

ECE 722
Advanced Computer Architecture

COURSE OUTLINE

Please refer to course website for updated information.

CALENDAR DESCRIPTION

Understand advanced design approaches and techniques of computer architecture existing in modern computing systems.

SCHEDULE And MODE OF DELIVERY

The material for this course will be delivered through a mixture of lectures, textbook/paper readings, and assignments.

Lecture: Thursdays 5:00 p.m.- 7:30 p.m.

INSTRUCTOR

Dr. M. Hassan
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Office Hours: by appointment

COURSE WEBSITE/S

<http://avenue.mcmaster.ca>

COURSE OBJECTIVES

This course focuses on advanced concepts of computer architecture. By the end of this course, students should be able to:

- Understand the computer architecture of modern computing systems such as multi-cores and systems-on-chip
- Understand and analyze the trade-offs when designing architectures for modern computing systems
- Understand modern memory hierarchies

- Understand the interaction between computer architecture and the rest of the system including compilers, applications, and operating systems.

ASSUMED KNOWLEDGE

- Sufficient knowledge about basics of computer architecture is a must.
- Knowledge of C/C++ programming. This is necessary for assignments

COURSE MATERIALS

Textbooks:

This is a recommended textbook:

Computer Architecture: A Quantitative Approach, Sixth Edition by Hennessy and Patterson

COURSE OVERVIEW

Week	Topic
1	Introduction, birds eye view, and logistics
2	Microarchitecture of processors and pipeline architectures including Out-of-Order
3	Superscalar processors, and VLIW
4	Multi-threading, and Multi-cores
5	Interconnect
6	Cache Hierarchy 1: cache policies
7	Cache Hierarchy 2: Coherence and Memory Consistency Models
8	Prefetchers
9	Modern Main Memory: DRAM
10	Virtual Memory and its interaction to the Operating System
11	Modern Main Memory: Emerging technologies
12	Recent Advances and directions

A more detailed timeline is available on the course web site.

At certain points in the course it may make good sense to modify the schedule. The instructor may modify elements of the course and will notify students accordingly (in class, on the course website).

ASSIGNMENTS OVERVIEW

The course heavily adopts an interactive methodology, where students do their readings, share their findings with colleagues, discuss it, present it, and evaluate it. Therefore, assignments include reading research papers and present it, write a research paper, and review and evaluate their peers. This gives a total of 3-4 presentations (based on total number of students), writing a scientific IEEE-formatted paper that summarizes a project they do, as well as peer-reviews. Exact timelines will be discussed with students in the first lecture. There is no final exam.

ASSESSMENT

Component	Weight	Due Date
Peer-Review Assignments	20%	
Presentations	40%	
Project	40%	
Total	100 %	

Late submissions of assignments or project report are subject to 20% penalty per day (less than one day is counted as one day). This grade distribution is also tentative and any change will be discussed with the students during lectures.

CONDUCT EXPECTATIONS

As a McMaster graduate student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and

copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

ACADEMIC ACCOMMODATIONS OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact [Student Accessibility Services \(SAS\)](#) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

RESEARCH ETHICS

The two principles underlying integrity in research in a university setting are these: a researcher must be honest in proposing, seeking support for, conducting, and reporting research; a researcher must respect the rights of others in these activities. Any departure from these principles will diminish the integrity of the research enterprise. This policy applies to all those conducting research at or under the aegis of McMaster University. It is incumbent upon all members of the university community to practice and to promote ethical behaviour. To see the Policy on Research Ethics at McMaster University, please go to <http://www.mcmaster.ca/policy/faculty/Conduct/ResearchEthicsPolicy.pdf>.

www.eng.mcmaster.ca/ece