Carleton University
Department of Systems and Computer Engineering
SYSC 5504 (ELG 6154) Principles of Digital Communication Winter 2011/12

Course Handout

Instructor:

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This is an introductory graduate course to digital communication theory. It is designed to introduce graduate students to the fundamental concepts in digital signalling over the additive white Gaussian noise (AWGN) channel. Channel models other than the AWGN channel are treated in the follow-up course SYSC 5605 (ELG 6165) Advanced Digital Communications.

This course is offered as ELG 6154 by the University of Ottawa, which is our partner in the joint graduate program within the Ottawa Carleton Institute of Electrical and Computer Engineering (OCIECE).

Prerequisites and Co-requisites:

- A graduate course on stochastic processes, SYSC 5503 or equivalent (can be taken concurrently).

Text:

- John G. Proakis, *Digital Communications*, 5th edition, McGraw-Hill, 2008.

Additional References:

- B. Sklar, *Digital Communications: Fundamentals and Applications*, 2nd edition, Prentice-Hall, 2001.
- S. Lin and D. Costello, Jr., *Error Control Coding*, 2nd edition, Prentice-Hall, 2004.
- I. A. Glover and P. M. Grant, *Digital Communications*, Prentice-Hall, 1998.
- J. M. Wozencraft and I. M. Jacobs, *Principles of Communication Engineering*, John Wiley & Sons, 1965.

Web Site:

- http://www.sce.carleton.ca/courses/sysc-5504/f11

Marking Scheme:

- 20% Assignments
- 20% Term Project
- 60% Final Examination

Course Outline:

- **Introduction:** Elements of digital communication systems. Review of signals and systems. Review of basic concepts in probability theory. Digital signals and their spectral characteristics.
- **Channel Models:** Binary Symmetric Channel, AWGN, ISI, Multipath Fading.
- **Signal Design:** Binary bandpass signalling (PSK, ASK, FSK). M-ary signalling (M-PSK, QAM). Signal space concepts.
- **Optimal Receivers:** Principles of optimal reception. The matched filter receiver. The MAP and ML receivers for the AWGN channel. Carrier and Symbol Synchronization. Error performance.
- **Channel Capacity:** Channel models and channel capacity. Shannon limit.
- **Error Detection and Correction:** Block and convolutional codes. Viterbi and MAP algorithms. Trellis-Coded Modulation.