

# 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, SERC 2039

**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, nanostructured materials. 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. Self-assembly for bottom-up patterning

## II. Microscopy for nanotechnology

1. Scanning Electron Microscopy (SEM)  
Energy dispersive X-ray spectroscopy (EDX) (**Midterm exam**)
2. Transmission Electron Microscopy (TEM)
3. Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM)

## III. Nanostructured materials: properties and applications

1. Size matters: surface and quantum effects
2. Metal and semiconductor nanoparticles
3. Carbon-based nanomaterials  
(**Final exam**)

### Required textbook:

- No textbook is required. Lecture notes are provided.

### Reference books (on reserve in Science and Engineering Library):

- *Introduction to Nanoscience and Nanotechnology* by Gabor L. Hornyak, H.F. Tibbals, Joydeep Dutta, and John J. Moore. CRC Press, 2008
- *Introduction to Nanoscience and Nanotechnology* by Chris Binns, Wiley, 2010
- *Nanotechnology: Understanding Small Systems* by Ben Rogers, Sumita Pennathur, Jesse Adams, CRC Press, 2011

### Grading policy

Discussion in small groups is encouraged for homework. However, each student should work through problems individually. No late homework will be accepted. Exams will be completed individually during class time, and will be closed book. If an examination is missed due to a University approved activity or documented emergency/illness, the grade of comprehensive final exam will be used in place of the missing exam score. Missed examinations due to unexcused absences receive the grade of zero. No makeup exams will be provided for any circumstances. 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.

<b>Grading</b>	<b>Graduates</b>	<b>Undergraduates</b>
Homework (regular and paper review) .....	30%	30%
Midterm exam .....	25%	30%
Final exam .....	30%	30%
Demonstration or topic presentation .....	15%	
Attendance .....		10%