

EE582-2: Advanced Topics
Nanoelectronics
Spring 2008

Schedule Line #: 61846

Time and Place: MWF 11:10, Sloan 5

Instructor: Dr. Mohamed A Osman, 335-2301, osman@eecs.wsu.edu

Course Description:

This course will cover the limits of silicon electronics integration and how the nanoworld provides alternative approaches to devices and circuits. Quantization of electron motion in nanoscale devices will be introduced and examined. Solutions of Schrodinger equations for different devices will be discussed in detail. The operation principles and concepts of nanoelectronics devices, spintronics, bioelectronics, and self-assembly will be examined.

Topics:

1. Semiconductors
2. **Moore's Law, scaling and limits** of integrated electronics due to energy supply, heat, thermal motion, reliability, and physical limits
3. **Basics of Nanoelectronics:** Quantization, Schrodinger equation solutions for simple quantum wells.
4. Nanoelectronic devices:
 - a. Tunneling devices
 - b. Single electron transistor devices (SET)
 - c. Quantum wires
 - d. Quantum dots and Qbits
 - e. Short channel MOS transistor.
 - f. Carbon nanotube channel MOS transistors
5. Spintronics: Electron spin transistor
6. Self-assembled Nanostructures
7. Bioelectronics and molecular electronics

Text Books:

Title: nanoelectronics and nanosystems

Authors: K. Goser, P. Glosekotter and J. Dienstuhl

Publisher: Springer 2004

ISBN; 3-540-40443-0 (soft cover)

Title: Nanophysics and nanotechnology , 2nd edition

Author: Edward L. Wolf

Publisher: Wiley-VCH 2006

ISBN-10: 3-527-40651-4 (SOFT COVER)

Other books;:

1. "Spin electronics", David D. Awschalom, Robert A. Buhrman , James M. Daughton (Editor), Stephan von Molnár , Michael L. Roukes (Editors), Kluwer Academic Publishers, 2004
2. *Mesoscopic Electronics in Solid State Nanostructures*, T. Heinzel, Wiley-VCH, 2007, ISBN; 978-3-527-40638-8 .

Handouts and material from the internet will be used to supplement the text books.

Grading:

Homework	10%
Term paper	20%
Review Topic & in Class presentations	30%
Project	40%