Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 2310
Introduction to Digital Systems

Calendar description

Number systems: binary, decimal, hexadecimal. Digital representation of information. Computer arithmetic: integer, floating point, fixed point. Boolean logic, realization as basic digital circuits. Applications: simple memory circuits, synchronous sequential circuits for computer systems. Finite state machines, state graphs, counters, adders. Asynchronous sequential circuits. Races.

Includes: Experiential Learning Activity.

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

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

Prerequisites

(ECOR 1051 and ECOR 1052 and ECOR 1053 and ECOR 1054) or ECOR 1606 or SYSC 1005, and enrolment in Computer Systems Engineering, Communications Engineering, or Software engineering, and second-year status in Engineering.

Precludes additional credit for ELEC 2607.

Prior knowledge

Students should:

- Have a basic understanding of the ordinary mathematical system and algebra.

Course objectives

The objective of this course is to provide knowledge on fundamentals of digital systems. In the design and implementation of digital systems, all information is encoded, processed and communicated as binary values (i.e. using 0's and 1's). These systems are built from simple digital logic gates that manipulate binary values. Digital memory circuits are used to store binary values over time. Digital systems frequently utilize finite state machines to control the manipulation of information as a sequence of steps. A clock is often used to control the pace of data processing and communication. Although a clock provides a well-defined reference for sequencing steps, circuits can sometimes be designed to operate asynchronously (i.e., without a clock) to speed up processing.

List of topics

- Information representation

- Digital systems and binary numbers
- Basic logic gates
- Boolean algebra
- Gate-level minimization
- Combinational logic
- Combinational logic (cont.)
- Sequential circuits: Latches and flip-flops
- Synchronous sequential circuits: Counters, Registers, Memory
- Synchronous sequential circuits: Finite state machines. Multiplication and division
- Asynchronous circuits

Learning outcomes

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

- Define concepts of digital representation of information.
- Ability to work effectively with a variety of number systems and numeric representations, including signed and unsigned binary, hexadecimal, two's complement, fixed point, and floating point.
- Understand the basic building blocks of digital systems.
- Understand Boolean Algebra and formulate, analyze and simplify Boolean functions.
- Apply analysis skills to correctly describe the behavior of given combinational and sequential digital logic circuits.
- Able to design, implement and analyze combinational logic with digital gates and sequential circuits with flip-flops.
- Capable of designing and implementing simple finite state machines.

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)
1.7.S: Knowledge Base: Introduced: Electronics and circuits	1-7
2.1: Problem Analysis: Developed: Problem definition	2-7
4.6: Design: Introduced: Alternate solution(s) definition	4-7
4.7: Design: Developed: Evaluation based on engineering principles	4-7
5.1: Use of Engineering Tools: Introduced: Diagrams and engineering sketches	5-7

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: 50%
- Engineering Design: 50%

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)