Nanoelectronics for Computer Engineers
Course Information and Tentative Syllabus
Fall 2007

- **Course Instructor:**

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- **Recommended Texts:**

– Karl Goser, **Nanoelectronics and Nanosystems: From Transistors to Molecular and Quantum Devices,** Springer, First edition, 2005
– Rainer Waser (Ed)**, Nanoelectronics and Information Technology,** Second Edition, Wiley-VCH, 2003

- **Course Description:**

The objective of this course is to provide the students with basic elements of the knowledge of emerging nanoelectronic devices. After an introduction to CMOS scaling and the coming challenges, the course will cover topics on main categories of nanoscale electronic components: carbon nanotube based devices, quantum dots and molecular devices. Basic electrical properties of these devices and their fabrication and characterization methods will be reviewed.

More attention will be paid to the applications of these devices in implementation of future high performance digital systems, processing units and memories. Recently proposed memory and logic architectures that take advantage of the properties of the emerging devices will be discussed. Different defect tolerance approaches that are devised to deal with high defect rates in these components will also be addressed.

- **Tentative Course Materials**

❋ Introduction: Fundamental requirements for logic devices, Physical limits to processing, Major aspects of architectures .. (1 week)

❋ Scaling trends in CMOS and the challenges (2 weeks)

❋ Fundamental Concepts in Nanoelectronics (1 week)

❋ Emerging Device Technologies:

- Resonant Tunelling Devices (1 week)

- Single Electron devices (1 week)
- Quantum Cellular Automata's (QCAs) (1 week)
- Molecular Electronics (1 week)
- Carbon nanotube-based Electronics (2 weeks)

❁ Memories Implemented based on Emerging Devices (1 week)

❁ Proposed Reconfigurable Architectures Based on New Devices (2 weeks)

❁ Defect Tolerance Approaches (2 weeks)

● **Grading:**

- It is anticipated that students will make two presentations over the semester on a topic of their choice: one will be given middle of the way through the course and one during finals week. The topics of the presentations should coincide, with one building on another (although exceptions can be made, according to the circumstances). The presentations are intended to review a number of published results in a given area and summarize them, show the key challenges in the given area and describe the state-of-the-art.
- At the sixth week of the semester, a two page description of the topic is required, including a summary of the topic, a list of issues, a list of references, and a statement of the research challenge. Feedback from the instructor can be expected before continuing on the topic.
- The load for each of these presentations is 25% of the grade.
- Midterm and final exams will each have a 20% load.
- Active class participation and quizzes will count for the next 10%.