EE 8950 - Advanced Semiconductor Transistors – Spring 2015
(01/20/2015 - 05/15/2015)

Instructor:
Steven Koester

Lectures:
Time: TuTh 11:15 AM – 12:30 PM, Place: MechE 102

Instructor Office Hours:
Time: Tu/W 04:00 PM – 05:00 PM, Place: Keller 6-117

Teaching Assistant:
None

TA Office Hours:
N/A

Class Websites:
TBD

Textbooks:
There is no required textbook, however, readings from numerous fundamental articles from the literature will be assigned. In addition, the following texts may be useful to have as supplemental references.

Suggested:
Fundamentals of Modern VLSI Devices, Y. Taur and T. Ning
Physics of Semiconductor Devices, S. Sze

Grading:
30% - Homework (literature reviews)
20% - In-class presentation
50% - Final project

Homework:
This portion of the class will consist of several take-home assignments that will typically be related to reading and describing a literature paper about a specified topic on advanced field-effect transistors.

In-class presentation:
There will be one in-class presentation that will occur sometime in the middle of the semester. This presentation will be on the same topic as the final project and will be intended to show progress toward goal.
**Final project:**
There will be one final project due at the end of the semester. Students will be expected to write a comprehensive review of a particular topic related to advanced field-effect transistors. Papers will be graded on organization, clarity, completeness of the discussion, demonstrated understanding of the topic area, and grammar. The paper has to be your own work, and plagiarism will not be tolerated! All text, figures and diagrams utilized from external sources must be referenced. Further details will be provided in the class.

**University of Minnesota Scholastic Guidelines:**
http://www.fpd.finop.umn.edu/groups/senate/documents/policy/classexpectguide.html

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**COURSE OUTLINE:**

Preliminary set of concepts to be covered (subject to modification until final syllabus is posted)

1. MOSFET historical perspective
2. Review of basic MOS and pn junction physics
3. Long-channel MOSFET properties
4. Scaling theory
5. Complementary metal-oxide-semiconductor (CMOS)
6. MOSFET processing
7. Threshold adjustment
8. Short-channel effects (e.g. drain-induced barrier lowering)
9. Silicon-on-insulator
10. Subthreshold behavior
11. Advanced gate dielectrics
12. Threshold voltage roll-off
13. Tunneling effects (e.g. gate induced gate leakage)
14. Hot electron effects
15. Ballistic transistor model
16. Fully-depleted MOSFETs
17. CMOS performance benchmarking
18. AC and high-frequency performance
19. Heterostructure field-effect transistors
20. Alternative channel materials
21. Strain engineering
22. Multi-gate devices (double-gate, finFETs, etc.)