Digital Design
EEL 4712C

Class Periods: Monday, Wednesday, and Friday, Period 4, 10:40 am – 11:30 am
Location: NEB 0202
Academic Term: Fall 2020

Instructor:
Dr. Farimah Farahmandi
farimah@ece.ufl.edu
352-392-0910
Office Hours: Mondays & Wednesdays: 2:00-3:00 pm or by appointment, Subject to change.

Laboratory Schedule:

- Mondays, Period E2 - E3 (8:20 PM - 10:10 PM) (TA: TBD)
- Tuesdays, Period 11 – E1 (6:15 PM - 8:10 PM) (TA: TBD)
- Tuesdays, Period 9 - 10 (4:05 PM - 6:00 PM) (TA: TBD)
- Wednesdays, Period 9 - 10 (4:05 PM - 6:00 PM) (TA: TBD)
- Thursdays, Period 11 - E1 (6:15 PM - 8:10 PM) (TA: TBD)
- Thursdays, Period E2 - E3 (8:20 PM - 10:10 PM) (TA: TBD)
- Tuesdays, Period E2 – E3 (8:20 PM - 10:10 PM) (TA: TBD)

Note that the information about the links to laboratory sessions will be available through the course Canvas webpage.

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website

- Benjamin Hicks, benjamin.hicks@ufl.edu, TBD, TBD
- Anna Raymaker, annaraymaker@ufl.edu, TBD, TBD
- Raul Rolon, rolonr@ufl.edu, TBD, TBD
- Jared Herbert, jaredherbert@ufl.edu, TBD, TBD
- Zahin Ibnat, ibnatz16@ufl.edu, TBD, TBD
- Stefen Lagos, stefenlagos@ufl.edu. TBD, TBD

Course Description
Catalog description: **Credits 4**;
Advanced modular logic, design languages, finite state machines and binary logic.

Course Pre-Requisites / Co-Requisites
Digital Logic and Computer Systems (EEL 3701) with a minimum grade of C- is a prerequisite for Digital Design. To be successful in this class, you need to know binary logics, modular combinational and sequential logic, design languages, machine instructions, and finite state machines.

Course Objectives
The objective of the course is to teach the fundamentals of digital designs using descriptive hardware languages (e.g., VHDL). The course provides an overview of basic concepts in digital logic such as multiplexers, decoders, encoders, and arithmetic circuits. It also introduces students the techniques to model and implement complex combinational and sequential (e.g., processors) digital circuits using basic digital blocks. The course also emphasizes the synthesis of circuits and their implementation on Field Programmable Gate Arrays (FPGAs). Intensive lab sessions are designed to enable hands-on experience learning. In Digital Design course, students will also become familiar with verification, validation, and debugging of their designs to make sure that they have correctly implemented the specification from timing and functional aspects. To meet the objectives of the class, the students will need to invest a lot of their time and be ready to carry a lot of work.

Materials and Supply Fees

Equipment

- An FPGA-based laboratory board, DE10lite (will be provided to you)
- Digilent Analog Discovery (must be purchased):
https://mil.ufl.edu/3701/dad-nad.html

Relation to Program Outcomes (ABET):
The table below is an example. Please consult with your department's ABET coordinator when filling this out.

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.	High
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Medium
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software
Instructor-provided references

Recommended Materials
- Fundamentals of Digital Logic with VHDL Design
- Brown, S. D. and Vranesic, Z. G
- Second or third edition

Course Schedule
Week 1: VHDL Intro, Combinational Logic
Week 2: Arithmetic operations, Lab 1
Week 3: Synthesis Coding Guidelines, Testbenches
Week 4: Carry-lookahead Adders, For-generate, Lab 3, Misc VHDL
Week 5: Sequential Logic, Finite State Machines
Week 6: Finite State Machines w/ Datapaths, Midterm 1
Week 7: Finite State Machines w/ Datapaths, Cont., VGA

Week 8: 2-process FSMD, Interfacing protocols, Misc VHDL
Week 9: FPGA Architectures
Week 10-11: MIPS architecture, Midterm 2
Week 12: Metastability, Tri-state Buffers, Buses
Week 13: Design-Space Exploration, Architecture Tradeoffs
Week 14-15: Digital Design Research

Attendance Policy, Class Expectations, and Make-Up Policy

There are no make-up exams/quizzes unless there is an acceptable reason (illness, serious family emergencies, UF-imposed curriculum requirement or activity, religious holiday, or jury duty). In those cases, a make-up exam will be organized. Students should contact the instructor ahead of the exam so that an alternate exam schedule can be found. Students missing exams for unpredictable family or medical reasons should notify the instructor ahead of the exam time. If you miss more than one test, you will need to contact the instructor to evaluate whether you should pursue the class further or receive an incomplete. Students missing an exam without giving advance notice to the instructor, or without providing a valid (documented) reason, will receive a grade of F for this exam. Make-up will not be given for computer assignments. If you believe that you have a valid exam conflict, please send the information at least eight days in advance to the instructor. Please specify the times of your conflict and then times immediately before or after the scheduled exam time when you are available.

To ensure a classroom environment conducive to success for everyone, please turn off all cell phones before class starts. If you must enter the classroom late, be considerate, and be as quiet as possible. Persistent disruptive behavior will result in grade deductions.

All use of electronic devices during an exam will be considered a violation of the student honor code (i.e., cheating). Laptop computer and tablets are welcome in class as long as they are used for class-related work. Surfing the web, checking email, making posts, etc., is strictly prohibited.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Midterm 1 (9/29/2021)	100	20%
Midterm 2 (11/3/2021)	100	20%
Midterm 3 (12/17/2021)	100	20%
Labs 1-4	100 each	22%
Lab 5	200	8%
Final Project	100	10%

Grading Policy

You will receive numerical grades for your quizzes and exams. The final grade will be determined primarily by the curve. The break between "B" and "B-" will be approximately set at the average of total scores of students with a score of %50 or more. Letter grades will be monotonic in the total course scores. Your grade will be solely based on your performance in the course and not on outside factors such as your wish to graduate this semester or the possibility of losing a scholarship.

A "C-" will not be a qualifying grade for critical tracking courses. In order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better ("C" or better). Note: a "C-" average is equivalent to a GPA of 1.67, and therefore, it does not satisfy this graduation requirement. For more information on grades and grading policies, please visit: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

The following grading scale is subject to change

Percent	Grade	Grade Points
90- 100	A	4.00

87 – 89.9	A-	3.67
84 - 86.9	B+	3.33
80 - 83.9	B	3.00
77 - 79.9	B-	2.67
74 - 76.9	C+	2.33
71 - 73.9	C	2.00
66.0 - 70.9	C-	1.67
63 - 65.9	D+	1.33
60 - 62.9	D	1.00
58 - 59.9	D-	0.67
0 - 57.9	E	0.00

Students Requiring Accommodations
Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation
Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

In-Class Recording
Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: https://registrar.ufl.edu/ferpa.html

Campus Resources:

Health and Wellness

Covid-19 Protocols:

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated. Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus. UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test & Protect website for more information.

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and

weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/;https://care.dso.ufl.edu.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.