

Department of Electrical and Computer Engineering

University of Massachusetts, Amherst

ECE 124: Introduction to Digital and Computer Systems

Spring 2023

Catalog Data: The theory of digital circuits and computer systems, stressing general techniques for the analysis and synthesis of combinational and sequential logic systems. Open to ENGIN, pre-ENGIN, EE and CSE majors.

Prerequisite None

Instructors Professor Yeonsik Noh (lectures and discussions)

Textbook M.Morris Mano, Michael D.Ciletti, *Digital Design*, 6th Ed., Pearson, 2018.

Objectives

Introduction to digital design and its application in the field of Electrical and Computer Engineering. Students completing this course will be able to design and analyze digital electronic circuits. They will learn the basics of Boolean algebra that forms the theoretical foundation on which circuits are built; how information can be represented in a digital system and what common logic functions are used to process it; how to aggregate circuits into larger components to create complex designs. Students will experience the convergence of these goals at the end of the semester when the functionality of a simple microprocessor is discussed.

Topics

- Number Systems and Number Codes
- Binary Logic, Boolean Algebra, and Boolean Functions
- Canonical Forms and Duality
- Karnaugh Map
- Incompletely Specified Functions
- NAND and NOR Implementation of Digital Logic
- Combinational Circuits (Binary Adders, Subtractors, Multipliers, Decoders and Encoders, Multiplexers, and Comparators)
- Sequential Circuits (Latches and Flip-Flops, Registers, Counters)
- Sequential Circuit Analysis
- Finite State Machine, Sequential Circuit Design
- Timing Analysis
- Memory (RAM, ROM)
- Programmable Logic
- Arithmetic Logic Unit (ALU)
- A Simple Microprocessor
- Verilog HDLs (hardware description languages)

Schedule Weekly Student Workload: three 50-min lectures + one 50-min discussion.

Lectures: MoWeFr 1:25 – 2:15 pm (2/6/2023 – 5/17/2023) at Thompson Hall 102

Discussions: 1) Tu 10:00 am - 10:50 am (50 mins) at Engineering Laboratory room 323
2) Tu 11:30 am - 12:20 pm (50 mins) at Engineering Laboratory room 323
3) Tu 02:30 pm - 03:20 pm (50 mins) at Engineering Laboratory room 323

Grading Policy Exam I: **15%**, Exam II: **20%**, Final Exam: **20%**,
Homework: **40%**, Discussion notes: **3%**, and Participation in survey: **2%**

Exams (3 times)

- **Given time for all exams is 60 minutes.**
- Mid-term Exam I (Chapters 1, 2, and 3)
 - **March 9, 2023 (Thursday), 7 – 8 pm (60 mins) at Thompson Hall 102**
- Mid-term Exam II (Chapters 2 through 4)
 - **April 13, 2023 (Thursday), 7 – 8 pm (60 mins) at Thompson Hall 102**
- Final Exam (Chapters 2 through 7)
 - **May 19, 2023 (Friday), 1 – 2 pm (60 mins) at Thompson Hall 102**

Homework (6 (six) times)

- Homework assignments will be **posted on Moodle** on designated Friday morning.
 - 2/24, 3/10, 3/24, 3/31, 4/21, and 5/5
- **Only 5 (five) high-scored homework assignments** will be counted for the grading.
- Homeworks are due on Gradescope ***the following Friday before midnight Eastern Time***. See the homework submission guidelines for instructions on how to upload your work on Gradescope.
- There may be **an additional Verilog assignment** to cover one of the missed homework.

PLEASE NOTE that the late homework will not be accepted. You will not be able to submit your homework on Gradescope after the deadline. In case of any extenuating circumstances, I will give you a **1-day extension** to complete the homework. You will then email the homework to the instructor with an explanation of your situation and proof when applicable. (e.g., doctor's note for health-related extensions, etc.)

Grades

A	4.0	92.00- 100	AUD-Audit
A-	3.7	89.00- 91.99	INC-Incomplete
B+	3.3	86.00- 88.99	IF-Incomplete Failure
B	3.0	82.00- 85.99	IP-In Progress (for thesis and dissertation courses only)
B-	2.7	79.00- 81.99	NR- Not Reported DR- Drop
C+	2.3	73.00- 78.99	SAT-Satisfactory withdraw
C	2.0	68.00- 72.99	WP- Withdraw passing
C-	1.7	66.00- 67.99	WF- Withdraw Failing
D+	1.3	62.00- 65.99	
D	1.0	60.00- 61.99	
F	0.0	0- 60	

Grading via Gradescope (<https://www.gradescope.com>, Course Entry Code: 8NZDDV)

Grading for homework and exams will be conducted via Gradescope which is a website-based grading solution. Students have to create their accounts and enroll in the course by the code (8NZDDV). Homework will be posted on the course Moodle every Friday except where otherwise indicated. Students are supposed to upload their solution on the course in Gradescope by due. Please note that students should mark their final answer.

Professional Component: Credits of engineering science: 3
Credits of design: 1

Relationship of course objectives to program outcomes

Program outcomes
a. Able to apply knowledge of mathematics, science, and engineering
b. Able to design and conduct experiments, as well as to analyze and interpret data
c. Able to design a system, component, or process to meet desired needs within realistic constraints
d. Able to function on multi-disciplinary teams
e. Able to identify, formulate, and solve engineering problems
f. Understands professional and ethical responsibility
g. Able to communicate effectively
h. Understands the impact of engineering solutions in a global, economic, environmental, and societal context
i. Recognizes the need for, and is able to engage in, life-long learning
j. Has knowledge of contemporary issues
k. Able to use the techniques, skills and modern engineering tools necessary for engineering practice

Contact Information/ Office Hours

Teaching team member (Office)	email
Prof. Yeonsik Noh (Skinner Hall 06)	ynoh@umass.edu
Abu Bony Amin	abubonyamin@umass.edu
Sina Razaghi	srazaghi@umass.edu
Jiteshri Dasari	jdasari@umass.edu
Cole Feely (Marcus 207)	cfeely@umass.edu
Redwan Rahman (Marcus 207)	rrahman@umass.edu
Mandy Peng (Marcus 207)	chifangpeng@umass.edu

Office Hours	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Prof. Noh			3 – 5 (p)				
C. Feely		6 – 8 (p)	6 – 8 (p)			1 – 2 (p)	
R.Rahman				6:30 – 7:30 (p)	6 – 8 (p)		11(a) – 12(p)
M. Peng	5 – 6:30 (p)			5 – 6:30 (p)			2 – 3 (p)

Zoom Address for office hours during weekend	
Cole Feely	https://umass-amherst.zoom.us/j/2456235450
Redwan Rahman	https://umass-amherst.zoom.us/j/6966330744
Mandy Peng	https://umassamherst.zoom.us/j/4131257026

Piazza (Online platform to ask questions) links: This term we will be using ONLY Piazza for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TA, and myself. *Rather than emailing questions to the teaching team,* I encourage you to post your questions for homework, lectures, discussions and exam on Piazza. If you have any problems or feedback for the developers, email team@piazza.com.

- Find our class signup link at: <https://piazza.com/umass/spring2023/ece124> (Code: **8NZDDV**)

Health and Wellbeing Success in this course and the College of Engineering depends heavily on your personal health and wellbeing. Recognize that stress is an expected part of the college experience, and it often can be compounded by unexpected setbacks or life changes outside the classroom. I strongly encourage you to reframe challenges as an unavoidable pathway to success. Reflect on your role in taking care of yourself throughout the term, before the demands of exams and projects reach their peak. Please feel free to reach out to me about any difficulty you may be having that may impact your performance in your courses or campus life as soon as it occurs and before it becomes too overwhelming. I encourage you to contact support services on campus that stand ready to assist you. Within the College, you may reach out to your academic advisor, the Office of Student Affairs (126 Marston) or the Office of Community Equity and Inclusion (128 Marcus). You can learn about the confidential mental health services available on campus by calling the Center for Counseling and Psychological Health (CCPH) at 413.545.2337 or visiting their website at umass.edu/counseling. There are many other resources on campus for students facing personal, financial or life challenges to find support, stay in school, and graduate. See a comprehensive list at umass.studentlife/single-stop. Help is always available. Please reach out for support finding the resources you need.

Disability Accommodation and Inclusive Learning Statement Your success in this class is important to me. We all learn differently and bring different strengths and needs to the class. The University of Massachusetts Amherst is committed to making reasonable, effective and appropriate accommodations to meet the needs of students with disabilities and help create a barrier-free campus. If you have a qualifying disability and require accommodations while participating in this course, please work with Disability Services to have an accommodation letter sent to me in a timely manner. If you have a disability but are not yet affiliated with Disability Services, please register with Disability Services (161 Whitmore Administration building; phone 413-545-0892). Information on services and materials for registering are also available on their website www.umass.edu/disability. If you are eligible for exam accommodations, your exams will be administered by the exam proctoring center. Contact Disability Services immediately, and comply with their exam scheduling policies, including the requirement that you book your exams at least seven days in advance of the exam date. *It is incumbent upon you contact me during the first few weeks of the semester, or shortly following registration with Disability Services, to ensure that your accommodations are being sufficiently met, including extra time and note-taking access, as applicable.* Finally, beyond disability accommodations, if there are aspects of the course that prevent you from learning or make you feel excluded, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course.

Integrity There is no place for a dishonest engineer! Please read and be aware of the academic honesty policy: http://www.umass.edu/dean_students/academic_policy. While this isn't something that should arise, it is something we should be aware of and discuss as a class, as integrity is a core value of the engineering profession.

Inclusivity The diversity of the participants of this course is a valuable source of ideas, problem solving strategies, and engineering creativity. If you feel that your contribution is not being valued or respected for any reason, please speak with me privately. If you wish to communicate with someone else in the College, speak with Assistant Dean Dr. Paula Rees (rees@umass.edu, 413.545.6324, 128b Marcus Hall). You may also submit anonymously through the College of Engineering Climate Concerns and Suggestions on-line form (<https://tinyurl.com/UMassEngineerClimate>) and/or the Positive and Negative Classroom Experience online form (<https://tinyurl.com/UMassEngineerClassroom>). We are all members of an academic community with a shared responsibility to cultivate a climate where all students/individuals are valued and where both they and their ideas are treated with respect.

Pronouns and Names Everyone has the right to be addressed by the name and pronouns that they use for themselves. Students can indicate their preferred/chosen first name and pronouns on SPIRE, which appear on class rosters. Please let me know what name and pronouns I should use for you if they are not on the roster. A student's chosen name and pronouns are to be respected at all times in the classroom. To learn more, read the Intro Handout on Pronouns: https://www.umass.edu/stonewall/sites/default/files/pronouns_intro.pdf

Title IX Any conduct that has the purpose or effect of unreasonably interfering with an individual's performance by creating an intimidating, hostile, or sexually offensive educational, academic, residential, or working environment is considered sexual harassment. Faculty have the responsibility to inform students of the resources and reporting options relevant to reporting an incident of sexual assault, sexual harassment, relationship violence or stalking for all genders. You may go to the Title IX webpage at <http://www.umass.edu/titleix/> and the Sexual & Relationship Violence Resource Guide at (https://www.umass.edu/titleix/sites/default/files/documents/sexual_violence_resource_guide-fall2019.pdf) to find more information about resources and reporting options. Please reach out to me if you would like assistance connecting with any of these resources/options. You may also contact William

Brady, the Interim Title IX Coordinator by email at wdb Brady@umass.edu or by phone at (413) 545-6204 if they have any questions or want to make a report, file a complaint, find out about resources and/or academic support.