

UNIVERSITY OF ILLINOIS  
College of Engineering  
Department of Materials Science and Engineering

**MSE 487: MATERIALS FOR NANOTECHNOLOGY**  
Spring 2019

**Instructor:** Paul Braun, 2017 MRL, 244-7293, pbraun@illinois.edu  
**Lecture:** Tu-Th 9:30-10:50 am, 305 MSEB  
**Office Hours:** by appointment  
**Grader:** Ashish Kulkarni, 164 ESB, akulkrn3@illinois.edu  
**Office Hours:** Tuesday, 3-4pm, 164 ESB or by appointment  
**Website:** <https://compass2g.illinois.edu/>

**Extensive readings from the current literature will be assigned over the semester.**

Course Outline: (note, may revise as the course progresses)

*Part I. Introduction to Nanoscience and Nanotechnology*

*Part II. Physical and Chemical Properties at the Nanoscale*

Bonding and crystal structure  
Thermodynamics at the nanoscale  
Electronic properties  
Magnetic properties  
Optical properties  
Mechanical properties

*Part III. Synthesis and Characterization Methods*

Thin film growth  
Self-assembly and self-organization  
Photolithography  
Examples of applications of characterization methods

*Part IV. Selected Applications of Materials for Nanotechnology (tentative)*

Carbon nanotubes  
Metallic and semiconductor nanocrystals  
Ferroelectrics and multiferroics  
Nanostructuring by severe plastic deformation  
Nanomechanics of biological systems

Grading: 65% consisting of paper reviews (8-10), guest lecture reviews (~8), homeworks (2), and final presentations attendance (1). Each guest lecture review counts as ½ of an assignment.

*3 Credit Option:* 35% Term paper

*4 Credit Option:* 20% In-class research proposal presentation, 15% Written research proposal

Note: All students expected to participate in guest lectures and in-class research proposal presentation evaluation, and attendance mandatory on those days. Attendance at final presentations will be graded as 1 HW assignment (e.g. if two days of presentation, and you miss one, you will receive a 50% for one HW assignment).

## COURSE ASSIGNMENTS

- 1. Homework assignments first two weeks.**
- 2. Starting week 3, a list of published papers will be assigned for review (you will select one paper from the list provided)**
  - You will submit two copies of a written critical review of the paper, adding personal comment(s) prompted by your reading, and supported by some additional source (e.g., papers cited by the article you summarized, papers you found by searching the literature...). A template to review the paper will be provided.
- 3. Starting week 4, you will review and grade the quality of your classmate's reviews.**
  - You will submit a written critical "review of the review", including a grade, adding personal comment(s) prompted by your reading, and supported by some additional sources in the literature. Failure to complete this will result in you being assigned a grade of "0" for your review. Should your "review of the review" be superficial or low quality, I reserve the right to significantly reduce your grade on your review.
- 4. Guest lecture reviews.**
  - One week following each guest lecture, you will submit a written critical review of the guest lecture using the template provided. Guest lecture reviews will be graded on an A-F scale and each critical review will count as ½ of a homework or paper review.
- 5. Term paper (3-credit option) or Research proposal (4-credit option)**
  - Each student will prepare and submit either a term paper (3-credit option) or a research proposal (4-credit option). The paper/proposal should consist of 10 to 15 pages of text plus figures and references on a topic of your choice. Note, "science" focused papers/proposals are generally better than "technology" focused proposals.
  - All thesis MS and PhD students must list their research advisor's name on their research proposal. The proposal must be different than your or your group's current research.
  - A pre-proposal (graduate students) or term paper abstract (undergraduate students) will be due by **Thursday March 7th**.
  - Term papers will be due in class on **Tuesday April 30<sup>st</sup>** (last day of class)
  - Research proposals will be due by noon to the MatSE main office (201 MSEB) on the day scheduled for the course final, **Thursday May 9th**
  - There will be no final exam

## GRADING POLICY

**All assignments no later than 5 min. after the start of class.** Assignments may also be turned into **Ashish Kulkarni's MSEB mailbox** before the start of class. Assignments handed in after this until noon the following day will receive 25 pts off. Assignments will not be accepted after that. Late assignments should be turned into **Ashish Kulkarni's MSEB mailbox**. If you have professional (e.g. interviews) or significant personal issues (e.g. illness), contact Ashish and me via email for accommodations.

You are expected to have read the Student Code section related to Academic Integrity ([http://admin.illinois.edu/policy/code/article1\\_part4\\_1-401.html](http://admin.illinois.edu/policy/code/article1_part4_1-401.html)). All infractions listed in the Student Code, including cheating and plagiarism, will result in penalties in accordance with the Student Code. If you have any question regarding what constitutes an infraction, contact me.

Plagiarism will be treated very seriously. If you do not understand what constitutes plagiarism, talk with me. For example, you cannot copy text from published papers without marking it as "copied from" or equivalent.

**Paper selection for weekly review**

Each week, I will post a list of ~450 papers published in Nature Nanotechnology and Nano Letters to compass2g (under “Course Content/Review Assignments. Each student will be assigned a number. You will pick one paper from the nine papers you are assigned, using the following formula:

*Assigned paper #s = student number + 50n (n = integer from 0 to 8)*

(e.g., if you are assigned student number #18, you pick one paper from paper #18, 68, 118, 168...)

**Important: You should only pick original scientific articles, not commentaries or review articles. If in doubt, send me the pdf of the paper you select, and I will inform you if it is suitable. I filter some, but not all the commentaries out.**

Your review must be substantive. Follow the procedure I hand out.