**Nano Structured Materials Course Syllabus\***

* **Course Goals:**
* Nanotechnology promises to be the technology of the future benefitting the humanity in a number of ways. This course is aimed at preparing students for further industrial or academic work in the field of nano-manufacturing.
* **Course Objectives:**
* The course content has been structured to help the student achieve the following objectives:
  + 1. To gain an understanding of the principles of nanotechnology;

characterization of nano-structured materials; and tools and

equipment for producing and assembling at the nano scale.

* + 2. To acquire practical experience by having laboratory sessions.
  + 3. To cultivate interest in the research and development of nanotechnology for future advancement of your career.
* **Required Text:**
* Guozhong Cao (2004). Nanostructures and Nanomaterials: Synthesis, Properties & Applications, 448 pages, Imperial College Press, ISBN-10:
* 1860944159
* **Journal Articles:**
* To be provided along the course
* **Course Program:**

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| Week | Topic | Chapter | Grading |
| Jan 14 | Introduction to the course,   * Students Interests and Expectations; * Historical perspective of micro and nano manufacturing technology, Advantages and applications of nanotechnology   Assign HMW1 | 1 |  |
| Jan 28 | Characterization Tools:  Optical microscopy, Profilometry, Ellipsometry, Spectrophotometer, Scanning Electron Microscope, AFM, FFM.  Student presentations (Each student records a 5 minute presentation about a specific tool)  Quizz 1; Assign HMW2; Deliver HMW1 | 9 |  |
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| Feb 4 | HOLIDAY |  |  |
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| Feb 11 | * Materials overview, atomic structure, bonding, polymers, electrical characteristics, periodic table, crystal structures and defects, physical chemistry of solid surfaces, Introduction to Si-based materials, Ge-based materials * Quizz 2; Assign HMW3; Deliver HMW2 * **Propose a Term Paper in no more than 200 words** | 2 |  |
| Feb 18 | * Overview of Nano Fabrication Methods: Top-down and bottom-up approaches, lithography, deposition, CVD, PVD, etching, and material modification methods, processes and equipment * Quizz 3; Assign HMW4; Deliver HMW3 | 7 |  |
|  | * Laboratory Session 1. Aerogel **(L)** |  |  |
| Feb 25 | * Zero dimensional Nano structures (Nano Particles) - Fabrication procedures, sol-gel processing, applications, properties and applications of Nano Particles * Quizz 4; Assign HMW5; Deliver HMW4 | 3 |  |
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| Mar 4 | * One dimensional Nano structures - Nano wires and nanorods, fabrication methods, Properties and applications of Nano Wires. * Quizz 4; Assign HMW6; Deliver HMW5 | 4 |  |
|  | Laboratory Session 2. Metal Oxide Nanoparticles **(L)** |  |  |
| Mar 11 | Two dimensional nano structures  Quizz 5; Assign HMW7; Deliver HMW6 | 5 |  |
|  | * MIDTERM |  | 20% |
| Mar 18 | * Top down fabrication procedures, Lithography, Pattern transfer methods, Wet Etching and Dry etching. * Quizz 6; Assign HMW8; Deliver HMW7 | 7 |  |
|  | * Laboratory Session 3. Gold Nanoparticles **(L)** |  |  |
| Mar 25 | * Application of nano materials, Carbon Nano Tubes, Quantum dots, etc., Organic compounds and bio-applications of nano materials. Part 1 * Quizz 7; Assign HMW8; Deliver HMW7 | 6,9 |  |
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| Apr 8 | * Application of nano materials, Carbon Nano Tubes, Quantum dots, etc., Organic compounds and bio-applications of nano materials. Part 2 * Quizz 8; Deliver HMW8 |  |  |
|  | * Laboratory Session 4. Solar Cell. **(L)** |  |  |
| Apr 15 | * Spring Break |  |  |
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| Apr 22 | * Deliver and present before the group the Term Paper. * Presentation time 5 minutes; Q&A 5 minutes. |  |  |
| Apr 29 | * BUFFER SESSION |  |  |
|  | * Term Paper |  | 20% |
|  |  |  |  |
|  | * Homeworks\*\* |  | 20% |
|  |  |  |  |
|  | Lab. Reports |  | 20% |
|  |  |  |  |
|  | Final |  | 20% |

* \* Syllabus based on a course lectured by Dr. Nageswara Rao Posinasetti, at
* University of Northern Iowa Cedar Falls, IA 50614—0178, on Fall 2010.
* \*\* Some of the Homeworks will require working in the laboratory and the
* Homework Deliver is a Laboratory Report.
* **The ones with (L) are compulsory.**
* **Internet Sources**

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| ASME Nanotechnology Institute | http://www.nanotechnologyinstitute.org |
| EUSPEN (European Union Precision Engineering and Nanotechnology) | http://www.euspen.eu/ |
| Foresight Institute | http://www.foresight.org/ |
| Information on Nanotechnology | * http://www.nanomagazine.com/ |
| * Institute of Nanotechnology | * http://www.nano.org.uk/ |
| * National Nanotechnology Initiative | * http://www.nano.gov/ |
| Information on Nanotechnology | http://www.nanomagazine.com/ |
| * Google Nanotechnology directory | http://www.google.com/Top/Science/Technology/Nanotechnology/ |
| * Information on Nanotechnology | http://www.nanowerk.com/ |
| * Nanocolors ␣ the nanotech * 2.0 hub | http://nanocolors.wordpress.com/ |
| * Swiss Nanoscience Institute | http://www.nanoscience.ch/nccr/ |
| Nanotechnology Education | * http://www.nano4me.org/ * http://nanoengineer-1.com/content/index.php?option=com\_frontpage &Itemid=1   http://nanozone.org/ |
| * Center of Integrated Nano mechanical Systems | * http://mint.physics.berkeley.edu/coins/ |
| * Video on Nanotechnology | * http://www.vega.org.uk/video/programme/3 |
| * IBM Research labs in Zurich | * http://www.zurich.ibm.com/st/nanoscale/ |
| * European Nanotechnology gateway | * http://nanoforum.org/ |
| * Toward Advanced Nanotechnology | * http://e-drexler.com/index.html |
| * AAAS | * http://www.eurekalert.org/context.php?context=nano&show=backgr ound |
| * Medical applications of nano | * http://nano.cancer.gov/ |
| * Small Times magazine | * http://www.electroiq.com/index.html |
| * Carbon Nano Tubes | * http://www.pa.msu.edu/cmp/csc/nanotube.html |
| * International Council on Nanotechnology | * http://icon.rice.edu/ |
| * Nanoparticle Information Library | * http://nanoparticlelibrary.net/index.asp |
| * Univ. of Sussex and Bristol, UK | * http://www.nanofolio.org/win/ |
| Nano Dictionary | http://pages.unibas.ch/colbas/ntp/NanoDictionary.pdf |
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* **ASSIGNMENTS**

1. There shall be eight (8) assignments/topics
2. The report (between 3 to 5 pages in APA format) for each of the assignment must be produced from a computer word processing program.
3. You must use this format:
   * Margins: 1" all around
   * Font: Arial (12pt)
   * Print in "normal" or "high quality" mode (do not use draft or quick print mode).
   * Set up your report as an internal memo:
4. Use single space in header and double space in body of document
5. Staple in upper left corner.
6. Writing style can be in 1st or 2nd person.
7. The narrative should be clear and concise.
8. Spell check and grammar check for accuracy.

* DATE: Month Day, 2019
* To: Dr. Jaime Bonilla
* FROM: Student
* RE: Homework Topic

**Term Paper:**

* It is expected to be a detailed study and presentation of a topic relevant to the course content and related to your interest. The topic must be discussed with the instructor by . The topic and a written brief, describing the topic should be submitted by February 11. The term paper, about 8-10 pages in APA format, should be submitted on the day of the presentation. Questions in final examination may include some of the presentations.
* **Laboratory Demonstration:**
* Students will be exposed to practical operations, and experimental demonstrations of some of the equipment for Nano fabrication available in Monterrey Tech. Students will produce a technical report on the experiences.
* **Final Examination:**
* The final examinations will cover all topics covered during lectures, quizzes and presentations made by graduate students. The coverage for the examinations will be known prior to the examination.
* **Academic dishonesty:**
* Cheating of any kind on examinations and/or plagiarism of papers or projects is strictly prohibited. Anyone caught passing off the work of others as their own (i.e., copying from a book/journal or cut and pasting from internet sources without appropriate citation) runs the risk of immediately failing the course and expulsion from the class and the University. For more institutional rules regarding academic dishonesty, please see the University policies.