Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 4604
Digital Communication Theory

Calendar description

Introduction to information theory, source coding and data compression, Error control coding, Trellis coded modulation, advanced topics of current interest: spread spectrum; digital wireless communications.

Includes: Experiential Learning Activity.

Lectures three hours a week, laboratory three hours alternate weeks.

http://calendar.carleton.ca/undergrad/courses/SYSC/

Prerequisites

SYSC 3503.

Precludes additional credit for SYSC 4600.

Prior knowledge

Students should have knowledge of:

- Probability theory and the fundamentals of Communication Theory.

Course objectives

This course provides an introduction to information theory, source coding and data compression. It also covers the fundamentals of error control coding mainly focused on linear block codes and convolutional codes. Advanced topics of current interest such as the state of the art for channel coding and spread spectrum will be studied.

List of topics

- Fundamental principles of digital communications and information theory.
- Source coding.
- Introduction to error control coding; block codes, syndrome decoding, Hamming distance, error detecting and correcting capabilities of block codes, cyclic codes, examples of linear block codes, CRC, ARQ.
- Block codes.
- Convolutional codes, distance properties, systematic and nonsystematic codes, decoding of convolutional codes, Viterbi algorithm.
- Convolutional codes.
- Polar codes.

- Spread-spectrum and CDMA (code-division multiple access).
- Spread-spectrum and CDMA.
- Fading channels and digital wireless communications.
- Fading channels and digital wireless communications.

Learning outcomes

By the end of this course, students should be able to:

- Understand the concept of information, entropy, Shanon limit.
- Be able to find the capacity of variety of discrete channels and the AWGN channel.
- Know the fundamental principle of source coding and particularly design Huffman coding.
- Know block codes, linear block codes, standard array decoding, syndrome decoding.
- Convolution codes, their encoding and Viterbi algorithm.
- The fundamental of Polar codes and design the basic forms of them.
- The basics of spread spectrum and CDMA.

Graduate Attributes (GAs)

The Canadian Engineering Accreditation Board requires graduates of engineering programs to possess 12 attributes at the time of graduation. Activities related to the learning outcomes listed above are measured throughout the course and are part of the department's continual improvement process. Graduate attribute measurements will not be taken into consideration in determining a student's grade in the course. For more information, please visit: https://engineerscanada.ca/.

Graduate Attribute	Learning outcome(s)
2.3: Problem Analysis: Applied: Use of assumptions	1, 2, 7
2.4: Problem Analysis: Applied: Interpreting the solution – validity of results	1, 2, 4, 5
3.2: Investigation: Applied: Design of experiment	3, 5, 6, 7
3.3: Investigation: Applied: Experimental procedure	1, 2, 4, 5
4.7: Design: Applied: Evaluation based on engineering principles	3, 5, 6, 7

Accreditation Units (AUs)

For more information about Accreditation Units, please visit: https://engineerscanada.ca/.

The course has a total of 46 AUs, divided into:

- Engineering Science: 75%
- Engineering Design: 25%

Instructor and TA contact

Specific to course offering (tbd)

Textbook (or other resources)

Specific to course offering (tbd)

Evaluation and grading scheme

Specific to course offering (tbd)

Breakdown of course requirements

Specific to course offering (tbd)

Tentative week-by-week breakdown

Specific to course offering (tbd)

General regulations

Specific to course offering (tbd)