EECS 598 Section 002, Fall 2017
Beyond CMOS

Syllabus, Sept 5, 2017

Instructor: Prof. Becky Peterson, 2302 EECS, 734-615-3105, blpeters@umich.edu

Lecture: Lec. 001 Monday & Wednesday 1:30-3:00pm, 185 EWRE

Office Hours: Friday 10:30am-12 noon in 2302 EECS. Alternate times are available if you have a conflict. Please contact Prof. Peterson to arrange.
Note: **No office hours will be held on Friday 9/15 due to travel.**
Office hours on Friday 9/22 will be shifted to 12:30-2:00pm.

Course Objective: This 3 credit course will introduce students to a variety of nanotechnologies that are emerging to supplement or replace silicon CMOS for computationally intensive electronics

Course Format: Half of the lecture sessions will consist of discussions of current research papers or hands-on simulation exercises using CAEN or online resources, while the other half of the sessions will be lectures covering the topics listed below.

Topics to be Covered:
State of the art silicon CMOS and the end of the roadmap
Non-silicon CMOS (III-V, Ge channels)
Carbon-based semiconductor materials (CNT, graphene)
2D transition metal dichalcogenide transistors
Tunneling FETs and ferroelectric gate stacks
Memory, logic in memory, memristors
Non-Boolean computing
Magnetic circuits
Spintronics
Extreme heterointegration and interposers
Power semiconductor device integration
Printed and flexible electronics

Grading:
10% Preparation and leading of discussion
Done twice during semester, in small groups
40% PDF notation of readings for each week and participation in class discussions, in lieu of homework
There are a total of 10 discussions scheduled. You will lead two, and thus not need to notate that week. The remaining eight weeks will be weighted equally to make up 40%. That is to say, each week counts as 5% of your total grade.
30% Two simulation projects (15% each)
20% Group presentation on topic of your choosing
There are no exams and no final exam.

Discussions: Pairs of students will lead discussion twice in the semester. Before the discussion, all other students should do the reading and post question and comments in NB by midnight Sunday for discussion Monday.
Discussion leader responsibilities: by Thursday in advance of your assigned discussion day, you should send me a list of 10 questions for class discussion. After a cursory review, I will post your questions to Canvas for all to see on Friday. On Monday, you will lead the discussion. Grades for NB and discussion leading is based on your effort and your intellectual engagement with the technical readings, and will be posted following each Discussion. There is no magic number of comments needed on each article online or aloud in class.

Simulation Projects: There will be two individual simulation projects. The first will use Synopsys Sentaurus software to model state-of-the-art devices. You will use a vendor-supplied device example, and then explore and explain its operation by (slightly) modifying and inspecting the simulation results. Each student will write an individual project report. Detailed tutorials will be given on the software packages; no prior knowledge is assumed. The topic of the second simulation project is TBD.

Group Presentations: Toward the end of the semester, you will form a team of 2-3 people. Each team will select a topic to investigate for a group presentation. You will write a two-page abstract, which I will use to approve the topic and give feedback. During the last few lecture periods, each group will give a ~40 min presentation. Each person must speak during the presentation. Detailed instructions will be given in November.

Class Resources: Canvas site "EECS 598 002 F17".
The weekly readings will consist mainly of published review papers and technical magazine articles, which will be provided electronically. We will use online pdf annotation and collaboration software throughout the course. There is no textbook.
We will use CAEN-based device simulation software for the projects. Detailed instructions will be provided; no prior knowledge or experience is assumed.

Email/Chat: Please post routine questions about assignments to Canvas-Discussion, so all can see and respond. For other questions, please send email to Prof. Peterson with "EECS 598" in the subject line (for brief questions), or visit office hours (for extended discussion).

Prerequisites: This course assumes a working knowledge of introductory semiconductor physics and devices. The pre-requisite is EECS 320 (Introduction to Semiconductor Devices) or equivalent, graduate standing, or permission of the instructor.

Electronics:	Occasionally, laptops may be required during lecture to access simulation packages. If you do not have a personal laptop available for this purpose, please notify Prof. Peterson at the beginning of the semester, so alternate arrangements can be made.
Honor Code:	All work in this class shall be in accordance with the College of Engineering's Honor Code (http://honorcode.engin.umich.edu/)
Accommodations for Students with Disabilities:	If you need an accommodation, please let me know as early as possible in the semester. If you already have a Verified Individualized Services and Accommodations (VISA) form, please provide a signed copy. If you do not have a VISA form, please work with the Services for Students with Disabilities (SSD, 734-763-3000; http://ssd.umich.edu) office. Any information you provide to me and to SSD will be treated as private and confidential.

Course Schedule
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5 Sept 2017

Date			Topic	Lecture	Discussion	Information/Deadlines
Sept	6	W	End of the roadmap	L1		
	11	M	Intro to Simulation Project #1	L		**Bring laptop. 2pm START**
	13	W	Open Forum on Synopsys	L		**Bring laptop. 2pm START**
	18	M	End of the Roadmap		D1	
	20	W	Carbon, 2D and other materials	L2		
	25	M	"		D2	
	27	W	Emerging memory	L3		
Oct	2	M	"		D3	
	4	W	Tunneling FETs	L4		**Simulation project #1 due**
	9	M	"		D4	
	11	W	Intro to Simulation Project #2	L		**Bring laptop to lecture**
	16	M	NO CLASS – Fall Study Break			
	18	W	Magnetic devices	L5		
	23	M	"		D5	
	25	W	Spintronics and quantum computing	L6		
	30	M	"		D6	
Nov	1	W	Non-Boolean computing	L7		
	6	M	"		D7	
	8	W	Heterointegration	L8		**Simulation project #2 due**
	13	M	"		D8	
	15	W	Power Semiconductor Devices	L9		**Presentation Abstracts due (2pg description of topic)**
	20	M	"		D9	
	22	W	Printed and Flexible Electronics	L10		
	27	M	"		D10	
	29	W	Conclusion: More than Moore	L11		
Dec	4	M	**Group Presentations**			
	6	W	**Group Presentations**			
	11	M	**Group Presentations**			