

# *ECE 712 -- Digital Communications*

*Spring, 2005*

## **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 analysis versus SNR, error control coding (both block and trellis coding), equalization, and synchronization. The course deals with "physical layer" issues, and is not a course which covers networking or multiple access in significant detail.

**Instructor:** Prof. Stephen Wilson, Professor of Electrical Engineering, Univ. of Virginia, 804-924-6091 (direct), e-address: [sgw@virginia.edu](mailto:sgw@virginia.edu)

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

Lecture notes will be available also through Newcomb Hall Bookstore (?)

## **Auxiliary Texts: (neither required but good resource if available)**

*Digital Communication*, Proakis

*Digital Communication*, Lee and Messerschmitt

## **Suggested Background:**

Fluency in probability and random processes; prior background in a graduate communication theory course, e.g. ECE 613 or equivalent, is useful but not essential.

## **Syllabus:** (approximate number of classes in parentheses)

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

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