ESE 538, Nanoelectronics

Course Syllabus

Course Staff and Office Hours

Instructor	*Email*	*Office Hours*	*Office*	*Phone*
Vera Gorfinkel	vera.gorfinkel@stonybrook.edu	TBD	Chemistry, room	631-632-1131

Course Description

The major goals and objectives are to provide graduate students with knowledge and understanding of physical background and applications of nanoelectronics. The course will cover electrical and optical properties of materials and nanostructures, fabrication of nanostructures, nanoelectronic devices including resonant-tunneling devices, transistors, and single-electron transfer devices, as well as applications of nanotechnologies in molecular biology and medicine.

Objectives

The course intends to give students a broad understanding of fundamentals, fabrication technologies and applications of nanoscale structures. Students will also be trained for literature study and critique, oral presentation, problem formulation, solution development, and formal writing.

Readings

1. ***S. Datta,*** *"Lessons from Nanoelectronics: A New Perspective on Transport (Lessons from Nanoscience: a Lecture Notes Series) World Scientific, 2012*
2. ***V. Mitin, V. Kochelap, and M. Stroscio*** *"Introduction to Nanoelectronics: Science, Nanotechnology, Engineering, and Applications", Cambridge University Press, 2008.*
3. ***C. P. Poole and F. J. Owens,*** *"Introduction to nanotechnology", John Wiley & Sons, 2003.*

Content

- Introduction (from classical electronics to nanoelectronics)
- Wave-particle duality, Schrödinger wave equation,
- Materials for nanoelectronics
  - Semiconductors
  - Carbon nanomaterials nanotubes
- Electrons in low-dimensional structures
  - Electrons in quantum wells
  - Electrons in quantum wires
  - Electrons in quantum dots
- Fabrication of nanostructures
  - Crystal growth
  - Nanolithography
  - Clusters and nanocrystals
  - Nanotube growth
  - Characterization of nanostructures
- Electron transport in semiconductors and nanostructures
  - Time and length scales of the electrons in solids
  - Statistics of the electrons in solids and low-dimensional structures
  - Electron transport in nanostructures
- Nanoelectronic devices
  - Resonant-tunneling diodes
  - Field-effect transistors
  - Single-electron-transfer devices

- Nanoelectronics for molecular biology: next generation DNA sequencing

Grading

Attendance	30%
Midterm	20%
Project (execution, report, presentation)	50%

Schedule

TBD

Disability

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, 128 ECC Building (631) 632-6748. They will determine with you what accommodations are necessary and appropriate. All information and documentation are confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information, go to the following web site: http://www.ehs.sunysb.edu and search Fire Safety and Evacuation and Disabilities.

Academic Honesty

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

Conduct

The University at Stony Brook expects students to maintain standards of personal integrity that are in harmony with the educational goals of the institution; to observe national, state, and local laws and University regulations; and to respect the rights, privileges, and property of other people. Faculty are required to report disruptive behavior that interrupts faculty's ability to teach, the safety of the learning environment, and/or students ability to learn to Judicial Affairs.