EEE 5322 VLSI Circuits and Technology

1. Catalog Description - (3 credit hours) – Introduction to VLSI circuit technology and manufacturing. Fabrication, device models, layout, parasitics, and simple gate circuits.

2. Pre-requisites - EEL 3396, EEL 3308C

3. Course Objectives - To develop proficiency in analyses, design and implementation of CMOS circuits. To develop understanding of interdependence of CMOS circuit design with process technology and IC manufacturing. To be a designer in modern CMOS processes with high level of manufacturing variations.

4. Contribution of course to meeting professional component (ABET only – undergraduate courses) - NA

5. Relationship of course to program outcomes (ABET only – undergraduate courses) - NA

6. Instructor - Dr. William R. Eisenstadt  
a. Office location - 529 NEB  
b. Office hours -  
c. Telephone - 392-4946  
d. Email address - wre@tece.ufl.edu  
e. Web site - www.tec.ufl.edu/~wre/

7. Teaching Assistants - None  
a. Office location -  
b. Telephone -  
c. Email address -  
d. Office hours -  

8. Meeting Times and Location - M W F 5th period, 100 NEB

9. Class/Laboratory Schedule - 3 class periods consisting of 50 minutes each per week

10. Material and Supply Fees - None

11. Textbooks and Software Required -  
a. Title - Introduction to Microelectronic Fabrication  
b. Author - Richard C. Jaeger  
d. ISBN Number - 0-201-44494-7

   a. Title - Digital Integrated Circuits, A Design Perspective  
b. Author - Jan. M. Rabaey, A. Chandrakasan, and B. Nikolic

Computer and Software required: Workstations with CADENCE Design system on campus, off-campus can use XWindows or X-terminal on a high-speed internet link to UF Campus Computers, or can use equivalent IC design software.

12. Recommended Reading - None
   a. Title -
   b. Author -
   c. Publication date and edition -
   d. ISBN Number -

13. Course Outline -
   Week 1: What is VLSI, Statistics Review, CMOS X-section, Intro. to Design rules, Chap. 2 .1, 2.2 and 2.3 of Rabaey, 1.2, 1.3.1 and Chap. 5 .1, 5.2, 5.3, 5.4 of Jaeger, Class handouts
   Week 2: Ion Implantation 1, Ion Implantation 2, Diffusion 1, Chap. 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 of Jaeger
   Week 3: Diffusion 2, Oxidation 1, Oxidation 2, Chap. 3.1, 3.2, 3.3, of Jaeger
   Week 4: Film Deposition, CMP, Cleaning, Etch, Chap. 6.1, 6.2, 6.3 and Chap. 7.7, 7.8, 3.8.2 of Jaeger
   Week 5: Photo-Lithography 1, Photo-Lithography 2, Yield, Chap. 2.1, 2.2, 2.3, 2.4, 2.5 of Jaeger, Chap. 1.3.2, 9.1, 9.3.5
   Week 6: CMOS Flow, Isolation and Latch-up, Midterm, Chap. 8.7 of Jaeger and Chapter 2.2 Rabaey
   Week 7: Layout Layers and X-sections Design Rules, Resistance, Capacitance, MOS Transistors, Class Note, Mosis Notes, Chapter 1 Rabaey, powerpoint from Rabaey
   Week 8: Resistance, Capacitance, Chap. 4.1 to 4.3 and Chap. 3.3 of Rabaey and 9.2, 9.3 Jaeger
   Week 9: MOS Transistors, CMOS Inverters, Chap. 3.3 and Chap. 5 of Rabaey
   Week 10: CMOS Inverters, Midterm 2, Chap. 5 of Rabaey
   Week 11: Combination Logic, Compound Gates, Chap. 6 of Rabaey
   Week 12: Transmission Gates, Memory, Chap. 6 and Chap. 12 of Rabaey
   Week 13: Memory, Pseudo NMOS, Pass Trans. Logic, Chap. 6 of Rabaey
   Week 14: Pre-charge Logic, and Dynamic Logic, Chap. 6 of Rabaey
   Week 15: Domino Logic, Logic Comparison, Noise Chap. 6 of Rabaey
   Week 16: Testing of CMOS Appendix H. of Rabaey

14. Attendance and Expectations - 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. Cell phones and other electronic devices are to be silenced. No text messaging during class or exams.

Requirements for class attendance and make-up exams, assignments, and other work are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx
15. Grading - Homework & Projects: 15%; Midterms & Quizzes: 55%; Final: 30%

16. Grading Scale - Grades will be on a curve and your relative statistical performance to the class average grades counts, not your absolute numerical performance. For example, if you have a 91 average and the class median is 90 (not likely) you will get a B. You must be significantly better than average to get an A.

96 – 100 A
93 – 95 A-
90 – 92 B+
86 – 89 B
83 – 85 B-
80 – 82 C+
76 – 79 C
73 – 75 C-
70 – 72 D+
66 – 69 D
63 – 65 D-
62 – 0 E

Undergraduate students, in order to graduate, 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. Graduate students, in order to graduate, must have an overall GPA of 3.0 or better (B or better). Note: a B- average is equivalent to a GPA of 2.67, 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

17. Make-up Exam Policy - If you have a University-approved excuse and arrange for it in advance, or in case of documented emergency, a make-up exam will be allowed and arrangements can be made for making up missed work. University attendance policies can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Otherwise, make-up exams will be considered only in extraordinary cases, and must be taken before the scheduled exam. The student must submit a written petition to the instructor two weeks prior to the scheduled exam and the instructor must approve the petition.

18. Honesty Policy - All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

“…failure to comply with this commitment will result in disciplinary action compliant with the UF Student Honor Code Procedures (http://www.dso.ufl.edu/sccr/procedures/honorcode.php)
19. Accommodations for Students with Disabilities - Students Requesting classroom accommodation must first register with the Dean of Students Office. That office will provide the student with documentation that he/she must provide to the course instructor when requesting accommodation.

20. UF Counseling Services - Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:

- UF Counseling & Wellness Center, 3190 Radio Rd, 392-1575, psychological and psychiatric services.
- Career Resource Center, Reitz Union, 392-1601, career and job search services.

21. Software Use - All faculty, staff and student 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.