

Introduction to Nanomaterials and Nanotechnology

ME 4875/MTE 575 - C-TERM 2017

Syllabus

Schedule:	Lectures. MTW-F 2:00-2:50 pm in Salisbury Labs 411
Prof – Pratap Rao	HL 106, pmrao@wpi, 508-831-4828
TA – Tao Yan	tyan@wpi.edu
Office Hours:	Prof: R 2-3pm, F 3-4pm in HL 106 TA: M 10-11am, T 11am-12pm in WB 333

Course Objectives

This senior level/ graduate course introduces students to current developments in nanomaterials and nanotechnology. Current advances in materials and devices consisting of metal, semiconductor, ceramic or polymer building-blocks that are nanometer-sized (1-100 nm) are reviewed. The differences in properties of matter at the nanometer scale compared to those at the macroscopic scale are studied, and the techniques used to synthesize and characterize nanomaterials are considered. Recommended background: ES 2001 Introduction to Materials or equivalent.

Canvas: We will use Canvas for access to course documents such as syllabus, lecture slides, readings, homework problem sets, homework solution sets, and course announcements.

Textbook: None required. Reading assignments will be posted on Canvas.

Grading: **Homework Sets (4)*** 60%

*Students who are registered for graduate course MTE 575 will have additional homework problems assigned

Project 40%

Report - 25%

Poster Presentation - 15% [11% from Prof. evaluation + 3% from evaluation by audience (peers from other teams) + 1% for being present at all poster sessions to evaluate the other teams]

Students will work in 4-person teams on the course project. Students are responsible for printing their posters and bearing the printing costs.

Policies and Guidelines:

Registration in closed class: Only waitlisted students who have obtained prior consent of the instructor will be allowed to register.

Class Structure: Class will generally revolve around PowerPoint lectures, which will be uploaded to Canvas. Reading assignments will be posted on Canvas. You must have completed these readings before coming to class.

Homework is due in class on the due date. No late homework will be accepted.

Peer evaluation: Part of each teams' project grade will come from peer assessment by classmates from other project teams. In addition, each person will be asked to evaluate each of their team members' contributions to the group effort at the end of the course, and grades on projects may be adjusted for individuals, accordingly. The peer evaluation form will be posted on Canvas. Students are responsible for informing the instructor of any problems within their team early in the term.

Extenuating Circumstances: Students should individually inform the instructor *during the first week of the term* of any *commitments* (religious observances, WPI sports, etc.) or *circumstances* that might affect your ability to meet any of the deadlines in the course or to take exams at the scheduled times. If the instructor is informed of conflicts after the first week, students will be excused from deadlines only under extraordinary circumstances

Student Accommodations: If you need course adaptations or accommodations because of a disability, or if you have medical information to share with me, please make an appointment with me as soon as possible. If you have not already done so, students with disabilities who believe that they may need accommodations in this class are encouraged to contact the Office of Disability Services (ODS) as soon as possible to ensure that such accommodations are implemented in a timely fashion. This office is located in 124 Daniels Hall, disabilityservices@wpi.edu, (508)831-4908.

Please review WPI's academic dishonesty policy in the Campus Planner and Resource Guide. Regarding homework assignments, some collaboration is allowed, but this should take the form of general discussion of concepts and approaches required for solution of problems. After this discussion, students should independently solve the problems. Solutions to problems should not appear as though they were copied from another student, or from solution manuals to any textbook. In addition, all literature sources must be properly referenced in homework, project reports, and posters. Plagiarism will not be tolerated.

ME 4875/MTE 575 - C/17 - Course Outline

Lecture #	Date	Topic	Items Assigned/Due
1	Jan 13, F	Introduction to Nanomaterials	HW 1 Assigned
-	Jan 16, M	No Class (MLK Day)	
2	Jan 17, T	Overview of Applications of Nanomaterials Project Topics and Resources	Project Topics Announced
3	Jan 18, W	Modern Physics Atomic Structure	Project preferences due by 11.59 pm
4	Jan 20, F	Bonding Crystal Structure	HW 1 Due, HW 2 Assigned Project Topics and Teams Assigned
Module 1: Characterization of Nanomaterials (4 lectures)			
5	Jan 23, M	Introduction and Limits of Optical Microscopy	
6	Jan 24, T	Imaging/Mechanical Characterization by Atomic Force Microscopy	
7	Jan 25, W	Imaging by Electron Microscopy	
8	Jan 27, F	Nanoscale Chemical Characterization	
Module 2: Synthesis of Nanomaterials (8 lectures)			
9	Jan 30, M	Top-Down: Optical Lithography	HW 2 Due, HW 3 Assigned
10	Jan 31, T	Top-Down: Beam- and Nano-Lithography	
11	Feb 1, W	Bottom-Up: Scanning Probe, Additive Manufacturing	

12	Feb 3, F	Bottom-Up: Vapor Deposition of films	
13	Feb 6, M	Bottom-Up: Vapor Deposition of nanowires	
14	Feb 7, T	Bottom-Up: Nanoparticles (spray pyrolysis and colloidal)	
15	Feb 8, W	Bottom-Up: Solution, Sol-gel, Self-Assembly	
16	Feb 10, F	No Class, no OH (Prof. Out)	
Module 3: Properties of Nanomaterials (8 lectures)			
17	Feb 13, M	Electronic	HW 3 Due, HW 4 Assigned
18	Feb 14, T	Optical	
19	Feb 15, W	Heat/Phonons	
20	Feb 17, F	Mechanical	Draft of Poster Due
21	Feb 20, M	Chemical and Magnetic	Poster feedback
22	Feb 21, T	Mass and Charge Transport	
23	Feb 22, W	Mass and Charge Storage	
24	Feb 24, F	Biology-Relevant Properties	HW 4 Due
25	Feb 27, M	Course Summary & New Research	
26	Feb 28, T	Poster Session 1	
27	March 1, W	Poster Session 2	
28	March 3, F	Poster Session 3	Project Report Due at 5pm in HL 106