Carleton UNIVERSITY | Department of Systems and Computer Engineering

SYSC 4310
Computer Systems Architecture

Calendar description

Evolution of computer systems architecture to improve performance. Memory hierarchy, hardware accelerators. Instruction level parallelism, pipelining, vector processing, superscalar, out-of-order execution, speculative execution. Thread level parallelism, multi-core, many-core, heterogeneous systems. Processor-level interconnect bus, non-uniform memory access. Application-oriented architectures. Virtualization.

Includes: Experiential Learning Activity.

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

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

Prerequisites

SYSC 3320, and enrolment in Computer Systems Engineering.

Precludes additional credit for SYSC 4507.

Prior knowledge

Students should have:

- Knowledge and experience in the C programming language.
- Basic knowledge of computer architecture.
- Knowledge of hardware Description Languages (Verilog HDL).

Course objectives

- Understand advanced computer architecture and performance-driven microarchitectural features.
- Recognize the requirements placed on the memory hierarchy by modern computer architectures.
- Understand the need for and challenges associated with the growing heterogeneity in computer architecture solutions.

In order to meet these objectives, lectures throughout this course will describe the concepts of computer architecture, showing the evolution towards modern multi-core processors. Laboratory work will provide meaningful practical assignments that exercise these concepts.

List of topics

- Memory hierarchy and Virtual memory
- OS hardware support and pipelined processors
- Superscalar processors
- Out of order execution
- Multithreaded processors
- Multicore processors
- Heterogeneous multicore
- Accelerators and High Level Synthesis
- NUMA for parallel computing

Learning outcomes

By the end of this course, students should have:

- Proficiency ILP and TLP concepts.
- A comprehensive understanding of different processor micro-architectures.
- Ability to design subsets of modern processor systems.
- Experience in modeling performance of computer systems.

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)
3.1: Investigation: Developed: Complex problem assessment	
3.2: Investigation: Developed: Design of experiment	
3.3: Investigation: Developed: Experimental procedure	
3.4: Investigation: Developed: Data reduction methods and results	
5.3: Use of Engineering Tools: Developed: Tools for design, experimentation simulation, visualization, and analysis	
5.5: Use of Engineering Tools: Introduced: Limitations of such tools and the assumptions inherent in their use	

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)