

# COMPSCI 3350B, Winter 2024

## Computer Organization

### Syllabus

## Course Information

### Overview

The course is designed to give students an understanding of hardware, its design, its implementation, and the impact of this on how software runs on the hardware. We will look at the general topics:

- Hardware Abstractions
- Qualitative Measures and Performance Metrics
- Memory Hierarchies and Organization
- Logical Circuits
- Instruction Set Architectures (MIPS)
- CPU data path and Pipelining
- Multi-core architectures, parallelism

### Calendar Description

Topics include semiconductor technologies, gates and circuits, buses, semiconductor memories, peripheral interfaces, I/O techniques, A/D conversion, standards, and RISC.

### Prerequisite Requirements

COMPSCI 2208A/B, COMPSCI 2210A/B, COMPSCI 2211A/B, and either COMPSCI 2209A/B or COMPSCI 2101A/B

**Antirequisite:** ECE 3375A/B

Unless you have either the requisites for this course or written special permission from your dean to enroll in it, you may be removed from this course, and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees if you are dropped from a course for failing to have the necessary prerequisites.

### Teaching Staff + Office Hours

Iqra Batool

[ibatool2@wuo.ca](mailto:ibatool2@wuo.ca)

MC 334, 3:30 to 5:30 pm

### Teaching Assistants

Name	Email
Qiu hao Zeng	<a href="mailto:gzung53@uwo.ca">gzung53@uwo.ca</a>
Wei Wang	<a href="mailto:wwang828@uwo.ca">wwang828@uwo.ca</a> (remote)
Ali Saleh	<a href="mailto:asaleh45@uwo.ca">asaleh45@uwo.ca</a>
Kamalpreet Singh	<a href="mailto:ksing332@uwo.ca">ksing332@uwo.ca</a>
Rory Campbell	<a href="mailto:rcamp@uwo.ca">rcamp@uwo.ca</a> (remote)

## Class Schedule

Monday	9:30-11:30 am
Wednesday	10:30-11:30 am

## Special Dates

Jan. 8 Classes start.

Jan. 16: Last day to add a second-term half-course.

Feb. 17–25 Spring Reading Week, including Family Day (Saturday – following Sunday)

Mar. 4 : Date by which students in a second-term half course must receive an assessment for work totaling 15% of their final grade (1000- and 2000-level courses only)

Mar. 7: Last day to withdraw from a second-term half course without academic penalty.

Mar. 29 & 31 Good Friday and Easter Sunday.

Apr. 8: Last day of classes in the Winter Term

Apr. 9–10 Study Days

Apr. 11–30 April examination period

## Course Materials

Students are required to have access to a computer with a reliable internet connection. All course materials will be posted to OWL: <http://owl.uwo.ca>. This includes course notes and supplementary materials. Students should regularly check OWL (<http://owl.uwo.ca>) for news, announcements, and forum posts. This is the primary method by which information will be disseminated to all students in the class. Students are responsible for checking OWL regularly.

There is no required textbook for this course. However, the suggested reading material is *Computer Architecture: A Quantitative Approach* by Hennessy and Patterson. Another fine textbook is *Computer Organization and Design* by Patterson and Hennessy—at least the 4th edition of each.

Students can seek support on the **OWL Help page** if they need assistance. Alternatively, they can contact the Western Technology Services Helpdesk at 519-661-3800.

## Forums and Email Contact

Students should post all questions about course content on the OWL site's forums. This includes any questions about lectures, assignments, or quizzes. Before submitting a new question, please check existing questions and answers on the forums first. Emails (from your uwo.ca account) should be used only for personal and private matters. If your forum question goes unanswered for a day or two, a friendly email reminder to the TAs or the instructor is okay.

**Include “CS3350” in your email subject.** Otherwise, you may not receive a reply to your email.

## Course Topics + Schedule

- Introductions, Hardware Abstractions (0.5 weeks)
- CPU and Memory (3 weeks)
  - CPU performance metrics
  - Memory hierarchy
  - Cache memories
  - Impact of cache on CPU performance
- Stateless Circuits (1 week)
  - Simple gates, switches, truth tables
  - Functional completeness
  - Boolean algebra, simplification, canonical forms
  - Combinational logic blocks: multiplexer, ALU, n-bit arithmetic
- Synchronous Circuits/State Circuits (1 week)
  - Clocks, signals, and waveforms
  - Flip-flops: D, T, SR, JK; Registers
  - Finite state machines
- CPU data path, Instruction Set Architecture (2 weeks)
  - Typical 5-stage data path
  - Single-cycle vs multi-cycle
  - MIPS
- Instruction-level Parallelism (3 weeks)
  - Single-cycle vs multi-cycle
  - Pipelining
  - Performance metrics
  - Multi-issue processors: VLIW, superscalar
  - Hazards: data, control, structural
- Multi-core Processors (2 weeks)
  - Parallelism for performance
  - Cache coherency, MESI protocol
  - Thread-level parallelism and synchronisation
  - Modern parallel architectures, GPU architectures

## Evaluation and Tentative Schedule

Assignments	Schedule	Percentage
	January 30 <span style="color: blue;">87.5%</span>	50%
	February 10	
	March 15	
	April 6	
Quizzes	Schedule	Percentage
	1 <sup>st</sup> Quiz 24, January, 2024 <span style="color: blue;">86.5%</span>	7.5%
	2 <sup>nd</sup> Quiz 25 March, 2024	7.5%
Final Exam	TBD	35%

### Assignment Regulations

- Assignments are due at 23:55 on the due date. Late assignments will be handled as follows.
  - 0-24 hours late: you make the instructor sad,
  - 24-48 hours late: -20%,
  - 48-72 hours late: -50%,
  - >72 hours late: submissions are no longer accepted; you will receive 0 grade.
- Assignments will be released at least two weeks before the due date. Extensions may be made on due dates depending on progression through the course material.
- Assignments are to be submitted on Owl. Details are available on the OWL site. Assignments should be typeset or **legible, scanned** copies of hand-written work. If the TA cannot read your handwriting, it will be marked as incorrect.
- Plagiarism is unacceptable. It is reasonable to assume that students discuss assignments and possible solutions; however, all assignments shall be independent.
- Any concerns with assignment marking must be addressed *within one week* of the assessment being returned. No adjustments will be made after this time. Concerns about quizzes and assignments may be addressed to the instructor or Tas through email.

### Quiz and Exam Regulations

- Plagiarism is unacceptable.
- Quizzes and exams are closed book. Any required information, numerical constants, formulas, etc., will be given in the quiz/exam/question.
- No electronic devices other than a simple scientific calculator may be in the possession of students during quizzes and the Final Exam.

- Any concerns with quiz marking must be addressed *within one week* of the assessment being returned. No adjustments will be made after this time. Concerns about quizzes will be addressed to the instructor.
- If you miss one quiz, the weight will be re-assigned to the other quiz. Contact the instructor to confirm your absence is recorded.
- If you miss more than one quiz, you must receive academic accommodation from the Academic Counselling office of your Faculty of Registration. Handling of the missed quizzes will be on a case-by-case basis.
- The office of the registrar will schedule the Final exam at a later date.
- If you miss the Final Exam, please get in touch with the Academic Counselling office of your Faculty of Registration as soon as possible. They will assess your writing eligibility and the Special Examination (the name the University gives to a makeup Final Exam). You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than two exams in 23 hours, more than three exams in 47 hours).

## **Policies, Accommodation, Accessibility**

### **Physical Health**

Students should also note that individual instructors are not permitted to receive documentation. Directly from a student, whether supporting an application for consideration on medical grounds or for other reasons. All documentation required for absences must be submitted to the Academic Counselling office of a student’s Home Faculty for the policy on Accommodation for Medical Illness - Undergraduate Students, see

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/academic\\_consideration.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration.pdf)

and for the Student Medical Certificate (SMC), see: [http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

### **Mental Health**

Mental and emotional well-being is paramount and should not be treated lightly. Students who are in emotional/mental distress should refer to Health and Wellness at Western for a complete list of options about how to obtain help. Students in immediate distress should contact Student Health Services, Campus Police, or Psychological Services, whose contact information can be found here

<https://www.uwo.ca/health/crisis.html>.

### **Religious Accommodation**

Students should consult the university’s list of recognized religious holidays and give reasonable notice in writing to the instructor and an academic counsellor before the holiday if their course requirements are affected by a religious observance. Additional information is given in the Western Multicultural Calendar: <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

### **Accessibility**

Please contact the course instructor if you require material in an alternate format or any other arrangements to make this course more accessible to you. You may also wish to contact Student Accessibility Services (<http://www.sdc.uwo.ca/ssd/>) via their website or at (519)-661-2147 if you have any questions regarding accommodation.

## **Ethical Conduct**

Academic offences are taken seriously, and students are directed to read the appropriate policy on this website, specifically, the definition of a Scholastic Offence. All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database to detect plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement between The University of Western Ontario and **Turnitin.com**. Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

## **Student Support**

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being.

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Learning-skills counsellors at the Student Development Centre ( <http://www.sdc.uwo.ca/> )are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exams, textbook reading, and more. Support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre and year-round via individual counselling. The University Students' Council also provides other services.

## **Registration Services**

Students should refer to the Registrar's website for registration information and services.