

ECE241H1 F

Digital Systems

Fall 2023 Syllabus

Course Meetings

ECE241H1 F

Section	Day & Time	Delivery Mode & Location
LEC0101	Tuesday, 12:00 PM - 1:00 PM Thursday, 12:00 PM - 1:00 PM Friday, 12:00 PM - 1:00 PM	In Person: BA 1170 In Person: BA 1170 In Person: BA 1170
LEC0102	Monday, 2:00 PM - 3:00 PM Wednesday, 2:00 PM - 3:00 PM Thursday, 2:00 PM - 3:00 PM	In Person: BA 1170 In Person: BA 1170 In Person: BA 1170
LEC0103	Monday, 3:00 PM - 4:00 PM Wednesday, 3:00 PM - 4:00 PM Thursday, 3:00 PM - 4:00 PM	In Person: BA 1170 In Person: BA 1170 In Person: BA 1170
LEC0104	Monday, 10:00 AM - 11:00 AM Tuesday, 11:00 AM - 12:00 PM Thursday, 10:00 AM - 11:00 AM	In Person: MB 128 In Person: MB 128 In Person: MB 128
PRA0101	Monday, 9:00 AM - 12:00 PM Monday, 9:00 AM - 12:00 PM Monday, 9:00 AM - 12:00 PM	In Person: BA 3155 In Person: BA 3165 In Person: BA 3145
PRA0102	Monday, 9:00 AM - 12:00 PM Monday, 9:00 AM - 12:00 PM Monday, 9:00 AM - 12:00 PM	In Person: BA 3155 In Person: BA 3165 In Person: BA 3145
PRA0103	Wednesday, 9:00 AM - 12:00 PM Wednesday, 9:00 AM - 12:00 PM Wednesday, 9:00 AM - 12:00 PM	In Person: BA 3155 In Person: BA 3165 In Person: BA 3145
PRA0104	Wednesday, 9:00 AM - 12:00 PM Wednesday, 9:00 AM - 12:00 PM Wednesday, 9:00 AM - 12:00 PM	In Person: BA 3165 In Person: BA 3145 In Person: BA 3155
PRA0105	Tuesday, 3:00 PM - 6:00 PM Tuesday, 3:00 PM - 6:00 PM Tuesday, 3:00 PM - 6:00 PM	In Person: BA 3155 In Person: BA 3165 In Person: BA 3145
PRA0106	Tuesday, 3:00 PM - 6:00 PM Tuesday, 3:00 PM - 6:00 PM Tuesday, 3:00 PM - 6:00 PM	In Person: BA 3155 In Person: BA 3145 In Person: BA 3165

Section	Day & Time	Delivery Mode & Location
PRA0107	Tuesday, 12:00 PM - 3:00 PM	In Person: BA 3155
	Tuesday, 12:00 PM - 3:00 PM	In Person: BA 3145
	Tuesday, 12:00 PM - 3:00 PM	In Person: BA 3165
PRA0108	Tuesday, 12:00 PM - 3:00 PM	In Person: BA 3165
	Tuesday, 12:00 PM - 3:00 PM	In Person: BA 3155
	Tuesday, 12:00 PM - 3:00 PM	In Person: BA 3145

Refer to ACORN for the most up-to-date information about the delivery and location of the course meetings.

See the Quercus site for the marking scheme, course outline, lab handouts and project instructions.

Course Contacts

Instructor: Bruno Korst

Email: bkf@ece.utoronto.ca

Office Hours and Location: tbd

Additional Notes: Please refer to the Quercus page for instructions on office hours and meetings with the instructors.

Course Overview

Digital logic circuit design with substantial hands-on laboratory work. Algebraic and truth table representation of logic functions and variables. Optimizations of combinational logic, using "don't cares." Multi-level logic optimization. Transistor-level design of logic gates; propagation delay and timing of gates and circuits. The Verilog hardware description language. Memory in digital circuits, including latches, clocked flip-flops, and Static Random Access Memory. Set-up and hold times of sequential logic. Finite state machines - design and implementation. Binary number representation, hardware addition and multiplication. Tri-state gates, and multiplexers. There is a major lab component using Field-Programmable Gate Arrays (FPGAs) and associated computer-aided design software.

Course Learning Outcomes

By the end of the course, students will be able to understand basic digital logic circuit design, optimization and concepts. Students will become comfortable in using computer-aided design (CAD) tools with their design. Furthermore, students will gain hands-on experience with design and debug of digital systems using programmable logic.

Prerequisites: None

Corequisites: None

Exclusions: None

Recommended Preparation: None

Credit Value: 0.5

Graduate Attributes:

- 1C. Knowledge Base for Engineering: Demonstrate competence in specialized engineering knowledge appropriate to the program. [Applied]
- 4A. Design: Demonstrate ability to frame a complex, open-ended problem in engineering term. [Applied]
- 4D. Design: Demonstrate ability to advance an engineering design to a defined end state. [Applied]
- 5B. Use of Engineering Tools: Demonstrate ability to use discipline specific techniques, resources and engineering tools. [Applied]
- 6C. Individual and Team Work: Demonstrate success in a team based project. [Applied]

Course Materials

Title: Fundamentals of Digital Logic with Verilog Design, 3rd Edition (2014)

Authors: Stephen Brown and Zvonko Vranesic

Publisher: McGraw-Hill

Labs will make use of the Quartus FPGA design software. The software is made available on the lab workstations, but students are welcome to download and install on their own machines directly through the Intel website.

Marking Scheme

Assessment	Percent	Details	Due Date
Midterm test	25%		2023-10-11
Labs	14%	There will be 7 labs. Labs will be due on the week of the days listed. Percentages per lab will be presented on the Quercus page.	2023-09-18,2023-09-25,2023-10-02,2023-10-16,2023-10-23,2023-10-30,2023-11-13
Project	16%	Students will demonstrate their design in the lab.	2023-11-20,2023-11-27,2023-12-04
Final Exam	45%	Final exam covers all course material. No calculator; one student-prepared aid sheet allowed.	Final Exam Period

Lab percentages (totaling 14%) are distributed as

Lab01 and Lab02 -- 1%

Lab03, Lab04, Lab05 -- 2%

Lab06, Lab07 -- 3%

Students will work on the lab in groups of two as numbers allow.

In-Lab Grade Component Some marks will be assigned individually, based on student performance, including answering questions asked in the lab sessions. Some marks will be assigned to the group, mainly for demonstrations in the lab.

Auto-marked Component: Some grading and testing of the lab designs may be handled by an automated grading system. Students will be provided instructions about what code to submit and how to use the automated grading system.

Working on labs together is encouraged but students must be able to demonstrate understanding of the work on an individual basis. Any work submitted for auto-grading should be the work of the group alone, i.e., students can work through a design with students in other groups, but submitting the same, or highly similar, code as another group is not acceptable. To avoid issues, once a design is discussed and understood, students should write the code themselves without looking at the code of other students or code that might be found online. Automated code comparison may be used to check for plagiarism.

Minimum lab work requirement: To earn credit for this course, you must have achieved a non-zero grade for the In-Lab Grade Component of five of the seven labs. Failure to achieve this will result in an auto-fail for the course.

Late Assessment Submissions Policy

5% deduction per day of late submission.

Policies & Statements

University Land Acknowledgement

I wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca, and the Mississaugas of the Credit. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

Learn more about Canada's relationship with Indigenous Peoples [here](#).

Indigenous Students' Supports

If you are an Indigenous engineering student, you are invited to join a private Discord channel to meet other Indigenous students, professors, and staff, chat about scholarships, awards, work opportunities, Indigenous-related events, and receive mentorship. Email [Professor Bazylak](#) or [Darlee Gerrard](#) if you are interested.

Indigenous students at U of T are also invited to visit First Nations House's (FNH) Indigenous Student Services for culturally relevant programs and services. If you want more information on how to apply for Indigenous specific funding opportunities, cultural programs, traditional medicines, academic support, monthly social events or receive the weekly newsletter, go to the FNH [website](#), [email](#) or follow FNH on social media: [Facebook](#), [Instagram](#), or [TikTok](#). A full event calendar is on the CLNX platform. Check CLNX often to see what new events are added!

Wellness and Mental Health Support

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. The University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that could assist you during these times.

As a U of T Engineering student, you have a Departmental [Undergraduate Advisor](#) or a Departmental [Graduate Administrator](#) who can support you by advising on personal matters that impact your academics. Other resources that you may find helpful are listed on the [U of T Engineering Mental Health & Wellness webpage](#), and a small selection are also included here:

- [U of T Engineering's Mental Health Programs Officer](#)
- [Accessibility Services](#) & the [On-Location Advisor](#)
- [Health & Wellness](#) and the [On-Location Health & Wellness Engineering Counsellor](#)
- [Graduate Engineering Council of Students' Mental Wellness Commission](#)
- [SKULE Mental Wellness](#)
- [U of T Engineering's Learning Strategist](#) and [Academic Success](#)
- [Registrar's Office](#) and [Scholarships & Financial Aid Office & Advisor](#)

We encourage you to access these resources as soon as you feel you need support; no issue is too small.

If you find yourself feeling distressed and in need of more immediate support, consider reaching out to the counsellors at [U of T Telus Health Student Support](#) or visiting U of T Engineering's [Urgent Support – Talk to Someone Right Now](#).

Accommodations

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, visual impairments, chronic health conditions, addictions, D/deaf, deafened or hard of hearing, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students [register with Accessibility Services](#) as soon as possible.

We know that many students may be hesitant to reach out to Accessibility Services for

accommodations. The purpose of academic accommodations is to support students in accessing their academics by helping to remove unfair disadvantages. We can assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. The process of accommodation is private; we will not share details of your needs or condition with any instructor.

If you feel hesitant to register with us, we encourage you to reach out for further information and resources on how we can support. It may feel difficult to ask for help, but it can make all the difference during your time here.

Phone: 416-978-8060

Email: accessibility.services@utoronto.ca

Equity, Diversity and Inclusion

Looking for community? Feeling isolated? Not being understood or heard?

You are not alone. You can talk to anyone in the Faculty that you feel comfortable approaching, anytime – professors, instructors, teaching assistants, [first-year](#) or [upper years](#) academic advisors, student leaders or the [Assistant Dean of Diversity, Inclusion and Professionalism](#).

You belong here. In this class, the participation and perspectives of everyone is invited and encouraged. The broad range of identities and the intersections of those identities are valued and create an inclusive team environment that will help you achieve academic success. You can read the evidence for this approach [here](#).

You have rights. The [University Code of Student Conduct](#) and the [Ontario Human Rights Code](#) protect you against all forms of harassment or discrimination, including but not limited to acts of racism, sexism, Islamophobia, antisemitism, homophobia, transphobia, ableism, classism and ageism. Engineering denounces unprofessionalism or intolerance in language, actions or interactions, in person or online, on- or off-campus. Engineering takes these concerns extremely seriously and you can confidentially disclose directly to the Assistant Dean for help [here](#).

Resource List:

- [Engineering Equity, Diversity & Inclusion Groups, Initiatives & Student Resources](#)
- [Engineering Positive Space Resources](#)
- Request a religious-based accommodation [here](#)
- Email Marisa Sterling, P.Eng, the Assistant Dean, Diversity, Inclusion & Professionalism [here](#)
- Make a confidential disclosure of harassment, discrimination or unprofessionalism [here](#) or email engineering@utoronto.ca or call 416.946.3986
- Email the Engineering Society Equity & Inclusivity Director [here](#)
- [U of T Equity Offices & First Nations House Resources](#)

Plagiarism Detection Tool

Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (<https://uoft.me/pdt-faq>).

Academic Integrity

All students, faculty and staff are expected to follow the University's guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your own honest efforts.

Plagiarism—representing someone else's work as your own or submitting work that you have previously submitted for marks in another class or program—is a serious offence that can result in sanctions. Speak to me or your TA for advice on anything that you find unclear. To learn more about how to cite and use source material appropriately and for other writing support, see the [U of T writing support website](#). Consult the [Code of Behaviour on Academic Matters](#) for a complete outline of the University's policy and expectations. For more information, please see the [U of T Academic Integrity website](#).

Quercus Information

This course uses the University's learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. The site is dynamic and new information and resources will be posted regularly as we move through the term, so please make it a habit to log in to the site on a regular, even daily, basis. To access the course website, go to the U of T Quercus log-in page at <https://q.utoronto.ca>. Once you have logged in to Quercus using your UTORid and password, you should see the link or "card" for this course. You may need to scroll through other cards to find this. Click on this link to open our course area, view the latest announcements and access your course resources. There are Quercus help guides for students that you can access by clicking on the "?" icon in the left side column.

SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please also note that any grades posted are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until they have been formally approved and posted on ACORN at the end of the course. Please contact me as soon as possible if you think there is an error in any grade posted on Quercus.