ECE 7712 — Digital Communications
Spring, 2017

Outline:

The course will study the fundamental aspects of digital transmission, as applied to radio, optical, satellite, and wireline transmission media. Specific topics include channel models, digital modulation and detection, power spectrum, error performance versus SNR, error control coding (both block and trellis methods), equalization, and synchronization. The course deals with 'physical layer' aspects of telecommunications, and is not a course that covers networking or multiple access in significant detail.

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Text: *Digital Modulation and Coding*, S.G. Wilson, Pearson/Prentice-Hall

Auxiliary Texts: (good resources, on reserve)

Digital Communications, Proakis

Digital Communications, Lee and Messerschmitt

Introduction to Digital Communications, Pursley

Suggested Background:

Fluency in probability and exposure to random processes; prior background in graduate level communication theory, e.g. ECE 6713, is helpful but not essential.

Syllabus: (approximate number of class meetings in parentheses

1. Overview and framework for digital communication study (1/2)
2. Statistical decision theory, ML detection (1 1/2)
3. Channel models (AWGN, Rayleigh fading) (1/2)
4. Signal sets and signal spaces (PSK, QAM, orthogonal, biorthogonal, etc.) (2 1/2)
5. Optimal receivers and performance analysis for coherent, noncoherent and differential detection (5)
6. Power spectrum issues and engineering tradeoffs for uncoded transmission (2)
7. Block coding (linear codes, cyclic codes, including BCH and Reed-Solomon cases, intro to LDPC codes) (5)
8. Trellis coding, including convolutional coding, Viterbi decoding, trellis-coded modulation, turbo coding (6)
9. Dispersive channels and equalization (2)
10. Receiver synchronization (time permitting) (2)

Assessment: midterm exam (25%), final exam (30%) seven homework sets (45%). exams are take-home