COMP ENG 3DR4
Computer Organization
Fall/Winter 2016/17
Course Outline

CALENDAR/COURSE DESCRIPTION

Instruction set design, computer arithmetic, assembly language, controller and datapath design, cache and memory systems, input-output systems, networks interrupts and exceptions, pipelining, performance and cost analysis, computer architecture history and a survey of advanced architectures

PRE-REQUISITES AND ANTI-REQUISITES

Prerequisite(s): Registration in any Computer Engineering or Electrical Engineering Program, COMPENG 3DQ4 or COMPENG 3DQ5
Antirequisite(s): COMPSCI2CA3, SFWRENG3GA3

SCHEDULE

Lectures: Mondays & Wednesdays 8:30 am – 9:20 am, and Fridays 10:30 am – 11:20 am in T13-102
Tutorials: Mondays 10:30-11:20 in ETB 238
Labs: L01 Tuesday 2:30 pm - 5:20 pm in ITB-155

INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION

Dr. Shahram Shirani
ITB-A225
shirani@mcmaster.ca
ext. 27943

Office Hours:

Wednesdays and Fridays 2:30pm-3:30pm
Or by appointment

TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

Hamed Hassani Saadi
ITB-A103
hassanih@mcmaster.ca
ext. 26112

Hamireza Fazlali
ITB-A103
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Office Hours:

Monday to Friday:
14:30pm-17:30pm

COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn http://avenue.mcmaster.ca

COURSE OBJECTIVES

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

- List different classes of computers
- List the major components of a computer.
- Define several computer performance metrics.
- Select the most appropriate performance metric when evaluating a computer.
- Explain the relationship between the representation of machine instructions at the binary level and their representation by a symbolic assembler.
- Explain why a designer adopted a set of instruction formats, such as the number of fields per instruction.
- Explain how positive, negative and fractional numerical values are represented in digital computers
- Explain the limitations of computer arithmetic and the effects of errors on calculations.
- Appreciate the effect of a processor's arithmetic unit on its overall performance.
- Explain how an instruction is fetched from memory and executed.
- Compare alternative implementation of datapaths.
- Discuss the generation of control signals using hardwired or microprogrammed implementations.
- Explain basic instruction level parallelism using pipelining and the major hazards that may occur.
- Explain what has been done to overcome the effect of branches in pipelining.
- Discuss the way in which instruction sets have evolved to improve performance; for example, predicted execution.
- Identify the main types of memory technology.
- Explain the effect of memory latency and bandwidth on performance.
- Explain the use of memory hierarchy to reduce the effective memory latency.
- List different cache structures.
- Appreciate how errors in memory systems arise and what can be done about them.

ASSUMED KNOWLEDGE

Digital logic, basic logic modules (adders, multiplexers, registers, etc), digital systems design.

COURSE MATERIALS

Required Texts: "Computer Organization and Design, ARM Edition", by Patterson and Hennessy, Morgan Kaufman, 2017, ISBN 978-0-12-801733-3**.**

COURSE OVERVIEW

Date/Week	Topic	Readings
Week 1	Computer abstractions and technologies.	
Week 2	Computer abstractions and technologies	
Week 3	ARM assembly language	

Week 4	ARM assembly language
Week 5	ARM assembly language
Week 6	Computer arithmetic
Week 7	Computer arithmetic
Week 8	Processor and pipelining
Week 9	Processor and pipelining
Week 10	Processor and pipelining
Week 11	Processor and pipelining
Week 12	Memory Hierarchy and Cache
Week 13	Parallel processors

LABORATORY OVERVIEW

Date/Week	Topic
Week 2	Lab orientation and safety
Week 4	ARM assembly language programming
Week 6	ARM assembly language programming
Week 8	ARM assembly language programming
Week 10	Exceptions and exception handling
Week 12	Exceptions and exception handling

LABORATORY OPERATION

The labs are in the form of take-home mini-projects. Students will use a simulator to complete these mini projects. There will be three mini projects. Students will meet the TA every other week to discuss their progress in the take home labs and seek help if needed.

ASSESSMENT

Component	**Weight**
Assignments and quiz	20%
Mini-projects (take home labs)	20%
Midterm test	30%
Final exam	40%
Total	100%

There will be 3 or 4 homework assignments during the term. Assignments will have equal marks. Assignments are INDIVIDUAL. Students are responsible for understanding and following the University's Code of Academic Integrity. Quizzes might be given in class. The quizzes will be short (15-20 minutes in length) and will be announced at least one week in advance. No make-up quizzes will be given for any reason.

ACCREDITATION LEARNING OUTCOMES

Note: The *Learning Outcomes* defined in this section are measured throughout the course and form part of the Department's continuous improvement process. They are a key component of the accreditation process for the program and will not be taken into consideration in determining a student's actual grade in the course. For more information on accreditation, please ask your instructor or visit: http://www.engineerscanada.ca .

Outcomes	Indicators	Measurement Methods(s)
Competence in Specialized Engineering Knowledge	1.4	Midterm, final, assignments, quiz
Demonstrates an ability to identify reasonable assumptions (including identification of uncertainties and imprecise information) that could or should be made before a solution path is proposed.	2.1	Midterm, final, assignments, quiz
Recognizes and follows an engineering design process (This means an iterative activity that might include recognizing the goal, specifying the constraints and desired outcomes, proposing solutions, evaluating alternatives, deciding on a solution, and implementing.)	4.1	Midterm, final, assignments, quiz
Demonstrates an ability to respond to technical and non-technical instructions and questions	7.1	Midterm, final, assignments, quiz
Assesses possible options and design configurations from a sustainability engineering perspective, which emphasizes environmental stewardship, life-cycle analysis, and long-term decision-making principles	9.3	Midterm, final, assignments, quiz

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at http://www.mcmaster.ca/academicintegrity The following illustrates only three forms of academic dishonesty: Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. Improper collaboration in group work. Copying or using unauthorized aids in tests and examinations.

ACADEMIC ACCOMMODATIONS

Students who require academic accommodation must contact Student accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contact by phone at 905.525.9140 ext. 28652 or e-mail at sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

NOTIFICATION OF STUDENT ABSENCE AND SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work": http://www.mcmaster.ca/msaf/

NOTICE REGARDING POSSIBLE COURSE MODIFICATION

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

REFERENCE TO 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

Electrical and Computer Engineering Lab Safety

Information for Laboratory Safety and Important Contacts

This document is for users of ECE instructional laboratories in the Information Technology Building.

This document provides important information for the healthy and safe operation of ECE instructional laboratories. This document is required reading for all laboratory supervisors, instructors, researchers, staff, and students working in or managing instructional laboratories in ECE. It is expected that revisions and updates to this document will be done continually. A McMaster University lab manual is also available to read in every laboratory.

General Health and Safety Principles

Good laboratory practice requires that every laboratory worker and supervisor observe the following:

1. Food and beverages are not permitted in the instructional laboratories.
2. A Laboratory Information Sheet on each lab door identifying potential hazards and emergency contact names should be known.
3. Laboratory equipment should only be used for its designed purpose.
4. Proper and safe use of lab equipment should be known before using it.
5. The course TA leading the lab should be informed of any unsafe condition.
6. The location and correct use of all available safety equipment should be known.
7. Potential hazards and appropriate safety precautions should be determined, and sufficiency of existing safety equipment should be confirmed before beginning new operations.
8. Proper waste disposal procedures should be followed.

Location of Safety Equipment

Fire Extinguisher
On walls in halls outside of labs

First Aid Kit
ITB A111, or dial "88" after 4:30 p.m.

Telephone
On the wall of every lab near the door

Fire Alarm Pulls
Near all building exit doors on all floors

Who to Contact

Emergency Medical / Security: On McMaster University campus, call Security at extension **88** or **905-522-4135** from a cell phone.
Non-Emergency Accident or Incident: Immediately inform the TA on duty or Course Instructor.
University Security (Enquiries / Non-Emergency): Dial 24281 on a McMaster phone or dial 905-525-9140 ext. 24281 from a cell phone.
See TA or Instructor: For problems with heat, ventilation, fire extinguishers, or immediate repairs
Environmental & Occupational Health Support Services (EOHSS): For health and safety questions dial 24352 on a McMaster phone or dial 905-525-9140 ext. 24352 from a cell phone.
ECE Specific Instructional Laboratory Concerns: For non-emergency questions specific to the ECE

In Case of a Fire (Dial 88)

When calling to report a fire, give name, exact location, and building.

1. Immediately vacate the building via the nearest Exit Route. Do not use elevators!
2. Everyone is responsible for knowing the location of the nearest fire extinguisher, the fire alarm, and the nearest fire escape.
3. The safety of all people in the vicinity of a fire is of foremost importance. But do not endanger yourself!
4. In the event of a fire in your work area shout "*Fire!*" and pull the nearest fire alarm.
5. Do not attempt to extinguish a fire unless you are confident it can be done in a prompt and safe manner utilizing a hand-held fire extinguisher. Use the appropriate fire extinguisher for the

specific type of fire. Most labs are equipped with Class A, B, and C extinguishers. Do not attempt to extinguish Class D fires which involve combustible metals such as magnesium, titanium, sodium, potassium, zirconium, lithium, and any other finely divided metals which are oxidizable. Use a fire sand bucket for Class D fires.
6. Do not attempt to fight a major fire on your own.
7. If possible, make sure the room is evacuated; close but do not lock the door and safely exit the building.

Clothing on Fire

Do not use a fire extinguisher on people

1. Douse with water from safety shower immediately or
2. Roll on floor and scream for help or
3. Wrap with fire blanket to smother flame (a coat or other nonflammable fiber may be used if blanket is unavailable). Do not wrap a standing person; rather, lay the victim down to extinguish the fire. The blanket should be removed once the fire is out to disperse the heat.

Equipment Failure or Hazard

Failure of equipment may be indicative of a safety hazard - You must report all incidents.

Should you observe excessive heat, excessive noise, damage, and/or abnormal behaviour of the lab equipment:

1. Immediately discontinue use of the equipment.
2. In Power Lab, press wall-mounted emergency shut-off button.
3. Inform your TA of the problem.
4. Wait for further instructions from your TA.
5. TA must file an incident report.

Protocol for Safe Laboratory Practice

Leave equipment in a safe state for the next person - if you're not sure, ask!

In general, leave equipment in a safe state when you finish with it. When in doubt, consult the course TA.

Defined Roles

TA	The first point of contact for lab supervision	
ECE Lab Supervisor	Steve Spencer- ITB 147	steve@mail.ece.mcmaster.ca
ECE Chair	Tim Davidson- ITB A111	davidson@mcmaster.ca
ECE Administrator	Kerri Hastings- ITB A111	hastings@mcmaster.ca
ECE Course Instructor	Please contact your specific course instructor directly	