Advanced VLSI Design

EEE 6323
Class Periods: Tuesday | Period 7 (1:55 PM - 2:45 PM) and
Thursday | Period 7 - 8 (1:55 PM - 3:50 PM)
Location: NEB 0102
Academic Term: Spring 2020

Instructor:

Name: Swarup Bhunia
Email Address: swarup@ece.ufl.edu
Office Phone Number: 352-392-5989
Office Hours: Tuesday 3-4pm or by appointment

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website
- Tamzidul Hoque, thoque@ufl.edu, Benton 324, Wednesday 10:00-11:00am
- Abdulrahman Alaql, alaql89@ufl.edu, Benton 324, Friday 1:00-2:00pm

Course Description

Advanced very large scale integrated circuit design, testability, and performance evaluation. Use of industrial VLSI software. Building an advanced CMOS VLSI circuit. Prereq:

Course Pre-Requisites / Co-Requisites

EEE 5322 - VLSI Circuits and Technology
Students with foundational knowledge in digital circuit design would be eligible to meet the prerequisite. Instructor's permission needed.

Course Objectives

To develop a basic understanding of CMOS integrated circuit design. To develop foundational knowledge in system on chip (SoC) architecture and design, including low power, secure and testable SoC design methods. To develop proficiency in analysis, design and implementation of CMOS circuits. To develop a basic understanding of design considerations to maximize chip success.

Materials and Supply Fees

Not Applicable

Required Textbooks and Software

- Title: CMOS VLSI Design 4e: A circuits and systems perspective
- Neil H.E. Weste, David Harris
- 2010, 4th Edition, Pearson
- ISBN-10: 9789332542884

In addition, handouts developed by instructor may be downloaded from Canvas.

Recommended Materials

- Title: Digital Integrated Circuits, A Design Perspective
- Author: Jan. M. Rabaey, A. Chandrakasan, and B. Nikolic
- 2003, 2nd Edition, Prentice Hall
- ISBN-10: 0130909963

Computer and Software Required: Workstations in the NEB 2nd floor ECEL lab with CADENCE Design system will be used throughout the course. All students are required to have a Gator link account and use Canvas for course handouts, grade information, course notices, etc., see e-learning support services

Course Study Requirements: Students are responsible to study all in class materials including those written on the board and presented orally, all Class Handouts all assigned readings, all projects and homework. Absence from class can result in missing materials tested on exams.

Course Schedule

Week 1:   Syllabus, Introduction to AVLSI, CMOS gate design review / Lecturer: Swarup Bhunia

Week 2:   Layout, DC and Transient Analysis, PUN graph example, Logical Effort / Lecturer: Swarup Bhunia / Homework 1

Week 3:   Multi-stage logic and networks, power dissipation and analysis / Lecturer: Swarup Bhunia / Review paper assigned

Week 4:   Circuit Families and advanced circuit families / Lecturer: Swarup Bhunia / Homework 1 solution

Week 5:   Arithmetic circuits and advanced arithmetic circuits, finite state machine (FSM) design / Lecturer: Swarup Bhunia / Homework 2

Week 6:   Power dissipation and power analysis, timing analysis / Lecturer: Swarup Bhunia / Exam 1

Week 7:   Power dissipation and power analysis, timing analysis / Lecturer: Swarup Bhunia / Homework 2 solution

Week 8:   Low-power design / Lecturer: Swarup Bhunia / Exam 1 solution

Week 9:   Low-power and robust design / Lecturer: Swarup Bhunia / Homework 3

Week 10:   Digital design flow / Lecturer: Swarup Bhunia / Review paper due

Week 11:   System on chip (SoC) architecture, intellectual property (IP) integration / Lecturer: Swarup Bhunia / Homework 3 solution

Week 12:   SoC security 1 (security policies, security architecture) / Lecturer: Swarup Bhunia / Exam 2

Week 13:   SoC security 2 (security design and verification) / Lecturer: Swarup Bhunia / Exam 2 solution

AVLSI Final Design project, Report Due Tuesday April 21, there will be design demos in the NEB lab on and after April 22, 2020.

Group Project Report: Due Thursday March 19, 2020.

Attendance Policy, Class Expectations, and Make-Up Policy

The instructor prefers extensive interaction with students in the class on the course topics presented in the class. Hence, attendance is highly recommended. There is a no wireless device policy (no cell phones, smart phones, computers, tablets, etc.) during exams. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. Excused absences must be in compliance with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations/) and require appropriate documentation.

Make Up Exam Policy: Students are expected to attend exams at the scheduled times. Exams can be made up if there is a genuine medical emergency with a doctor's or clinic medical note or a family emergency with some documentation. Students are NOT excused from exams for job interviews and early holiday travel home. Students with other non-emergency exam scheduling issues must obtain permission from the instructor prior to missing an exam.

Evaluation of Grades

The grade for each student will be evaluated based on the following: Homework Sets (3), One Final project, Two Exams: Exam1, Exam 2, and One Review Paper on System on Chip design.

Assignment	Total Points	Percentage of Final Grade
Homework Sets (3)	100 total	15%
Final Project	100 point total for all parts	30%

	100	20%
Exam 1	100	20%
Exam 2	100	20%
Review Paper (Group or Individual Work)	100	15%
		100%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: https://catalog.ufl.edu/graduate/regulations/

Students Requiring Accommodations
Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure 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/.

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 Honor Code (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. 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
• Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.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

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: http://www.counseling.ufl.edu/cwc, 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 support, 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://www.crc.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://care.dso.ufl.edu.

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