Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 3320
Computer Systems Design

Calendar description

System on Chip (SoC)-based computer system design. SoC internal organization. Cache memory. Interfacing: external memory, hardware subsystems. Direct memory access. Floating point units. Introduction to field programmable gate arrays.

Includes: Experiential Learning Activity.

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

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

Prerequisites

SYSC 3310 and third year status in Computer Systems Engineering, or permission of the Department.

Precludes additional credit for SYSC 3601 and ELEC 4601.

Prior knowledge

Students should have a basic understanding of:

- Computer system organization
- Binary numbers systems
- Digital logic

Course objectives

The course aims at developing solid understanding of modern computing systems design approaches and demonstrating how programmable logic and processor systems are mixed together on a single chip to design optimized computer systems. The course also aims at equipping students with the necessary hands-on experience to design and implement hybrid SoC-based computer systems.

List of topics

- Digital Systems
- Computer System Architecture
- Digital Systems Design Approaches
- Programmable Logic, FPGA (Field Programmable Gate Arrays)
- VHDL (VHSIC Hardware Description Language)

- Hybrid SoC Design Approach
- ARM Internal Architecture
- ARM Assembly
- Pipelining and Superscalar Design
- Input-Output and Interfacing (Interconnect, Interrupts, and Direct Memory Access)
- Memory Organization-Technologies, Main Memory Addressing, and Cache Memory Access
- Arithmetic Operations (Fixed-point and Floating-Point Arithmetic)
- Digital Signal Processors (DSPs)

Learning outcomes

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

- Computer system design levels such as logic-gate, register-transfer-logic, assembly and high-level programming.
- Modern SoC-based computer systems compared to conventional Modules-on-Board (MoB) systems.
- ARM architectures and ARM Assembly.
- Applications of SoC computer systems in new emerging applications such as Internet-of-things and wearables.
- Major factors that controls computer systems design such as high-performance, low-power, and low-cost.
- Flexibility to design single components of computer systems differently to balance performance versus costs.

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)
1.5.S: Knowledge Base: Developed: Computer systems	1-6
3.1: Investigation: Developed: Complex problem assessment	7, 12
4.1: Design: Developed: Clear design goals	7-12
4.2: Design: Developed: Detailed design specifications and requirements	7-12
4.6: Design: Developed: Alternate solution(s) definition	7-12
4.7: Design: Developed: Evaluation based on engineering principles	7-12

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)