention deficit disorder, psychological, physical, etc.) please feel free to see me during office hours. Specific accommodation requests are handled by the Dean's Office.

**Late Assignments:** All assignments are due by the end of class on the due date. If you will be out of town, you must make arrangements to get me the assignment before the due date. *Late assignments will not be accepted!*

## ECE 5660 – Spread Spectrum Communications Spring 2008 Syllabus\*

<u>Week</u>	<u>Date</u>	<u>Lecture Topics</u>	<u>Book Chapter(s)</u>
1	1/14	Introduction to Course Review of Digital Communications Intro to Spread Spectrum	Spread Spectrum Ch. 1 Spread Spectrum Ch. 2
2	1/21	Intro to Direct Sequence Spread Spectrum Intro to Frequency Hopped Spread Spectrum	Spread Spectrum Ch. 3 Spread Spectrum Ch. 4
3	1/28	Pesudo-random sequences Spreading Codes <i>Mini Project 1 Assigned</i> <i>Research Project Proposal due</i>	Spread Spectrum Ch. 5
4	2/4	Acquisition	Spread Spectrum Ch. 6
5	2/11	Tracking <i>Mini Project 1 Due</i>	Spread Spectrum Ch. 7
6	2/18	Performance of Spread Spectrum – DS in AWGN and Rayleigh Fading Rake Receiver	Spread Spectrum Ch. 8
7	2/25	Performance of DS with Error Correction Coding Performance of Spread Spectrum – FH <i>Mini Project 2 Assigned</i>	Spread Spectrum Ch. 8 Spread Spectrum Ch. 9
8	3/10	CDMA	Spread Spectrum Ch. 10 Spread Spectrum Ch. 11 CDMA Chapter 1 CDMA Chapter 3
9	3/17	CDMA <i>Mini Project 2 Due</i>	Spread Spectrum Ch. 10 Spread Spectrum Ch. 11 CDMA Chapter 3
10	3/24	CDMA <i>Mini Project 3 Assigned</i>	Spread Spectrum Ch. 11 Spread Spectrum Ch. 14 CDMA Chapter 3 CDMA Chapter 4
11	3/31	Interference Rejection – Single User techniques <b>ORAL PROJECT PRESENTATIONS 4/12</b>	Spread Spectrum Ch. 13
12	4/7	Interference Rejection - Multi-user detection	Spread Spectrum Ch. 12 CDMA Chapter 5
13	4/14	Multiuser Detection Other wideband techniques – OFDM	Spread Spectrum Ch. 12 CDMA Chapter 5
14	4/21	Other wideband techniques – UWB Applications – IS-95	
15	4/28	4/22 – Written Project Reports Due 4/30 - <i>Mini Project 3 Due</i>	

\*Note: Please review this schedule immediately. If you have conflicts due to religious observances or other immovable, important events, please see me before the end of the second week of class. After that time, I will not consider making special arrangements except in the case of an emergency.