ECE241H1 F

Digital Systems

Fall 2025 Syllabus

Course Meetings

ECE241H1 F

Section	Day & Time	Delivery Mode & Location
LEC0101	Monday, 2:00 PM - 3:00 PM Wednesday, 2:00 PM - 3:00 PM Thursday, 2:00 PM - 3:00 PM	In Person: MS 2170 In Person: SF 1101 In Person: MC 254
LEC0102	Monday, 2:00 PM - 3:00 PM Tuesday, 3:00 PM - 4:00 PM Thursday, 2:00 PM - 3:00 PM	In Person: BA 1170 In Person: MC 254 In Person: BA 1170
LEC0103	Monday, 1:00 PM - 2:00 PM Wednesday, 1:00 PM - 2:00 PM Thursday, 1:00 PM - 2:00 PM	In Person: SF 1101 In Person: SF 1101 In Person: MC 254
LEC0104	Monday, 1:00 PM - 2:00 PM Tuesday, 2:00 PM - 3:00 PM Thursday, 4:00 PM - 5:00 PM	In Person: BA 1180 In Person: BA 1180 In Person: BA 1180
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 3165 In Person: BA 3155 In Person: BA 3145
PRA0102	Monday, 9:00 AM - 12:00 PM Monday, 9:00 AM - 12:00 PM	In Person: BA 3165 In Person: BA 3145
PRA0103	Wednesday, 3:00 PM - 6:00 PM Wednesday, 3:00 PM - 6:00 PM Wednesday, 3:00 PM - 6:00 PM	In Person: BA 3165 In Person: BA 3155 In Person: BA 3145
PRA0104	Wednesday, 3:00 PM - 6:00 PM Wednesday, 3:00 PM - 6:00 PM Wednesday, 3:00 PM - 6:00 PM	In Person: BA 3165 In Person: BA 3155 In Person: BA 3145
PRA0105	Thursday, 3:00 PM - 6:00 PM Thursday, 3:00 PM - 6:00 PM Thursday, 3:00 PM - 6:00 PM	In Person: BA 3165 In Person: BA 3155 In Person: BA 3145
PRA0106	Thursday, 3:00 PM - 6:00 PM Thursday, 3:00 PM - 6:00 PM Thursday, 3:00 PM - 6:00 PM	In Person: BA 3145 In Person: BA 3165 In Person: BA 3155

Section	Day & Time	Delivery Mode & Location
PRA0107	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 3155 In Person: BA 3145
PRA0108	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 3155 In Person: BA 3145

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

Course Contacts

Instructor: Prof. Stephen Brown
Email: prof.brown@utoronto.ca

Instructor: Prof. Jason Anderson
Email: jason.anderson@utoronto.ca

Instructor: Shuran Wang
Email: shuran.wang@mail.utoronto.ca

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

You will learn about the fundamentals of computer hardware design, starting with the design of basic logic gates and then proceeding to learn about the most important types of combinational and sequential circuit building blocks. At the end of the course you will know how to design simple digital systems that include input and output devices, arithmetic and logic units, memory, and control circuits.

Credit Value: 0.5
Graduate Attributes:

- 1C. Knowledge Base for Engineering: Demonstrate competence in specialized engineering knowledge appropriate to the program. [Applied] **Measured in Course**

- 4A. Design: Demonstrate ability to frame a complex, open-ended problem in engineering term. [Applied] **Measured in Course**
- 4D. Design: Demonstrate ability to advance an engineering design to a defined end state. [Applied] **Measured in Course**
- 5B. Use of Engineering Tools: Demonstrate ability to use discipline specific techniques, resources and engineering tools. [Applied] **Measured in Course**
- 6C. Individual and Team Work: Demonstrate success in a team based project. [Applied] **Measured in Course**

Course Materials

Recommended textbook: Fundamentals of Digital Logic with Verilog Design, 3rd Edition, Stephen Brown and Zvonko Vranesic, McGraw Hill

Marking Scheme

Assessment	Percent	Details	Due Date
Term test	25%		2025-10-16
Lab Exercises and Project	25%	There will be five marked lab exercises plus the course project.	No Specific Date
Final Exam	50%	The final exam covers all course materials presented in lectures and covered in lab exercises in the course. Exam type: D (instructor will specify aids) Calculator type: 4 (no electronic aids allowed)	Final Exam Period

Late Assessment Submissions Policy

A message will be posted on Quercus as appropriate about late labs.

Course Schedule

Week	Description
Week 1 Date	Course introduction, decimal, binary, and hex numbers, logic expressions, AND, OR, NOT, logic gates, Verilog

Week 2 Date	XOR, timing diagram, Boolean algebra, Boolean algebra, Venn diagrams, terminology, sum-of-products, product-of-sums
Week 3 Date	Intro lab (not marked), multiplexers, Verilog, 7-segment displays, more Verilog, adder circuits, adder circuit, NAND, NOT
Week 4 Date	Lab 1, optimization of logic expressions, K-maps, terminology, optimization with don't-care minterms
Week 5 Date	Lab 2, synchronous circuits, latches, flip-flops, timing diagrams, Verilog for storage elements, reset logic
Week 6 Date	Lab 3, Blocking vs Non-blocking, Shift registers, FF Enable
Week 7 Date	Midterm week, no lab, FSM Intro
Week 8 Date	Lab 4, FSM (Moore)
Week 9 Date	Lab 5, FSMs (Mealy), Memory, VGA
Week 10 Date	Project 1, 2's complement, Carry bypass adder, multiplier
Week 11 Date	Project 2, system design
Week 12 Date	Project 3, transistors, multiplexers

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 if you are interested.

Indigenous students at U of T are also invited to visit 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

Your personal wellness and mental health are important. The University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that can support your well-being.

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 Student & Community Wellness Coordinator
- Health & Wellness and the On-Location Engineering Wellness Counsellor
- Health & Wellness Peer Support Program
- Accessibility Services & the On-Location Advisor
- Graduate Engineering Council of Students' Mental Wellness Commission
- SKULE™ Mental Wellness
- U of T Engineering's Learning Strategist and Centre for Learning Strategy Support
- 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. You may reach out to the counsellors at U of T Telus Health Student Support for 24/7 free and confidential counselling support.

If you find yourself feeling distressed and in need of more immediate support visit uoft.me/feelingdistressed or 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 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

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.