

CSCE 2114 Digital Design

Catalog Description:

This course introduces the many levels of abstraction that enable today's digital computing systems. It explores design at the layers of a computing platform from switches and wire to a programmable machine. It introduces the hardware aspects of digital computers, logic gates, flip-flops, reduction, finite state machines, combinational and sequential logic design, digital systems, software design tools, hardware description language (VHDL), and implementation technologies.

Corequisite: Lab component.

Prerequisites: MATH 2554 or MATH2445: Calculus I (with a grade of "C" or better)

Required Textbook:

- "Fundamentals of Digital Logic with VHDL Design," by Stephen Brown and Zvonko Vranesic, Third Edition, McGraw Hill, ISBN: 978-0077221430, MHID 0-07352953-2

Recommended Reference:

- "Digital Design: Principles and Practices," by John F. Wakerly, Fourth Edition, Pearson, ISBN: 978-0131863897
- "Advanced Digital Design With The Verilog HDL," by Michael D Clietti, Second Edition, Pearson, ISBN: 978-0136019282
- "Rapid Prototyping of Digital Systems SOPC Edition", by Hamblen, Hall, and Furman, Springer, ISBN: 978-0387726700

Goals: The goal of the class is to develop the ability to apply knowledge of digital logic to the design of a microprocessor and operate an advanced CAD software application.

Topics covered:

- Design Concepts
- Intro. to Logic Circuits
- Implementation Technology
- Optimized Implementation of Logic Functions
- Number Representation
- Arithmetic Circuits
- Combinational Circuits
- Flip-Flops, Registers, and Counters
- Synchronous Sequential Circuits
- Asynchronous Sequential Circuits
- Digital Systems
- Computer Aided Design Tools
- Breadboard Techniques
- Basic Logic Circuits
- Sequential Circuits

- CAD Tools
- FPGA Implementations

Class/laboratory schedule:

Meets either 3 times a week for 50 minutes or 2 times a week for 1 hour 20 minutes for 15 weeks. Lab meets once a week for 2 class periods. Laboratories meet 8 times for 2 hours per lab.

Evaluation Methods and Grading:

Grades in this class will be determined by a weighted average of the following:

Attendance and Participation: 10%
Homework: 20%
Labs: 15%
Two midterm exams: 25%
Final Exam (cumulative): 30%

Only exam grades may be curved. We will use the following scale to assign final grades:

A: [90, 100] B: [80, 90), C: [70, 80), D: [60, 70), F: below 60%

Special note: I do not inflate grades. Grade inflation is a kind of lying about your ability. But, for a variety of reasons, some faculty members find it useful to inflate grades, and so do some of their students. Thus, in the remote case that you expect me to inflate your grade, drop this course now or change your expectations. Based on this philosophy, I do not touch your grade unless there is a mistake, and your TA has full authority on your assignment and lab grading. Zero is always a zero even after curving.

Students must get a 60% or better on labs and homework. Hence, an overall average greater than 60% may still result in a failure in some cases. For homework and labs, the late penalty is 10% per day. No credit will be given if solutions are released.

Academic Honesty:

As a core part of its mission, the University of Arkansas provides students with the opportunity to further their educational goals through programs of study and research in an environment that promotes freedom of inquiry and academic responsibility. Accomplishing this mission is only possible when intellectual honesty and individual integrity prevail.

Each University of Arkansas student is required to be familiar with and abide by the University's 'Academic Integrity Policy' which may be found at honesty.uark.edu/policy. Students with questions about how these policies apply to a particular course or assignment should immediately contact their instructor.

Attendance Policy and COVID Considerations

The University of Arkansas will primarily offer in-person instruction in the 2021-2022 academic year. Most of the university's academic programs have essential in-person components. Class

attendance is the responsibility of each student and expected. If you are absent, it is your responsibility to obtain assignments, notes, and any class information given.

For any valid excused absence request, you must obtain a written proof before the class. If you have COVID-19 symptoms, DO NOT COME TO CLASS. Just send the instructor an email and your first absence in the semester will be excused. If you must quarantine, self-isolate, or miss more than one class during the semester because of COVID-19 or other illness, obtain a doctor's note or any proof record after you recovers to avoid attendance penalties.

Class information (lecture slides, recordings) will be provided to students who must miss class due to COVID-19 or other excused absences on a short-term basis. Contact the CEA Center to determine if you think that you have a disability that permits you from participating in person. Accommodations will be made accordingly.

All students are expected to take the exams in the classroom or CEA facilities. If a student cannot do so, permission to take the exam online or skip one midterm can be granted on a case-by-case basis with written proof. All students must take the final to complete the course with no exception.

Mask Policy

The Board of Trustees for the U of A System reinstated its requirement for all campuses that masks be worn indoors where 6-feet of distance can't be assured in response to the high number of cases of the very contagious COVID-19 variant in Arkansas. The U of A is one of nine SEC schools with mask requirements at this time. This requirement is in place until further notice. You must wear a mask while in class for your protection and for the protection of those around you. If you do not have a mask, please let your instructor know, and a mask will be provided for you; there are also disposable masks available in most classrooms across campus. Students who do not comply with the mask requirement will be reported to the office of the Dean of Students.

Vaccinations

The UA strongly encourages everyone who is eligible and able, to become fully vaccinated. A vaccination incentive program has been implemented on the Fayetteville campus. We fully understand that there are students who do not wish to receive a vaccination at this time, can't receive a vaccination for medical or other reasons, and others who simply do not want to participate. While state law prohibits requiring it, COVID-19 vaccination is encouraged as our primary means of mitigating the spread of the virus. Those who receive vaccination protect themselves from serious illness, hospitalization, and in some cases even death, while protecting those around them, supporting our plans to have a more traditional in-person fall semester and hopefully avoid interruptions in the school year.

Technology/Software Requirements

Students must own or rent a mobile computing device (laptop/ipad) for this course. Access to a reliable Internet connection is required for this course. A problem with your Internet access may not be used as an excuse for late, missing, or incomplete coursework. If you experience problems with your Internet connection while working on this course, it is your responsibility to find an alternative Internet access point, such as a public library or Wi-Fi hotspot.

Recording of Class Lectures

By attending this class, student understands the course may be recorded and consents to being recorded for official university educational purposes. Be aware that incidental recording may also occur before and after official class times.

Unauthorized Use and Distribution of Class Materials

Third parties may attempt to connect with you to buy your notes and other course information from this class. Instructors may record the class and make the class available to students through Blackboard. These recordings may be used by students ONLY for the purposes of the class.

I will consider distributing course materials to a third party without my authorization a violation of my intellectual property rights and/or copyright law as well as a violation of the University of Arkansas' academic integrity policy. Students may not download, store, copy, alter, post, share, or distribute in any manner all or any portion of the class recording, e.g. sharing a clip of a class recording to one person is a violation of this provision.

Continued enrollment in this class signifies your intent to abide by the policy. In situations where class materials are used to gain an academic advantage, it may also be considered a violation of the University of Arkansas' academic integrity policy.

Emergency Preparedness:

Many types of emergencies can occur on campus; instructions for specific emergencies such as severe weather, active shooter, or fire can be found at emergency.uark.edu. The University of Arkansas has a campus-wide alert system for any hazardous conditions that may arise on campus. To learn more and to sign up: <http://safety.uark.edu/emergency-preparedness/emergency-notification-system/>

Inclement Weather:

If the university is officially closed, class will not be held. When the university is open, you are expected to make a reasonable effort to attend class, but not if you do not feel that you can get to campus safely. Any changes to due dates or the class schedule will be communicated via email to your uark email address.

Academic Support:

University of Arkansas [Academic Policy Series 1520.10](#) requires that students with disabilities are provided reasonable accommodations to ensure their equal access to course content. If you have a documented disability and require accommodations, please contact me privately at the beginning of the semester to make arrangements for necessary classroom adjustments. Please note, you must first verify your eligibility for these through the Center for Educational Access (contact 479-575-3104 or visit <http://cea.uark.edu> for more information on registration procedures).

Relationship of Course to Computer Engineering Program Student Outcomes:

- (a) An ability to apply knowledge of mathematics, science, and engineering.
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data.

- (e) An ability to identify, formulate, and solve engineering problems.
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Relationship of Course to Computer Science Program Student Outcomes:

- (a) An ability to apply knowledge of computing and mathematics appropriate to the discipline.
- (b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution.
- (c) An ability to design, implement and evaluate a computer-based system, process, component or program to meet desired needs.
- (i) An ability to use current techniques, skills, and tools necessary for computing practices.