ECE 466/566: Fundamentals of Nanotechnology

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Course level: Graduate students and senior undergraduate students
Prerequisite: College physics and basic semiconductor processing
Lectures: TR 11:00 am - 12:15 pm, Houser Hall 309
Office hours: TR 2:00 pm - 3:00 pm, or per appointment

Course description

ECE 466/566 is an interdisciplinary “Nano” course. The objective is to provide students with a broad overview of nanotechnology. This course focuses on some practical topics, which can be applied to nanotechnology-related research. Topics include nanofabrication, microscopy for nanotechnology, nano-scale devices. Due to the large amount of materials to be covered, this course will put emphasis on the basic principles of nanoscience and nanotechnology.

Topics to be covered (tentative, subject to change):

I. Nanofabrication
   1. Photolithography and its limitation
   2. Electron-beam lithography (EBL)
   3. Focused ion-beam lithography (FIB)
   4. Nanoimprint
   5. Soft-lithography patterning (Midterm exam 1)

II. Microscopy for nanotechnology
   1. Scanning Electron Microscopy (SEM)
   2. Energy dispersive X-ray spectroscopy (EDX)
   3. Transmission Electron Microscopy (TEM)
4. Scanning Probe Microscopy (SPM), including Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM)
5. Atom Probe Tomography (APT)  

III. Nanostructured materials and Nano-devices
1. Size matters: surface and quantum effects
2. Review on solid-state physics and devices (PN junction and MOSFET)
3. Carbon-based nanomaterials and device applications

Required textbook:
- Lecture notes are provided.

Reference books (on reserve in Science and Engineering Library):
- *Introduction to Nanoscience and Nanotechnology* by Chris Binns, Wiley, 2010

Grading policy
*Discussion in small groups is encouraged* for homework. However, each student should *work through problems individually*. Late homework will receive a maximum score of 50%. Homework later than two days will receive the grade of zero. Graduate students are required to do additional work by giving a tool demonstration such as SEM, TEM, AFM, or presenting a review paper on a specific topic in the class.

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<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework (biweekly paper review)</td>
<td>25%</td>
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<tr>
<td>Attendance</td>
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<td>Midterm exam 1</td>
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<td>Midterm exam 2</td>
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<td>Presentation</td>
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