



# SYLLABUS

# ECE 2060

Introduction to Digital Logic  
Autumn 2022

## INSTRUCTION TEAM

### LECTURE

Instructor	Dr. Betty Lise Anderson	<a href="mailto:anderson.67@osu.edu">anderson.67@osu.edu</a>
Graduate Teaching Associate	Srinivasan Subramaniyan	subramaniyan.4@osu.edu
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### LAB

Instructor	Dr. Gregg Chapman	Chapman.415@osu.edu
Graduate Teaching Associate	Yunjie Yang	yang.4972@osu.edu
Graduate Teaching Associate	Ian Schwind	Schwind.37@osu.edu

Laboratory Website: <https://u.osu.edu/ece2060labs/>

### Course description

Introduction to the theory and practice of combinational and clocked sequential networks.

## Course learning outcomes

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

- Master the number representations used in today's digital systems and their arithmetic properties and conversion techniques
- Master analyzing, synthesizing, and designing networks of combinatorial, digital logic elements
- Be competent to analyze, design and synthesize digital clocked sequential circuits
- Be familiar with modern computer tools for digital design, verification and simulation (mostly lab)
- Be familiar with how to implement their design schematics to hardware using modern FPGAs (mostly lab)
- Be familiar with digital circuit design methods
- Be competent in reporting standards (mostly labs)
- Be competent in using laboratory instruments and laboratory methodology (mostly labs)
- Exposure to methodology for critical troubleshooting skills (mostly labs)

## HOW THIS COURSE WORKS

**Mode of delivery:** The lectures will be delivered live, in person, at the scheduled class time, but they will be recorded and available within 24 hours. Thus, there are no required sessions when you must be logged in to Carmen at a scheduled time for the lecture portion. Exams and quizzes will be available for a day, and you can complete them anytime during that day, although the time you are allowed to take it will be finite. For example, once you start the quiz you will have a fixed amount of time to submit it. The laboratory portion is in-person, and you must attend at your assigned time and **ONLY** at your assigned time.

**Pace of activities:** There will be regularly assigned homework, usually after every class. There will also be regularly scheduled mini-midterms, roughly every two weeks. We will call them Minterms, and you will find out why this is such a good name choice during the course. There is no final exam.

**Credit hours and work expectations:** This is a **3-credit-hour course**. According to [Ohio State policy](#), students should expect around 3 hours per week of time spent on direct instruction (instructor content and Carmen activities, for example) in addition to 6 hours of homework (reading and assignment preparation, for example) to receive a grade of (C) average. Note that the lecture portion of this course counts as 2.5 credit hours and the lab as 0.5 credits. Thus, we will have fewer total lectures than a standard three-credit class, see schedule below. The lab is three hours *but there are only seven labs*. There is a minimal amount of out-of-class prep work for the labs.

**Homework:** Homework will generally be assigned after every class. No late homework is accepted because the solutions will be posted automatically directly after the due date.

**Attendance and participation requirements:** The following is a summary of everyone's expected participation:

- **Attending/viewing lectures:** Highly recommended but attendance will not be taken.
- **Attending labs:** In-person, strictly required. Address all lab questions to Prof. Chapman.
- **Office hours: OPTIONAL.** There will be a variety of office hours offered by me and the teaching assistants, offered at scheduled times via zoom. You may attend as many or as few as you like.

## COURSE MATERIALS AND TECHNOLOGIES

### Textbooks

#### REQUIRED

- Fundamentals of Logic Design, Roth and Kinney (any edition). Note that I will be following the book closely, and that it has great practice problems (with answers), study guides, and more.
- The textbook courseware for this course is being provided via CarmenBooks. Through CarmenBooks, students obtain publisher materials electronically through CarmenCanvas, saving them up to 80% per title. The fee for this material is included as part of tuition and is listed as CarmenBooks fee on your Statement of Account. In addition to cost-savings, materials provided through CarmenBooks are available immediately on or before the first day of class. There is no need to wait for financial aid or scholarship money to purchase your textbook.
- Unless you choose to opt-out of the program, you do NOT need to purchase other textbooks for this course. For more information on the program or information on how to opt out, <https://affordablelearning.osu.edu/reducing-textbook-costs-carmenbooks>
- Access this eBook through the CarmenBooks reader link in the course navigation (left-hand navigation ribbon).

## COURSE SCHEDULE

This course has a weird schedule.

- Due dates, reading assignments, etc. will be posted on Carmen as we go.

- The lecture portion of this course is 2.5 credit hours.. **That translates to 36 days of class instead of the usual 43.** We also normally have in-class midterms (2 days), but we will be giving out-of-class midterms, so that leaves 34 days of actual classes. **The last day of the lecture portion of the class will be Wednesday November 16. The labs continue until Friday November 11.**
- The lab portion of this class is 0.5 credit hours. That translates to 7 three-hour labs. The labs will begin in the fourth week of classes (see schedule below) and finish up in week 11.

## Lecture Schedule

Week	Dates	Topics
1	8/24	Class introduction
	8/26	No class
2	8/29	Intro to number systems and conversion
	8/31	Number conversion, binary arithmetic
	9/2	Binary negative numbers
3	9/5	Holiday- no class
	9/7	Negative numbers, binary code
	9/9	Boolean Algebra
4	9/12	Boolean Algebra + <b>MINTERM EXAM 1</b>
	9/14	Boolean Algebra
	9/16	Minterms and Maxterms
5	9/19	Binary adders and subtractors
	9/21	Design using truth tables
	9/23	Design using truth tables
6	9/26	Karnaugh Maps + <b>MINTERM EXAM 2</b>
	9/28	Karnaugh Maps
	9/30	Multi-level gate circuits
7	10/3	Multi-level gate circuits
	10/5	Multi-level gate circuits NAND-NAND Logic
	10/7	Multi-level gate circuits: multiple output logic

8	10/10	Intro to timing diagrams, hazards in combinational logic + <b>MINTERM EXAM 3</b>
	10/12	Intro to timing diagrams, hazards in combinational logic
	10/14	Autumn Break- no class
9	10/17	Decoders and Encoders
	10/19	ROMS and PLAs
	10/21	PLAs
10	10/24	Latches and Flip-Flops + <b>MINTERM EXAM 4</b>
	10/26	Latches and Flip-Flops
	10/28	Latches and Flip-Flops; timing diagrams
11	10/31	Counters
	11/2	Counters
	11/4	Registers
12	11/7	Analysis of clocked sequential circuits + <b>MINTERM EXAM 5</b>
	11/9	Finite state machines, flow diagram
	11/11	Analysis of clocked sequential circuits
13	11/14	Slush in case we fall behind (or new material)
	11/16	Last day of this course (lecture)
	11/18	
14	<b>11/21</b>	<b>MINTERM EXAM 6</b>

## Lab schedule

For detailed lab information, please visit <https://u.osu.edu/ece2060labs/>. Your lab professor is Dr. Chapman. You may or may not meet him. There is a lab Graduate Teaching Assistant (GTA ) whose identity depends on your section. There will also be a small army of lab monitors.

You are responsible for 7 labs.

The lab schedule is as follows:

Day	Meeting Time	Carmen Course #
Monday	8:00-11:00	12274
Wednesday	8:00-11:00	12449 and 9941 (2067)
Wednesday	11:15-2:15	10005
Wednesday	5:45-8:45	10006
Friday	8:00-11:00	10007
Friday	12:40-3:40	10008

DATES	Lab	Report Due	Title
September 23, 26, 28	Lab 1	October 7	Using Quartus Prime and the Intel DE2-115 Development Board
Sept 30, Oct 3, 5	Lab 2	October 17	Introduction to Logic
Oct 7, 17, 18	Lab 3	October 28	ModelSim and Intro to VHDL
October 10, 12, 14	<b>No Lab</b>	<b>NA</b>	<b>Autumn Break Week, NO LABS</b>
October 21, 24, 26	Lab 4	November 4	Latches and Flip-Flops
Oct 28, 31, Nov 2	Lab 5	November 14	Counters
November 4, 7, 9	Lab 6	November 18	The Audio Synthesizer
November 14, 16, 18	Lab 7	November 28	The Simon State Machine, Part 1
November 21, 23, 25	<b>No Lab</b>	<b>NA</b>	<b>Thanksgiving Break Week, NO LABS</b>
Nov 28, 30, Dec 2	Lab 8	December 9	The Simon State Machine, Part 2

## EXAM (MINTERM) SCHEDULE

Exam	Dates
1	September 13
2	September 27
3	October 11
4	October 25
5	November 8
6	November 22

## Course technology

For help with your password, university email, Carmen, or any other technology issues, questions, or requests, contact the Ohio State IT Service Desk. Standard support hours are available at [ocio.osu.edu/help/hours](https://ocio.osu.edu/help/hours), and support for urgent issues is available 24/7.

- **Self-Service and Chat support:** [ocio.osu.edu/help](https://ocio.osu.edu/help)
- **Phone:** 614-688-4357(HELP)
- **Email:** [servicedesk@osu.edu](mailto:servicedesk@osu.edu)
- **TDD:** 614-688-8743
- Navigating Carmen: for questions about specific functionality, see the [Canvas Student Guide](#).

## REQUIRED SOFTWARE

- **Microsoft Office 365:** All Ohio State students are now eligible for free Microsoft Office 365 ProPlus through Microsoft's Student Advantage program. Full instructions for downloading and installation can be found at [go.osu.edu/office365help](https://go.osu.edu/office365help).

## CARMEN ACCESS

You will need to use [BuckeyePass](#) multi-factor authentication to access your courses in Carmen. To ensure that you are able to connect to Carmen at all times, it is recommended that you take the following steps:

- Register multiple devices in case something happens to your primary device. Visit the [BuckeyePass - Adding a Device](#) help article for step-by-step instructions.
- Request passcodes to keep as a backup authentication option. When you see the Duo login screen on your computer, click **Enter a Passcode** and then click the **Text me new codes** button that appears. This will text you ten passcodes good for 365 days that can each be used once.
- Download the [Duo Mobile application](#) to all of your registered devices for the ability to generate one-time codes in the event that you lose cell, data, or Wi-Fi service.

If none of these options will meet the needs of your situation, you can contact the IT Service Desk at 614-688-4357 (HELP) and IT support staff will work out a solution with you.

# GRADING AND FACULTY RESPONSE

## How your grade is calculated

ASSIGNMENT CATEGORY	PERCENTAGE
Homework (we drop the lowest three)	15
Participation	5
Mintervals (mini-midterms) (five, 12% each; there are really six but we drop the lowest one)	60
Lab reports	20

Total	100
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## Late assignments

Late submissions will not be accepted, even if only slightly late. That is because the solutions are automatically posted. Please refer to Carmen for due dates.

## Missed homework

The lowest three homework grades will be dropped.

## Contested grading

- If you wish to dispute a grade on an assignment, you have one week from the date the grades were released to report it. You can request a regrade in GradeScope. After one week, we will NOT regrade any assignment.

## Missed exams

If you must miss an exam because of a serious and unavoidable conflict, you may arrange to take a make-up exam *in advance*, without penalty. You must let me know no later than one week before the scheduled exam.

- If you miss an exam due to an unexpected event such as illness, you must let Prof. Anderson know as soon as possible, for example the day of the exam, when you realize you are too sick to take it. If your illness is not so severe that that you need medical attention, please do not see a medical professional just to get a note. I can provide Statement of Illness for you to self-report.
- **The lowest exam score will be dropped.**

## Grading scale (in the absence of curving)

93–100: A  
 90–92.9: A-  
 87–89.9: B+  
 83–86.9: B  
 80–82.9: B-  
 77–79.9: C+  
 73–76.9: C  
 70–72.9: C-  
 67–69.9: D+  
 60–66.9: D  
 Below 60: E



- I expect letter grades will be assigned according to the table above.
- I will not make a curve adjustment that results in grades lower than shown in this table.
- Should I determine that a curve adjustment is necessary (e.g. I made an exam that was too long or too difficult) I may adjust the cut points for the letter grades to lower percentages. I do not make decisions on any curve adjustment until the end of the semester, after all assignments are graded.
- There is NO rounding of grades up to the next grade.
- There is no such thing as extra credit.

## LABORATORIES

The laboratories run independently from the lecture. For the most part, Prof. Anderson does not know what's going on in there at any given time.

**FOR ALL LABORATORY INFORMATION PLEASE VISIT <https://u.osu.edu/ece2060labs/>**

## Instructor feedback and response time

I am providing the following list to give you an idea of my intended availability throughout the course. (Remember that you can call **614-688-HELP** at any time if you have a technical problem.)

- **Grading and feedback:** You can generally expect feedback within **7 days**.
- **Email:** I will reply to emails within **24 hours Sundays-Thursdays. Replying on weekends or holidays may happen but is not promised.**

## OTHER COURSE POLICIES

### ECE Diversity and Antiracism Statement

Success in engineering requires multiple perspectives, a wide range of expertise, and diverse backgrounds to solve societal problems and advance science. To be a student, faculty, or staff member in the Department of Electrical and Computer Engineering means being innately tied to a rich tapestry of diverse cultures, ethnicities, and backgrounds through people from all over the world. ECE faculty and staff aspire to hear the voices of those disenfranchised by racism. As educators and mentors within ECE, we will promote a culture of care. We are working to become better allies to create a safer society for everyone, and to invite all of our students, staff, and faculty to be courageous, take a stand against racism, and condemn any form of racial injustice. Not only do we help cultivate diversity in ECE, we celebrate it.

*The Office of Institutional Equity (OIE) at Ohio State responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit [equity.osu.edu](http://equity.osu.edu) or email [equity@osu.edu](mailto:equity@osu.edu).*

### Counseling and Consultation Services

As a student you may experience a range of issues that can cause barriers to learning, such as strained

relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling **614-292-5766**. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on-call counselor when CCS is closed at **614-292-5766** and 24-hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at **1-800-273-TALK** or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

*The ECE website also offers a listing of [student wellness and support services](#) available at Ohio State.*

## Discussion and communication guidelines

The following are my expectations for how we should communicate as a class. Above all, please remember to be respectful and thoughtful.

- **Writing style:** While there is no need to participate in class discussions as if you were writing a research paper, you should remember to write using good grammar, spelling, and punctuation. A more conversational tone is fine for non-academic topics.
- **Tone and civility:** Let's maintain a supportive learning community where everyone feels safe and where people can disagree amicably. Remember that sarcasm doesn't always come across online. Also, I will not respond to any correspondence that contains obscenities or is rude. You are learning to be a professional.
- **Citing your sources:** When we have academic discussions, please cite your sources to back up what you say. For the textbook or other course materials, list at least the title and page numbers. For online sources, include a link.
- **Backing up your work:** Consider composing your academic posts in a word processor, where you can save your work, and then copying into the Carmen discussion.

## Academic integrity policy

### POLICIES FOR THIS ONLINE COURSE

- **Homework:** You are permitted and encouraged to work with others on the homework assignments. Each student should write up their own solutions independently, however.
- **Quizzes and exams (minterms are exams):** The rules will be clearly stated for each. Generally they will be open notes, where it will be specified whether those notes are an index card or whatever. You may not under any circumstances work with others, inside or outside of our class, on these assignments.
- **Reusing past work:** You are always prohibited in university courses from turning in work from a past class to your current class, even if you modify it.

- **Falsifying research or results:** All research you will conduct in this course is intended to be a learning experience; you should never feel tempted to make your lab results more successful than they were.
- **Collaboration and informal peer-review:** The course includes many opportunities for formal collaboration with your classmates. While study groups are encouraged, remember that comparing answers on a quiz or exam is not ever permitted. If you're unsure about a particular situation, please feel free just to ask ahead of time.

## OHIO STATE'S ACADEMIC INTEGRITY POLICY

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University and the Committee on Academic Misconduct (COAM) expect that all students have read and understand the university's *Code of Student Conduct*, and that all students will complete all academic and scholarly assignments with fairness and honesty. Students must recognize that failure to follow the rules and guidelines established in the university's *Code of Student Conduct* and this syllabus may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the university or subvert the educational process." Examples of academic misconduct include (but are not limited to) plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Ignorance of the university's *Code of Student Conduct* is never considered an excuse for academic misconduct, so I recommend that you review the *Code of Student Conduct* and, specifically, the sections dealing with academic misconduct. Be aware that I have just rotated off the COAM committee after many years, so I have a great deal of experience with it.

**If I suspect that a student has committed academic misconduct in this course, I am obligated by university rules to report my suspicions to the Committee on Academic Misconduct.** If COAM determines that you have violated the university's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in this course and suspension or dismissal from the university.

If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Other sources of information on academic misconduct (integrity) to which you can refer include:

- The Committee on Academic Misconduct web pages ([COAM Home](#))
- *Ten Suggestions for Preserving Academic Integrity* ([Ten Suggestions](#))
- *Eight Cardinal Rules of Academic Integrity* ([www.northwestern.edu/uacc/8cards.htm](http://www.northwestern.edu/uacc/8cards.htm))

## Copyright disclaimer

The materials used in connection with this course may be subject to copyright protection and are only for the use of students officially enrolled in the course for the educational purposes associated with the course. Copyright law must be considered before copying, retaining, or disseminating materials outside of the course.

## Health and safety requirements:

All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (<https://safeandhealthy.osu.edu>) . which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will be warned first and disciplinary actions will be taken for repeated offenses.

## Statement on Title IX

All students and employees at Ohio State have the right to work and learn in an environment free from harassment and discrimination based on sex or gender, and the university can arrange interim measures, provide support resources, and explain investigation options, including referral to confidential resources. If you or someone you know has been harassed or discriminated against based on your sex or gender, including sexual harassment, sexual assault, relationship violence, stalking, or sexual exploitation, you may find information about your rights and options at [titleix.osu.edu](http://titleix.osu.edu) or by contacting the Ohio State Title IX Coordinator at [titleix@osu.edu](mailto:titleix@osu.edu). Title IX is part of the Office of Institutional Equity (OIE) at Ohio State, which responds to all bias-motivated incidents of harassment and discrimination, such as race, religion, national origin and disability. For more information on OIE, visit [equity.osu.edu](http://equity.osu.edu) or email [equity@osu.edu](mailto:equity@osu.edu).

## Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you find yourself feeling isolated, anxious or overwhelmed, please know that there are resources to help: [ccs.osu.edu](http://ccs.osu.edu). You can reach an on-call counselor when CCS is closed at (614) 292-5766 and 24 hour emergency help is also available through the 24/7 National Prevention Hotline at 1-(800)-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org). The Ohio State Wellness app is also a great resource available at [go.osu.edu/wellnessapp](http://go.osu.edu/wellnessapp).

# ACCESSIBILITY ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

## Requesting accommodations

The university strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability including mental health, chronic or temporary medical conditions, please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your

accommodations so that they may be implemented in a timely fashion. **SLDS contact information:** [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; 098 Baker Hall, 113 W. 12<sup>th</sup> Avenue.

## Accessibility of course technology

This online course requires use of Carmen (Ohio State's learning management system) and other online communication and multimedia tools. If you need additional services to use these technologies, please request accommodations with your instructor.

- [CarmenCanvas accessibility](#)
- Streaming audio and video
- [CarmenZoom accessibility](#)
- Collaborative course tools