ELEG 451X: Introduction to Nanotechnology

Semester: Spring 2011.
Class Time: Tuesday 6:00PM-8:30PM.
Classroom: Dana Hall of Science, Room 24.
Instructor: Xingguo Xiong (Assistant Professor)
Office: Technology Building, Room 140.
Office Hours: Mon. Wed. 10:00am-11:00am, Thur. 2:00pm-3:00pm.
Phone: 203-576-4760.
Email: xxiong@bridgeport.edu
GA: Zheng Yao (zhengyao@bridgeport.edu, Tel: 203-296-0129)
Course Website: UB Blackboard, URL: http://blackboard.bridgeport.edu/webapps/login/

Description: Nanotechnology is the science and engineering involved in the design, synthesis, characterization and application of materials and devices with the size in nanometer (10^{-9}m) scale. As a newly emerged exciting high-technology, it has attracted intensive interest and heavy investments around the world. Nanotechnology is a general-purpose technology which will have significant impact on almost all industries and all areas of society. It can offer better built, longer lasting, cleanser, safer and smarter products for home, communications, medicine, transportation, agriculture and many other fields. This course will cover basic concepts in nanoscience and nanotechnology.

Credit: 3.0

Textbook: Massimiliano Di Ventra, Stephane Evoy, and James R. Heflin, *Introduction To Nanoscale Science and Technology*, 1st edition, June 30, 2004, Springer, ISBN-10: 1402077203; ISBN-13: 978-1402077203.

Reference: Charles P. Poole, and Frank J. Owens, *Introduction to Nanotechnology*, Wiley-Interscience, May 30, 2003, ISBN: 0471079359, ISBN-13: 978-0471079354.
M. A. Ratner and D. Ratner, *Nanotechnology: a gentle introduction to the next big idea*, Prentice Hall, 1st edition, Nov. 8, 2002, ISBN-10: 0131014005, ISBN-13: 978-0131014008.
Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, and Burkhard Raguse, *Nanotechnology*, Chapman & Hall/CRC, Jun. 27, 2002, ISBN: 1584883391.
Mark J. Jackson, *Microfabrication and Nanomanufacturing*, CRC Press, Nov. 10, 2005, ISBN: 0824724313.
Sergey E. Lyshevski, *Nano- and micro-electromechanical systems fundamentals of nano and microengineering*, CRC Press, 1st edition, Sept. 28, 2000, ISBN: 0849309166.

Goals: The goal of this course is to introduce to students the general concepts/terminology in nanoscience and nanotechnology, as well as their wide applications. Upon finishing this class, student will have a clear understanding about basic concepts in

this field, such as carbon nanotube, nanowire, bottom-up self-assembly, molecular electronics, molecule manipulation, etc.

Prerequisites: Undergraduate and graduate students with engineering or physics background.

Topics:

1. Nanoscale fabrication and characterization.
   - Nanolithography
   - Self-assembly and self-organization
   - Scanning probe microscopes
2. Nanomaterials and nanostructures.
   - The geometry of nanoscale carbon
   - Carbon Nanotubes, quantum dots, nanocomposites
3. Nanoscale and molecular electronics.
   - Advances in microelectronics - from microscale to nanoscale devices
   - Molecular electronics, single electron transistors
4. Nanotechnology in magnetic systems.
   - Semiconductor nanostructures for quantum computation
   - Nanotechnology in magnetic storage
5. Nanotechnology in integrative systems.
   - Nanoelectromechanical systems (NEMS)
   - Micromechanical systems (MEMS)
6. Nanoscale optoelectronics.
   - Quantum-confined optoelectronic systems
   - Organic optoelectronic nanostructures
7. Nanobiotechnology.
   - Biomemetic nanostructures
   - Biomolecular motors, nanofluidics.

Grading: The final grade will be 15% on homework, 15% on projects, 31% on mid-term exam, 35% on final exam, and 4% on attendance. There are four times of random attendance during the whole semester. Each attendance will be counted 1 point toward your final grade.

Exams There will be two exams: the mid-term exam and the final exam.

Computer Usage: PC.

Lab Project: Some software (e.g. QCADesigner) will be used for the projects in the class. A detailed tutorial will be prepared for you to get familiar with the software.

Cheating Policy: It is the student's responsibility to familiarize himself or herself with and adhere to the standards set forth in the policies on cheating and plagiarism as defined in Chapters 2 and 5 of the Key to UB (http://www.bridgeport.edu/pages/2623.asp) or the appropriate graduate program handbook.