

CSE 4357/5357 ADVANCED DIGITAL LOGIC DESIGN

Spring 2021

Instructor Information

Instructor(s)

Bill Carroll, PhD, PE, Professor of Computer Science and Engineering; Chair, UTA Faculty Senate.

Office Number

ERB 521

Office Telephone Number

817-272-3785 (CSE Department)

Email Address

carroll@uta.edu. This email is your primary means for contacting me. I respond promptly but not 24x7.

Faculty Profile

<https://www.uta.edu/profiles/bill-carroll>

Office Hours

MTuWTh 3:30 to 5:30 PM, or by appointment, or chance. During COVID-19, office hours will be held on MS Teams. I'll send you an invitation, so you can join anytime during these hours. Additional help sessions will be scheduled as needed.

Lab TA/Grader – None

Course Information

Section Information

CSE 4357-001 (lecture) TuTh 5:30 to 6:50 PM on MS Teams

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Time and Place of Class Meetings

Lecture: TuTh 5:30 to 6:50 PM on MS Teams. Lectures will be delivered synchronously online and you are expected to attend. Attendance will be taken on a regular basis. Exams will be given on-campus face-to-face. This is Hybrid 1 modality.

Labs: There is no formal lab. However, you may find it convenient to work on assignments in ERB 127. The lab will be open several hours per week and you may use it when it's available. You must abide by COVID-19 protocols, and students in formal labs have priority over lab and bench space.

Description of Course Content

CSE 4357/5357 Advanced Digital Logic Design -- Hierarchical organization, design, simulation, implementation, and testing of digital systems. Industrial standard computer-aided design tools including hardware description languages (HDLs), field-programmable gate arrays (FPGAs), and other prototyping hardware and software will be employed. Design of arithmetic and other algorithmic processes will be covered. A term project will be required. Prerequisite: C or better in CSE 3442.

COURSE OBJECTIVES

COURSE OBJECTIVES -- You will learn the concepts, methods, and technologies needed to analyze, specify, design, build, and test advanced digital logic circuits using programmable logic devices. You will use your knowledge and skills to design the components of a high-speed, four-function (add, subtract, multiply, and divide), fixed-point arithmetic logic unit (ALU). Finally, you will complete a term project that integrates the components to realize the ALU on a DE1-SoC development board.

Student Learning Outcomes

By the end of the course, you will have demonstrated an ability to

1. Apply your knowledge of electrical and electronic circuits, digital logic, and microprocessors to the design of advanced digital systems.
2. Design digital systems that meet functional requirements within realistic timing and energy constraints.
3. Use modern industry standard design tools, such as, Verilog, Quartus Prime, ModelSim, and the DE1-SoC development board.

Required Textbooks and Other Course Materials

1. (Required) Ciletti, *Advanced Digital Design with the Verilog HDL, Second Edition*, Pearson, 2011.
2. (Recommended) Lee, *Advanced Digital Logic Design*, Nelson (Thomson), 2006.
3. (Recommended) Nelson, Carroll, Nagle, and Irwin, *Digital Logic Circuit Analysis and Design, Second Edition* Pearson eText, 2021, ISBN 9780135305706 or ISBN 9780135297070.

Descriptions of major assignments and examinations

There will be two face-to-face, on campus examinations (February 23, April 6), regular lab-oriented assignments, and a term project that will be due at the end of the semester. Please see course calendar for more details.

Technology Requirements

MS Teams, Canvas, and Respondus Lockdown Browser will be used in the course. You will also need a laptop computer capable of running Windows applications including MS Word, Excel, and Intel Quartus II Version 18.1 (64-bit) CAD software. You will need a webcam, phone/camera stand, and access to a printer and scanner.

Handouts and Course Materials

All assignments, handouts, and course materials will be posted on Canvas, <https://uta.instructure.com/>.

Grading Information

Grading

A: 100-90, B: 89-80, C: 79-70, D: 69-60, F: 59-0 with points computed as follows.

$$0.25*\text{Exam1}+0.25*\text{Exam2}+0.25*\text{Assignments}+0.25*\text{TermProject}$$

Students not completing one or more of these requirements may receive an Incomplete (I) or F in the course. Students not completing the term project will receive a D or an F in the course. Late assignments will generally not be accepted.

Make-up Exams

Make up of missed examinations and assignments will be handled case-by-case and, generally, be approved only if sufficient justification can be made and documented. Requests for make-up must be made to the instructor within one week of the missed work's due date.

Expectations for Out-of-Class Study

Beyond the time required to attend each class meeting, students enrolled in this course should expect to spend at least an additional 12 hours per week of their own time in course-related activities, including reading required materials, completing assignments, preparing for exams, etc.

Grade Grievances

Any appeal of a grade in this course must follow the procedures and deadlines for grade-related grievances as published in the current University Catalog. For undergraduate courses, see [Undergraduate Grading Policies](#); for graduate courses, see [Graduate Grading Policies](#). For student complaints, see [Student Complaints](#).

Course Schedule*

1/19,21: Course overview, programmable logic, review of combinational logic. Review of basic Verilog.
1/26,28: Review of Quartus Prime 18.1. High-speed adders.

2/2,4: Review of sequential logic. Review of Verilog models of sequential machines.

2/9,11: Test benches. ModelSim.

2/16,18: FPGA organization and architecture. Quartus Prime processes.

2/23: **Examination 1. (SH 103)**

2/25: Quartus Prime analysis tools.

3/2,4: Basic multipliers.

3/9,11: High-speed multipliers.

3/16,18: *Spring Break*.

3/23,25: Pipelined functional units.

3/30,4/1: Dividers.

4/6: **Examination 2. (SEIR 194)**

4/8: Post synthesis design tasks.

4/13,15: Timing analysis.

4/20,22: ALU design.

4/27,29: Project work.

5/4: Project work.

*** Subject to change as necessary to maintain effective pedagogical pace and topical coverage.**

Institution Information

UTA students are encouraged to review the below institutional policies and informational sections and reach out to the specific office with any questions. To view this institutional information, please visit the [Institutional Information](https://resources.uta.edu/provost/course-related-info/institutional-policies.php) page (<https://resources.uta.edu/provost/course-related-info/institutional-policies.php>) which includes the following policies among others:

- Drop Policy
- Disability Accommodations
- Title IX Policy
- Academic Integrity
- Student Feedback Survey
- Final Exam Schedule

Additional Information

Mandatory Face Covering Policy

All students and instructional staff are required to wear facial coverings while they are on campus, inside buildings and classrooms. Students that fail to comply with the facial covering requirement will be asked to leave the class session. If students need masks, they may obtain them at the Central Library, the E.H. Hereford University Center's front desk or in their department. Students who refuse to wear a facial covering in class will be asked to leave the session by the instructor, and, if the student refuses to leave, they may be reported to UTA's Office of Student Conduct.

Academic Integrity

Students enrolled in UT Arlington courses are expected to adhere to the UT Arlington Honor Code.

I pledge, on my honor, to uphold UT Arlington's tradition of academic integrity, a tradition that values hard work and honest effort in the pursuit of academic excellence.

I promise that I will submit only work that I personally create or contribute to group collaborations, and I will appropriately reference any work from other sources. I will follow the highest standards of integrity and uphold the spirit of the Honor Code.

UT Arlington faculty members may employ the Honor Code as they see fit in their courses, including (but not limited to) having students acknowledge the honor code as part of an examination or requiring students to incorporate the honor code into any work submitted. Per UT System *Regents' Rule* 50101, §2.2, suspected violations of university's standards for academic integrity (including the Honor Code) will be referred to the Office of Student Conduct. Violators will be disciplined in accordance with University policy, which may result in the student's suspension or expulsion from the University.

Attendance

At The University of Texas at Arlington, taking attendance is not required but attendance is a critical indicator of student success. Each faculty member is free to develop his or her own methods of evaluating students' academic performance, which includes establishing course-specific policies on attendance. As the instructor of this section, I expect you to attend class and attendance will be checked on a regular basis. Those with excessive absences from the lecture and/or laboratory may have their final grade reduced appropriately. However, while UT Arlington does not require instructors to take attendance in their courses, the U.S. Department of Education requires that the University have a mechanism in place to mark when Federal Student Aid recipients "begin attendance in a course." UT Arlington instructors will report when students begin attendance in a course as part of the final grading process. Specifically, when assigning a student a grade of F, faculty report must the last date a student attended their class based on evidence such as a test, participation in a class project or presentation, or an engagement online via Canvas. This date is reported to the Department of Education for federal financial aid recipients.

The lecture section of this course will be taught in Hybrid 1 modality meaning that lectures will be taught synchronously online and examinations will be given face-to-face on campus. You are expected to attend the lectures. The laboratory sections will be taught in Hybrid 4 modality which means that some lab assignments will be conducted remotely and others will require face-to-face on-campus demonstration of some work.

Cell Phones and Wireless devices

Please refrain from using cell phones during class times. All electronic devices must be powered off during examinations. Use of tablets or laptops for viewing class materials is permitted.

Lab Safety Training

Students registered for this course must complete all required lab safety training prior to entering the lab and undertaking any activities. Once completed, Lab Safety Training is valid for the remainder of the same academic year (i.e., Fall through Summer II) and must be completed anew in subsequent years. There are no exceptions to this University policy. Failure to complete the required training will preclude participation in any lab activities, including those for which a grade is assigned.

Emergency Exit Procedures

Should we experience an emergency event that requires evacuation of the building, students should exit the room and move toward the nearest exit, which is located straight ahead as you exit ERB 126 and 127. Please refer to evacuation route maps in each room for more details. When exiting the building during an emergency, do not take an elevator but use the stairwells instead. Faculty members and instructional staff will assist students in selecting the safest route for evacuation and will make arrangements to assist individuals with disabilities.

Student Success Programs

UT Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. Resources include tutoring by appointment, drop-in tutoring, etutoring, supplemental instruction, mentoring (time management, study skills, etc.), success coaching, TRIO Student Support Services, and student success workshops. For additional information, please email resources@uta.edu, or view the Maverick Resources website.

The IDEAS Center (<https://www.uta.edu/ideas/>) (2nd Floor of Central Library) offers **FREE** tutoring and mentoring to all students with a focus on transfer students, sophomores, veterans and others undergoing a transition to UT Arlington. Students can drop in or check the schedule of available peer tutors at www.uta.edu/IDEAS, or call (817) 272-6593.

The English Writing Center (411LIBR)

The Writing Center offers **FREE** tutoring in 15-, 30-, 45-, and 60-minute face-to-face and online sessions to all UTA students on any phase of their UTA coursework. Register and make appointments online at the Writing Center (<https://uta.mywconline.com>). Classroom visits, workshops, and specialized services

for graduate students and faculty are also available. Please see Writing Center: OWL for detailed information on all our programs and services.

The Library's 2nd floor Academic Plaza (<http://library.uta.edu/academic-plaza>) offers students a central hub of support services, including IDEAS Center, University Advising Services, Transfer UTA and various college/school advising hours. Services are available during the library's hours of operation.

Emergency Phone Numbers

In case of an on-campus emergency, call the UT Arlington Police Department at **817-272-3003** (non-campus phone), **2-3003** (campus phone). You may also dial 911. Non-emergency number 817-272-3381