

ECE 448, FPGA Design with VHDL Spring 2023

Instructor

Dr. Kris Gaj
The Nguyen Engineering Building, room 3225
In Person Office hours: Tuesday 1:00-2:00 PM, Thursday 1:00-2:00 PM
Zoom Office Hours: by appointment

Lecture

Tuesday, Thursday 10:30-11:45 PM, Horizon Hall 2016

Web page

<https://people-ece.vse.gmu.edu/coursewebpages/ECE/ECE448/S22>

Grading

Lab assignments:	40%
Lab exercises:	4%
Quizzes & homework:	6%
Midterm exam for the lecture:	10%
Midterm exam for the lab:	15%
Final exam:	25%
Class & Piazza activity:	5% bonus

Tentative Schedule (subject to possible modifications):

1. Objectives, Scope, and Organization. 01/24/2023
2. HDL Refresher Quiz. Introduction to Testbenches. 01/26/2023
3. Examples of Testbenches. 01/31/2023
4. Combinational-Circuit Building Blocks. 02/02/2023, 02/07/2023
5. Sequential-Circuit Building Blocks. Timing Analysis. 02/09/2023
6. Sequential-Circuit Building Blocks. Mixing Description Style. 02/14/2023
7. Introduction to Basys 3. Using Seven-Segment Displays, LEDs, Switches, and Buttons. 02/16/2023
8. Introduction to Lab 4. The LightsOut Puzzle. 02/21/2023
9. Finite State Machines: State Diagrams, ASM Charts, and VHDL Code. 02/23/2023
10. Implementing Circuits with Regular Structure. Review for the Midterm Exam. 02/28/2023
- 11. Midterm Exam. 03/02/2023**
12. Programmable Logic Memories. 03/07/2023
13. RTL Design Methodology. 03/09/2023
14. Introduction to the FPro System. 03/21/2023

15. Bare Metal System Software Development. 03/23/2023
 16. LED-MUX Core & Debouncing Core. 03/28/2023
 17. Developing User MMIO Cores & Drivers. I/O Register Map of an MMIO Core. Address Decoding. 03/30/2023
 18. Software/Hardware Co-design Using the FPro System. 04/4/2023
 19. The FPro Video Subsystem. 04/11/2023, 04/13/2024
 20. Video cores. 04/18/2023
 21. RTL Design Methodology – Examples – Part 1. 04/20/2023
 22. Modeling of Circuits with Regular Structure – cont. 04/25/2023
 23. Timing Analysis. 04/27/2023
 24. RTL Design Methodology – Examples – Part 2. 05/02/2023
 25. Review before the Final Exam. 05/04/2023
- Final Exam. 05/16/2023, 10:30 AM-1:15 PM**

Literature

Required Textbooks

Pong P. Chu, *FPGA Prototyping by VHDL Examples: Xilinx MicroBlaze MCS SoC*, Wiley, 2017, 2nd edition.

Supplementary Textbooks

Stephen Brown and Zvonko Vranesic, *Fundamentals of Digital Logic with VHDL Design*, McGraw-Hill, 2008, 3rd edition.

Ricardo Jasinski, *Effective Coding with VHDL: Principles and Best Practice*, The MIT Press, 2016 © 1st edition.

Honor Code

All rules of the Mason Honor Code will be strictly enforced. You should review the rules and interpretations of the Mason Code available at

<https://oai.gmu.edu/full-honor-code-document/>,

and be familiar with them.

Students with Disabilities

If you need special assistance, please inform the instructor and the Office of Disability Services (ODS, <http://ods.gmu.edu>) as soon as possible. All special accommodations must be arranged through ODS.

Basic Course Technology Requirements

Activities and assignments in this course will regularly use the Blackboard learning system, available at <https://mymason.gmu.edu>. Students are required to have regular, reliable access to a computer and a stable broadband Internet connection (cable modem, DSL,

satellite broadband, etc., with a consistent 1.5 Mbps [megabits per second] download speed or higher.

Activities in this course will regularly use web-conferencing software:

- Zoom for office hours and project meetings.

In addition to the requirements above, students are required to have a device with a functional camera and microphone. In an emergency, students can connect through a telephone call, but video connection is the expected norm.

Academic Integrity

The integrity of the University community is affected by the individual choices made by each of us. Mason has an Honor Code with clear guidelines regarding academic integrity. Three fundamental and rather simple principles to follow at all times are that: (1) all work submitted be your own; (2) when using the work or ideas of others, including fellow students, give full credit through accurate citations; and (3) if you are uncertain about the ground rules on a particular assignment, ask for clarification. No grade is important enough to justify academic misconduct. Plagiarism is the equivalent of intellectual robbery and cannot be tolerated in the academic setting. If you have any doubts about what constitutes plagiarism, please see me.

For more information about the Mason Honor Code and about the Honor Committee, please visit the website for the Office of Academic Integrity (<http://oai.gmu.edu>).

Safe Return to Campus

All students are strongly encouraged to get vaccinated, including a booster. You can get a vaccine on the Fairfax Campus.

Mason campuses are mask-optional except in health care settings and when instructed by a healthcare professional due to illness or close contact with someone with COVID. However, if you are more comfortable wearing a mask, feel free to continue. We still encourage you to wear a mask indoors.

If you test positive for COVID or are diagnosed with COVID, please report your positive case through Mason COVID Health Check. Mason uses this information to identify possible outbreaks and monitor COVID case counts within the Mason community for decision-making purposes.

Mason provides free COVID testing on campus.

For more information, please visit:

<https://www.gmu.edu/safe-return-campus/mason-covid-updates/updates-students>