

# EE 520

## Spread spectrum

### CSU Fullerton, fall 2008 (audit course)

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## 1 class description

*Tuesday 8/26/2008*

CALIFORNIA STATE UNIVERSITY, FULLERTON  
ELECTRICAL ENGINEERING DEPARTMENT

EG-EE 522 Spread Spectrum Communication

Prerequisites: EG-EE 443 and 580. Introduction Spread Spectrum (SS) Systems. Performance analysis of coherent digital signaling schemes. Synchronization, direct sequence, frequency hopping, time hopping, and Hybrid Spread Spectrum Modulations. Binary shift register sequences. Code tracking loops. Performance of SS systems in a jamming environment, with forward error correction.

*Class Notes from Bookstore*

Text: Modern Communications and Spread Spectrum by George R. Cooper and Clare D. McGillen, McGraw Hill Book Company, 1986.

References:

- 1) Digital Communication and Spread Spectrum Systems by Rodger E. Ziemer and Roger L. Peterson, Macmillan Publishing Company, 1996
- 2) Spread Spectrum Communication by M. K. Simon, J. K. Omure, R. A. Scholtz and B. K. Levitt, Volume I, II and III, Computer Science Press, 1985.
- 3) Coherent Spread Spectrum Systems by J. K. Holmes, J. Wiley & Sons, Inc., 1982.
- 4) Spread Spectrum Systems, R. C. Dixon, J. Wiley & Sons. Inc., 1984.

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#### TENTATIVE COURSE OUTLINE

Chapters: 4, 6 + class notes.

Assign: Sections: 4.1, 6.1 - 6.7

Topics: Introduction, review of digital modulations, match filter detection of binary signals at baseband, signal space concepts, M-ary orthogonal signals, coherent detection of M-ary signals, correlation receiver, detection of nonorthogonal M-ary signals, noncoherent Detection of M-ary signals.

Chapter: Handout + class notes  
Topics: Digital modulation, Phase Shift Keying(PSK), Frequency Shift Keying (FSK), Amplitude Shift Keying( ASK). Multilevel signaling. Synchronization of digital communication systems.

EXAM #1 (75 mins.)

Chapter: 8  
Assgn: Sections 8.1 - 8.8 *and chapter 2 from first reference*  
Topics: Fundamentals of Spread Spectrum, Direct Sequence (DS), Frequency Hopping (FH), Time Hopping (TH) and Hybrid Spread Spectrum Systems. Chirp Spread Spectrum. FDMA, TDMA and CDMA .  
Chapters: 9, 11 + handouts  
Assign: Sections 9.1 - 9.13  
Topics: Properties of PN sequences, maximum-length linear shift register sequences (m sequences), properties of m sequences, PN signals from PN codes, despreading the PN signals, interference rejection and antijamming characteristics of direct sequence spread spectrum. Generation of Spread Spectrum Signals. Optimum tracking of wideband signals, baseband full-time early-late tracking loop, full-time early-late noncoherent tracking loop.

EXAM #2 (75 mins.)

Chapter:  $\rightarrow$  12 + handouts  
Assign: Sections 12.1 - 12.13  
Topics: Detection of Spread Spectrum Signals, Tau-Dither early late noncoherent tracking loop, acquisition with match filters.  
Chapter: 13 + handouts  
Assign: Sections 13.1 - 13.9 + handouts  
Topics: Application of SS to Communications . CDMA considerations: Number of active users with equal and with unequal power. Energy and Bandwidth Efficiency in Multiple Access.

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## FINAL EXAM

### GRADING POLICY

- 1) Grades will be assigned based on the class curve.
- 2) A performance around the average class performance will earn a B; a performance superior to the class mean will earn an A. A performance inferior to the class mean will earn a C and a very inferior performance; a D or an F.

Homework (incl. computer work) 12%

Two Mid-terms exams 53%

Final Exams 35%

Exams cannot be missed.

Homework must be turned in on time on clean format.