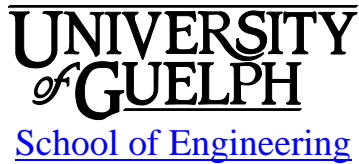


ENGG*4540 Advanced Computer Architecture

Winter 2017



(Revision 1: January 9, 2017)

1 INSTRUCTIONAL SUPPORT

1.1 Instructor

Instructor: Rafik Guindi, Ph.D.
Office: RICH 3525, ext. 52902
Email: rguindi@uoguelph.ca
Office hours: Mondays and Wednesdays: 3:00 to 4:00 pm; or by appointment

1.2 Lab Technician

Technician: Kyle Montgomery
Office: RICH 1531, ext. 54532
Email: kmontg03@uoguelph.ca

1.3 Teaching Assistant

TA	Email
Jingjing Wang	jwang28@uoguelph.ca

2 LEARNING RESOURCES

2.1 Course Website

Course material, news, announcements, and grades will be regularly posted to the ENGG*4540 [CourseLink](#). You are responsible for checking the site regularly.

2.2 Required Resources

- John L. Hennessy and David A. Patterson Computer Architecture: A Quantitative Approach, 5th Edition, Morgan Kaufmann Publishers.

2.3 Recommended Resources

- Any good reference on VHDL.

2.4 Additional Resources

- Lecture Information: All lecture notes are posted on the ENGG*4540 CourseLink system
- Lab Information: The Lab Manual will be posted on the ENGG*4540 CourseLink system

2.5 Communication & Email

Please use lectures and lab help sessions as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its student.

3 ASSESSMENT

3.1 Dates and Distribution

Assignments: 15%

Labs: 25%

Midterm: 20%

Wednesday, March 1st 2017, 1:00 – 2:30 pm. In class.

Final Exam: 40%

Monday, April 24th 2017, 7:00 pm to 9:00 pm. Room TBD.

3.2 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor at the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

Missed Quiz or Midterm Exam: There will be no makeup quizzes or midterm exam under normal circumstances. Please check the above paragraphs on Missed Assessments and Accommodation of Religious Obligations if you believe that they apply to your situation.

Lab Work: You must attend and complete all laboratories. If you miss a lab with grounds for granting academic consideration or religious accommodation, arrangements must be made with the instructor to complete a makeup lab upon presentation of a written request and suitable documentation.

Late Lab Reports: Late submissions of lab reports will not be accepted.

4 AIMS, OBJECTIVES & GRADUATE ATTRIBUTES

4.1 Calendar Description

This course covers topics such as: basics of pipeline structure, advanced pipelining and instruction level parallelism, multiprocessor and thread-level parallelism, memory-hierarchy design (main memory, virtual memory, caches), storage systems, interconnection networks, multiprocessor architectures (centralized and distributed). Advanced topics related to new emerging computer architectures will also be presented. The emphasis in each topic is on fundamental limitations and the trade-offs involved in designing computer systems, including memory and processing bandwidth, network bandwidth and latency, synchronization, and storage system bandwidth and latency.

Prerequisite(s): ENGG*3380

4.2 Course Aims

The aim of this course is to familiarize students with the basic principles of computer architecture and design, with an emphasis on cost-performance-energy trade-offs, good engineering design, and a focus on quantitative analysis of real systems.

4.3 Learning Objectives

At the successful completion of this course, the student will have demonstrated the ability to:

1. Identify the tasks involved in computer architecture design, with trends in technology, usage, and cost,
2. Measure and report performance of computer architectures,
3. Classify instruction set architectures, and comprehend the instruction formats and semantics,
4. Identify and analyze basic pipeline operations, data and control pipeline hazards, and instruction-level parallelism,
5. Communicate effectively about advanced computer architectures and memory-hierarchy design, including cache design issues and performance evaluation techniques.

4.4 Graduate Attributes

Successfully completing this course will contribute to the following CEAB Graduate Attributes:

Graduate Attribute	Learning Objectives	Assessment
1. Knowledge Base for Engineering	1, 2	Exams, Labs, Assignments
2. Problem Analysis	1, 2, 3	Exams, Labs, Assignments
3. Investigation	4, 5	Labs
4. Design	1, 2, 4, 5	Exams, Labs
5. Use of Engineering Tools	1, 2, 5	Labs
6. Communication	5	Labs
7. Individual and Teamwork	1, 2, 5	Labs

4.5 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. All lecture notes plus various exercises, examples and referenced resources will be made available to students on CourseLink system in the appropriate module. However, these are not intended to

be stand-alone course notes. During lectures, the instructor will expand and explain the content of notes and provide in class solutions to problems that supplement posted notes. Scheduled classes and labs will be the principal venue to provide information and feedback for tests and labs.

4.6 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and labs. In addition, students are encouraged to consult the instructor and the TA during the scheduled office hours or to contact the instructor or TA for any help needed. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

4.7 Relationships with other Courses & Labs

ENGG*3380: Internal bus structure, registers, control sequence design, microprogramming and memory organization.

5 TEACHING AND LEARNING ACTIVITIES

5.1 Timetable

Lectures:

Monday	1:00 pm – 2:20 pm	MCKN 307
Wednesday	1:00 pm – 2:20 pm	MCKN 307

Lab sessions:

Wednesday	9:30 am – 11:20 am	RICH 1532
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5.2 Lecture Schedule

Week	Lecture Topics	Text Book	Learning Objectives
1	Introduction	Chapter 1	1, 2
2	Instruction Set Architecture	Appendix A	3
3	Pipelining Basics	Appendix C	4
4	Superscalar	Chapter 3	2, 3
5	Very Large Instruction Word (VLIW)	Chapter 3	2, 3
6	Branch Prediction	Appendix C	4
7	Memory Hierarchy	Appendix B	5
8	Advanced Caches	Chapter 2	5
9	Vector Processors	Chapter 4	2, 3, 4
10	Graphical Processing Units (GPUs)	Chapter 4	2, 3, 5
11	Multithreading	Chapter 3	4, 5
12	Review	-	

Topics schedule will be adjusted throughout the course as needed.

5.3 Lab Schedule

Week	Scheduled Activity
1	Intro to Lab Equipment and Safety Training
2	Lab 1
3 – 4	Lab 2
5 – 6	Lab 3
7 – 8	Lab 4
9 – 10	Extra

Schedule will be adjusted throughout the course as needed.

5.4 Other Important Dates

Monday January 9, 2017: First class

Monday February 20 – Friday February 24, 2017: Winter Break

Friday March 10, 2016: 40th class day – Last day to drop the course

Wednesday April 5, 2017: Last class

6 LAB SAFETY

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible. If the laboratory rules are not followed, consequences will include removing access to the lab. If this results in lab work not being completed, the student will receive a grade of 0.

7 ACADEMIC MISCONDUCT

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member.

7.1 Resources

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

A tutorial on Academic Misconduct produced by the Learning Commons can be found at:

<http://www.academicintegrity.uoguelph.ca/>

Please also review the section on Academic Misconduct in your [Engineering Program Guide](#).

The School of Engineering has adopted a Code of Ethics that can be found at:

<http://www.uoguelph.ca/engineering/undergrad-counselling-ethics>

8 ACCESSIBILITY

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability for a short-term disability should contact the Centre for Students with Disabilities as soon as possible.

For more information, contact CSD at [519-824-4120](tel:519-824-4120) ext. 56208 or email csd@uoguelph.ca or see the website: <http://www.csd.uoguelph.ca/csd/>

9 RECORDING OF MATERIALS

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

10 RESOURCES

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs:

<http://www.uoguelph.ca/registrar/calendars/index.cfm?index>