

SYLLABUS

ECE-4211/5211 Rapid Prototyping with FPGAs

UCCS, Spring 2024

Course Description: Field programmable gate arrays (FPGAs) are an important part of the overall design flow for application specific integrated circuits (ASICs) because they offer the potential of allowing cheap hardware prototypes to be built to meet a narrow window of opportunity. They also offer novel, programmable architectures. This course will focus on the combined use of FPGAs and modern synthesis tools to develop rapid prototypes of ASICs. Architectural and performance tradeoffs and characteristics of both commercial anti-fuse and dynamically programmable FPGAs will be considered. Includes a mandatory final project.

Instructor:	Dr. Darshika G. Perera
Contact Information:	Email : darshika.perera@uccs.edu , dperera@uccs.edu Office : ENGR-222 Website : http://ece.uccs.edu/~dperera/
Class Time:	Thursday 8.00AM – 10.40AM
Class Rooms:	ENGR-229 for lectures, labs, and demos
Office Hours:	Mondays 11.00AM-12.00PM & Thursdays 12.00PM-1.00 PM
Text Book:	Not available
Prerequisites:	ECE 4242 / 5242 or consent of the instructor.
Grading	Homework and Labs: 60% * Final Project: 40% (mandatory to pass the course) **
Teaching Assistant	Mr. Mokhles Mohsin: mmohsin@uccs.edu

***Policy for Lab Demos and Lab Reports:**

- 1) All the lab demos and reports should be completed in professional manner and on time.
- 2) Lab demos are due during the lab hours (on the day indicated in the course schedule below).
- 3) Lab reports will not be accepted, without completing the lab demos.
- 4) Any lab demos after the lab hours on Thursday will not be accepted.
- 5) Any lab reports after the lab hours on Thursday will not be accepted.
- 6) Must turn in a hard copy – (soft copy during the online/remote classes).

** Final project is mandatory to pass the course for both the undergraduate and graduate students. The students will be given an “incomplete or fail grade” if any of these course requirements are not fulfilled.

Note: In order to obtain the final grade, apart from the presentation and the demo, you have to hand in a hard copy of the project report and email the final project files (all the Verilog codes) in a zipped folder. In the absence of these, you will get an incomplete grade.

Final Project: 40% includes: (Overall project 40%, Presentation & Demo 30%, Report 20%, and Attendance 10%).

Note: Check the Canvas regularly for announcements, updates, and new material.

Total marks/points are calculated as follows:

Total Marks/points: = $(0.6 * (\text{hw/labs 1 to 8}) / 8) + (0.4 * \text{final project})$

The grades are as follows:

A	=94-100
A-	=90-93
B+	=87-89
B	=84-86
B-	=80-83
C+	=77-79
C	=74-76
C-	=70-73
D+	=67-69
D	=64-66
D-	=60-63
F	=below 60

Course Schedule

Note: This is a tentative schedule, subject to change.

Please do not make travel arrangements during the final projects and final exam week.

Week	Date	Planned Activities	Homework and Labs Due
1	01/18	Lecture 1: Introduction to FPGAs & Rapid Prototyping (ENGR-229) Post: Homework 1	
2	01/25	Lecture 2 & 3: ISE Design Flow & ChipScope Pro for On-Chip Debugging; Discuss Final Project & Homework 3 (ENGR-229) Post: Homework 3	Homework 1 Homework 2: Go through ISE & ChipScope Pro Tutorial (ENGR-299)
3	02/01	Lecture 4: Serial Flash SPI (ENGR-229) Post: Homework 4	Homework 3 Demo: (ENGR-299)
4	02/08	Lecture 5: User Constraint Files, DCM, debounce, metastability, one-shot; Work on Homework 4 (ENGR-229) Post: Homework 5	Homework 3 Report: Design & Test a Washing Machine Controller (ENGR-299)

5	02/15	Lecture 6: LCD (ENGR-229) Post: Homework 6	Homework 4 Demo (ENGR-299)
6	02/22	Labs for Homework 5, i.e., work on Homework 5 (ENGR-229)	Homework 4 Report; Design & Test SPI Master to Support RDID Instructions
7	02/29	Lecture 7: DAC, ADC, & pre_amp (ENG-229) Post: Homework 7	Demo Homework 5 (ENGR-299)
8	03/07	Present Project Proposals; Labs for Homework 6, i.e., work on Homework 6 (ENGR-229)	Submit Project Proposals; Homework 5 Report: Debounce, one-shot, DCM, External I/Os for SPI Master;
9	03/14	Lecture 8: DDR-SDRAM Post: Homework 8	Demo Homework 6 (ENGR-299)
10	03/21	Lecture 9: Rotary Shaft Encoder; Work on Homework 7 (ENGR-229)	Homework 6 Report: Design the LCD Master
11	03/28	Spring Break – no classes	
12	04/04	Lecture 10: PicoBlaze Embedded Processor	Demo Homework 7 (ENGR-299)
13	04/11	Lecture 11: PS/2; Work on Homework 8 (ENGR-229)	Homework 7 Report: Design the Pre-Amp, ADC Master
14	04/18	Lecture 12: Timing Constraints (ENGR-229)	Demo Homework 8 (ENGR-229)
15	04/25	Work on Final Projects	Homework 8 Report: DDR-SDRAM (ENGR-229)
16	05/02	Work on Final Projects	
17	05/09	Final Project Demos & Presentations	Project Demos & Project Reports due

Recording Policy:

Students are prohibited from making audio or video recording of any class activity conducted in person or online unless the student has provided the instructor with a **Faculty Accommodation Letter from Disability Services**. In such cases, the Faculty Accommodation Letter must be presented to the instructor prior to any recording done and recording should be reserved for that individual's educational use only. Students who are permitted to record are prohibited from distributing recordings without consent. Distribution without consent could be forwarded to the Dean of Students for consideration under the student code of conduct. Recording class activity without consent is a violation of instructor and student right to privacy, copyright, and intellectual property.

Academic Dishonesty:

<http://www.uccs.edu/~dos/studentconduct/academicdishonesty.html> defines plagiarism and cheating as:

Plagiarism is the use of distinctive ideas or words belonging to another person, without adequately acknowledging that person's contribution. Regardless of the means of appropriation, incorporating another's work into one's own requires adequate identification and acknowledgement, unless the material used is considered common knowledge. Plagiarism is doubly unethical because it deprives the true author of the rightful credit and gives that credit to someone who has not earned it. When the source is not noted, the following would constitute plagiarism:

- Word-for-word copying;
- The mosaic (to intersperse a few words of one's own here and there while, in essence, copying another's work);
- The paraphrase (the rewriting of another's work, but still using the same fundamental idea or theory);
- Fabrication (inventing or counterfeiting sources);
- Ghost-written material (submitting another's effort as one's own)

Cheating involves intentionally possessing, communicating, using (or attempting to use) unauthorized (by the instructor) materials, information, notes, study aids, or other devices, in any academic exercise, or the communication with any other person during such an exercise. Examples:

- Copying from another's paper or receiving unauthorized assistance from another during an academic exercise or in the submission of academic material.
- Using a calculator when the use has been specifically disallowed.
- Collaborating with another student or students during an academic exercise without the consent of the instructor.
- **Important – Students are not allowed to post: their own solutions online; instructor's solutions online; or other students' solutions online.**

Bottom Line: You are not authorized to use another student's solutions to the homework, labs, or projects to create your solutions. You may discuss solutions, but the final work must be your own. Academic Dishonesty will result in an F in the course.

Military Policy:

If you are a military student with the potential of being called to military service and/or training during the course of the semester, you are encouraged to contact your UCCS Course Instructor no later than the first week of class to discuss the class attendance policy. You are also strongly encouraged to schedule a one-on-one conversation with the Instructor so that special accommodations can be made.

Disability Services:

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact and register with the Disability Services Office, and provide

them with documentation of your disability, so they can determine what accommodations are appropriate for your situation. To avoid any delay in the receipt of accommodations, you should contact the Disability Services Office as soon as possible. Please note that accommodations are not retroactive, and that disability accommodations cannot be provided until an accommodation letter has been given to Disability Services. Please contact Disability Services for more information about receiving accommodations at Main Hall room 105, 719-255-3354 or dservice@uccs.edu.

Testing Center:

The University Testing Center is available to all students; however, students with certified disabilities get first priority. The Testing Center requires 24-hrs advanced notice to schedule a testing time. Students are not always guaranteed the testing day and time of their choice and students without certified disabilities pay a testing fee.

Use of Laboratory Equipment:

Intentional misuse of laboratory equipment will not be tolerated and may result in criminal charges or other discipline.

During Fall 2021: (following requirements might have changed)

Mandatory Requirements due to COVID-19:

All students are expected to wear face coverings while inside all UCCS buildings/facilities. Guidance and exceptions to wearing a face covering can be read in the full executive order (<https://vcaf.uccs.edu/sites/g/files/kjihxj1631/files/inline-files/COVID-19%20-%20Exec%20Directive%20APPROVED%20%288.17.2021%29.pdf>). Students may be asked to leave the class if they are not wearing a face covering and additional disciplinary action may result in accordance with the Student Code of Conduct.

Before Fall 2021: (following requirements might have changed)

Additional Details/Requirements Due to COVID-19:

Classroom and Campus Etiquette:

- All students must take a self-health assessment regarding COVID 19 and symptoms (EVERY DAY) before coming to campus. You should carry evidence you have taken the quiz with you on campus.
- As you enter class, I may ask you to show me that you answered the questions on the self-health assessment as you enter the room.
- You are required to wear a face covering which covers your nose and mouth while on campus indoors at all times. This includes in the classroom. Wearing a face shield only is not sufficient for being in-class with faculty. Faculty may remove their face covering if at least 12 feet from students, but students are required to wear a face covering at all times. Students and faculty may wear both a face covering and a face shield when on campus.
- Face masks can't have holes in them. More information can be found here: [https://covid19.uccs.edu/sites/g/files/kjihxj1366/files/inline-files/On-Campus_Face_Covering_Requirements_and_Compliance_\(2\).pdf](https://covid19.uccs.edu/sites/g/files/kjihxj1366/files/inline-files/On-Campus_Face_Covering_Requirements_and_Compliance_(2).pdf)
- Students who do not wear a face covering when entering buildings and classrooms will be asked to leave.

- You are required to stay six feet away from your classmates, and staff and faculty at all times.
- **Faculty have the right to cancel a class** if there are students who do not observe 1) Answering the questions on the safety quiz, 2) wearing a face mask over their nose and mouth, 3) keeping proper social distance, and students who are visibly sick

Group Work in the Classroom

- Periodically you will be asked to engage in small group discussion in the classroom. Even in small groups, we must continue to wear face coverings and maintain social distance guidelines. In class, using Microsoft Teams and Canvas Collaboration tools including chat, whiteboard, and shared documents can enhance small group interaction while maintaining public health guidelines.

What should I do if I am sick?

- The student health center on campus can give you a rapid COVID 19 test if you have the symptoms of COVID 19. It only takes 15 minutes to get your results!
- If you're sick, even with a cold, please stay home to avoid spreading your illness.
- Isolate yourself from others if you are sick and seek medical care

Attendance and Missing quizzes, exams and activities due to illness

- Attendance will be taken at all in-person classes. This is in order to do contact tracing if needed.
- You may be excused from one class activity (quiz or exam, etc.) during the semester if ill. Please don't come to campus sick, even if it's not with COVID 19. Please let me know the day of the quiz or exam (or faculty can decide what's appropriate) before it starts, and I will average the scores of your other exams and quizzes and replace that score.
- If you have a long-term illness, we will consider that on a case-by-case basis.