Course Syllabus
EE 710-02 Nanoscience and Engineering
Spring 2009
T/Th 12:45 PM – 2:05 PM      EB 240 Engineering Bldg

Course Instructor: John D. Williams  406 Optics Building    (256) 824 – 2898
Email: williams@ece.uah.edu
Office Hours: 10:30-12 PM T/Th

Required Textbook:
2. Electronic or paper subscription to at least one of journal in nanotechnology

Optional Text: (fantastic undergraduate level review):

Course Objectives:
This course is designed to provide students with an overview of current topics in Nanoscience and Engineering. The sheer breath and multidisciplinary nature of this field does not allow for a complete discussion on the topic, however students will be provided with a survey of key concepts and state of the art research in the areas of scanning probe microscopy, nanoparticle applications, nanoelectronics, photonics, nanobiotechnology, materials chemistry, and surface science.

Additional References:
6. CNF Nanocourses, Cornell Nanoscale Science and Technology Facility, 1998-2008
7. Wolf, Nanophysics and Nanotechnology, Wiley VCH, Verlag, Germany, 2006
8. Neimeyer and Mirkin, Nanobiotechnology, Wiley VCH, Verlag, Germany, 2004

Options for required Journal Reading:
1. IEEE Transactions (several journals representing different topics), IEEE Press
2. Science Magazine, AAA Press
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4. Journal of Nanoscience and Technology, ASP*
5. Journal of Experimental Nanoscience, Taylor and Francis*
6. ACS Nano, ACS
7. Micro and Nano Letters, IEEE
9. Nano Today, Science Direct
10. International Journal of Nanoscience, World Scientific
11. Extreme Nano.com, LexisNexis Academic
15. Journal of Applied Physics, AIP Press
* represents a journal not currently available online at the UAHuntsville Library

Course Prerequisites:
Enrollment in a Science or Engineering MS/PhD program

Course Material:
1. Overview of Nanoscience
2. Material Science and Tribiology
   a. SPM technologies
   b. Surface forces and rheology
   c. Adhesion between solids
   d. Friction and wear
   e. Mechanics of bionanotechnology
3. Molecular and Nanoelectronics
   a. Molecular electronics
   b. Nanoelectronic circuits
   c. Spin Field Effect Transistors and spintronics
   d. Molecular machines
4. Manipulation and Assembly
   a. Nanoparticle manipulation using electrostatic and magnetic forces
   b. Bio- and chemical self assembly
   c. Applications of Supramolecular chemistry
5. Functional Nanostructures
   a. Carbon nanotubes
   b. Dendrimers
   c. Photonic crystals – science technology and modeling
   d. Nanofluidics in biology
   e. Composite materials
   f. Nanoparticles for drug delivery

Final Grade:

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<tr>
<th></th>
<th>Midterm</th>
<th>In class</th>
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<tbody>
<tr>
<td>Laboratory</td>
<td></td>
<td>Friday Afternoon Lab Sessions and Lab Report</td>
<td>28%</td>
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<tr>
<td>Project</td>
<td></td>
<td>Review Paper</td>
<td>20%</td>
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<tr>
<td>Project</td>
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<td>Review Paper</td>
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<tr>
<td>Final</td>
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<td>Comprehensive</td>
<td>17%</td>
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Grades depend heavily on the student’s ability to understand and apply concepts related to modern discoveries in nanotechnology. Both a midterm and a final exam will be used to evaluate the student’s ability to comprehend material presented in class.

**Review Papers:** Two individual literature reviews will be performed by each student over the course of the semester. The purpose of this assignment is to acquaint students with current literature on nanoscience, engineering, and technology. These reports should be no less than 10 pages (and no more than 15) single spaced with figures. A complete bibliography of all relevant references should be attached, but excluded from the page count. Each review article should cover the topic as completely as possible, including theoretical analysis, modeling, and device fabrication if possible. Students should treat these reports submitting a topical review to a peer reviewed journal.

Topics for the 1st paper are due by January 30th with the final report due on February 27th. Topics for the 2nd paper are due by March 13th with the final report due on April 10th.

**Laboratory:** Students will enter the laboratory on 4 different to study fundamental aspects of nanotechnology. Topics include lithography, self assembled monolayers layers, colloidal nanoparticle generation, and atomic force microscopy and biological energy production.

**Laboratory Dates:**
- Colloidal Silver: January 30th
- ATP synthesis lab: February 13th
- SAM lab: February 27th
- SPM lab: March 6th