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## ELEC 512 – Digital Communications

Term – Summer 2017 (201705)

### Instructor

Dr. Xiaodai Dong  
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### Office Hours

Days: Thursdays or by appointments  
Time: 1pm-2pm  
Location: EOW-439

### Course Objectives

- The objectives of the course are to introduce the fundamental theories of digital communications and the components of digital communication systems.

### Learning Outcomes

- a) Understand the basic concepts of energy signals and power signals, autocorrelation function, power spectral density of random signals
- b) Convert an analog source to digital signals by sampling and quantization, analyze quantization error, and compare uniform and non-uniform quantization
- c) Understand pulse coded modulation and other baseband transmission schemes, understand the different properties of these modulation schemes
- d) Grasp the basic idea of signal space and the concepts of signal distance, orthogonality, energy, and perform Gram-Schmidt orthogonalization on a set of signals
- e) Know how to characterize the additive white Gaussian noise channel
- f) Have full knowledge of basic digital modulation schemes such as ASK, PSK, QAM and FSK
- g) Understand the whole transmitter chain including pulse shaping
- h) Design optimum receivers based on matched filtering and optimum decision rules
- i) Analyze the performance of various digital modulation schemes
- j) Know the operating principle of differential encoding/detection and non-coherent receivers
- k) Design pulse shapes to avoid intersymbol interference in a bandlimited channel
- l) Have basic idea of channel equalizer

### Syllabus

- a) Introduction, signals and spectra review, probability review
- b) Formatting and baseband transmission
- c) Bandpass modulation and signal space
- d) Optimum receivers in additive white Gaussian noise channels
- e) Differential encoding/detection and non-coherent receivers
- f) Channel equalization

A-Section(s): A01 / CRN 30364, 30365  
Days: Mondays and Thursdays  
Time: 11:30am-12:50pm  
Location: ECS-108

|     |     |             |              |
|-----|-----|-------------|--------------|
| B01 | Tue | 14:00-17:00 | week: May 29 |
| B02 | Tue | 14:00-17:00 | week: June 5 |
| B03 | Fri | 14:00-17:00 | week: May 29 |

### Required Text

Title: Digital Communications Fundamentals and Applications  
Author: B. Sklar  
Publisher: Prentice Hall  
Year: 2<sup>nd</sup> edition, 2001

### References:

### Assessment:

|              |     |                                 |
|--------------|-----|---------------------------------|
| Assignments: | 10% |                                 |
| Labs         | 15% |                                 |
| Mid-term 1   | 25% | Date: June 15, 2017 (tentative) |
| Mid-term 2   | 30% | Date: July 20, 2017 (tentative) |
| Project      | 20% | Date: Aug. 6, 2017 (tentative)  |

### Note:

Failure to complete all laboratory requirements will result in a grade of N being awarded for the course.

The final grade obtained from the above marking scheme for the purpose of GPA calculation will be based on the percentage-to-grade point conversion table as listed in the current Undergraduate Calendar.

**Note to students:** Students who have issues with the conduct of the course should discuss them with the instructor first. If these discussions do not resolve the issue, then students should feel free to contact the Chair of the Department by email or the Chair's Secretary to set up an appointment.

**Accommodation of Religious Observance:** <http://web.uvic.ca/calendar2017-05/general/policies.html>

**Policy on Inclusivity and Diversity:** <http://web.uvic.ca/calendar2017-05/general/policies.html>

**Standards of Professional Behaviour:** You are advised to read the Faculty of Engineering document Standards for Professional Behaviour, which contains important information regarding conduct in courses, labs, and in the general use of facilities.

<https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf>

Cheating, plagiarism and other forms of academic fraud are taken very seriously by both the University and the Department. You should consult the entry in the current Undergraduate Calendar for the UVic policy on academic integrity.

<http://web.uvic.ca/calendar2017-05/grad/academic-regulations/academic-integrity.html#>

**Equality:** This course aims to provide equal opportunities and access for all students to enjoy the benefits and privileges of the class and its curriculum and to meet the syllabus requirements. Reasonable and appropriate accommodation will be made available to students with documented disabilities (physical, mental, learning) in order to give them the opportunity to successfully meet the essential requirements of the course. The accommodation will not alter academic standards or learning

outcomes, although the student may be allowed to demonstrate knowledge and skills in a different way. It is not necessary for you to reveal your disability and/or confidential medical information to the course instructor. If you believe that you may require accommodation, the course instructor can provide you with information about confidential resources on campus that can assist you in arranging for appropriate accommodation. Alternatively, you may want to contact the Resource Centre for Students with a Disability located in the Campus Services Building.

The University of Victoria is committed to promoting, providing, and protecting a positive, and supportive and safe learning and working environment for all its members.

**Course Lecture Notes:** Unless otherwise noted, all course materials supplied to students in this course have been prepared by the instructor and are intended for use in this course only. These materials are NOT to be re-circulated digitally, whether by email or by uploading or copying to websites, or to others not enrolled in this course. Violation of this policy may in some cases constitute a breach of academic integrity as defined in the UVic Calendar.