Course Syllabus

Course Information – Spring 2016

MECH 4360 001
Introduction to Nanostructured Materials
Room: ECSS 2.311
Time: TR 8:30 – 9:45 AM
Final Project: Due Thursday April 28 (in class) and Saturday at 11:55 p.m. April 30 (written)
NO FINAL EXAM

Professor Contact Information

Prof. Walter Voit
Office: NSERL 4.710
Phone: 972.883.5788
Email: walter.voit@utdallas.edu (preferred method of contact)
Office Hours:

By appointment (set up via email)
Before or after class are the best times to catch me in person

TA Contact Information

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Office Hours: by appointment

Course Pre-requisites, Co-requisites, and/or Other Restrictions

Prerequisites: MECH 3301, CHEM 1311

Course Description

MECH 4360 - **Introduction to Nanostructured Materials** (*3 semester hours*) Lecture course. The emphasis in this course is to introduce the science of the building blocks of nanostructured materials, their chemical and structural characterization, material behavior, and the technological implications of these materials. Special attention is devoted to presenting new developments in this field and future perspectives.

Learning Objectives/Outcomes

It is expected that you will gain a fundamental physical and mathematical understanding of nanostructures and nanotechnology rather than memorizing the equations and specific problems. By this, it is implied that you will be able to correctly apply the course content to new situations so as to evaluate potential industrial applications through both physical induction and mathematical analysis/computation. Such inductive and analytical reasoning will be taught through classroom examples and homework, and tested on examinations.

Required Textbooks and Materials

Nanomaterials, Nanotechnologies & Design, by Ashby and Schodek
Assigned journal articles available electronically through the McDermott library

Other reference materials (not required to purchase)

Fundamentals of Nanotechnology, by Hornyak, Moore, Tibbals and Dutta; *Structural Nanocrystalline Materials*: Fundamentals and Applications, by Koch, Ovid'ko, Seal and Veprek

Grading Policy

Choose 3 of 4 Tests (Drop one grade)

Test 1	25%	Thurs. Jan. 28
Test 2	25%	Thurs. Feb. 18
Test 3	25%	Tues. March 29
Test 4	25%	Tues. April 19

Final Project (Handed out March 18)	25%	May 1 (in class), May 3 (written)
Homework*	25% toward each test	Due as assigned on Test Days

**Homework is optional. Homework handed in after the due date will not be counted. All homework before each test can count up to 25% towards that specific test grade. Example 1 - If you score an 80 on your first test, and received a 100 average on the homework turned in before that test, your new test score will be 80*(3/4) + 100*(1/4) = 85.*

Example 2 – If you score a 95 on your first test, and received a 93 average on all homework, you will still receive a 95 for that test, because doing the homework cannot hurt your grade.

Example 3 – You choose not to do homework. Your test grade will be what you earn. Homework will be averaged separately between each test and the next.

Course & Instructor Policies

(make-up exams, extra credit, late work, special assignments, class attendance, classroom citizenship, etc.)

You must have a certified (doctor or otherwise) excuse for missing a test date. I am willing to work with you for university sanctioned travel or in other circumstances at least one week BEFORE the test date.

Off-campus Instruction and Course Activities

Below is a description of any travel and/or risk-related activity associated with this course.

None anticipated

Policies and Procedures for Students

The University of Texas at Dallas provides a number of policies and procedures designed to provide students with a safe and supportive learning environment. Brief summaries of the policies and procedures are provided for you at http://provost.utdallas.edu/home/index.php/syllabus-policies-and-procedures-text and include information about technical support, field trip policies, off-campus activities, student conduct and discipline, academic integrity, copyright infringement, email use, withdrawal from class, student grievance procedures, incomplete grades, access to Disability Services, and religious holy days. You may also seek further information at these websites:

- http://www.utdallas.edu/BusinessAffairs/Travel_Risk_Activities.htm
- http://www.utdallas.edu/judicialaffairs/UTDJudicialAffairs-HOPV.html
- http://www.utsystem.edu/ogc/intellectualproperty/copypol2.htm
- http://www.utdallas.edu/disability/documentation/index.html

These descriptions and timelines are subject to change at the discretion of the Professor.

Assignments & Academic Calendar

(Topics, Reading Assignments, Due Dates, Exam Dates)

1. Tues. Jan. 12 - Introduction, Syllabus, Quiz, Lecture - The 100 nm regime – HW#1 assigned[1]
2. Thurs. Jan. 14 - Review of Materials and Chemistry: Lattices, Bonding, Structure-Properties[2]
3. Tues. Jan. 19 - Grain Growth[3]
4. Thurs. Jan. 21 - Mechanical Properties[4]; Quantum Effects[5]; Test #1 Review – HW #1 Due
5. Tues. Jan. 26 - Guest Lecture – TBD
6. Thurs. Jan. 28 - **TEST #1**
7. Tues. Feb. 2 - Test #1 Discussion / HW #2 Assigned; Final Project Handed Out
8. Thurs. Feb. 4 - Characterization Tools / Nanoelectronics
9. Tues. Feb. 9 - Nanoelectronics
10. Thurs. Feb. 11 - Nanooptics
11. Tues. Feb. 16 - Nanooptics; Test #2 Review – HW #2 Due
12. Thurs. Feb. 18 - **TEST #2**
13. Tues. Feb. 23 - Test #2 Discussion / Nanomechanics – HW#3 Assigned
14. Thurs. Feb. 25 – Nanomagnetics
15. Tues. March 1 - Nanomechanics
16. Thurs. March 3 - Nanostructures
17. Tues. March 7 - Guest Lecture;
18. Thurs. March 10 - Nanostructures
19. March 14-18 SPRING BREAK
20. Tues. March 22 - Test #3 Review – HW #3 Due
21. Thurs. March 24 - Biomimetics
22. Tues. March 29 - **TEST #3**
23. Thurs. March 31 - Guest Lecture
24. Tues. April 5 - Test #3 Discussion / Nanobiotechnology – HW#4 assigned
25. Thurs. April 7 - Medical Nanotechnology
26. Tues. April 12 - Nanotechnology and Society
27. Thurs. April 14 - Test #4 Review – HW #4 Due
28. Tues. April 19 - **TEST #4**
29. Thurs. April 21 - Special Lecture & Project Day
30. Tues. April 26 - Project Day
31. Thurs. April 28 - Final Project Presentations (*You could be finished this day with class*)
32. Sat. April 30 - Written Project Due by 11:55 p.m.
33. May 6 – May 12 FINAL EXAM WEEK (NO FINAL EXAM)
34. Thus. May 15 - Final Grades Posted

Initial Homework Readings

1. Feynman, R.P. There's plenty of room at the bottom. *Engineering and Science* **23**, 22-36 (1960).
2. Pohl, K. et al. Identifying the forces responsible for self-organization of nanostructures at crystal surfaces. *Nature* **397**, 238-241 (1999).
3. Liu, F. & Kirchheim, R. Comparison between kinetic and thermodynamic effects on grain growth. *Thin Solid Films* **466**, 108-113 (2004).
4. Jortner, J. & Rao, C. Nanostructured advanced materials. Perspectives and directions. *Pure and applied chemistry* **74**, 1491-1506 (2002).
5. Bellessa, J. et al. Quantum-size effects on radiative lifetimes and relaxation of excitons in semiconductor nanostructures. *Physical Review B* **58**, 9933 (1998).