Course Description: Introduction to experimental methods in materials characterization; synthesis of colloidal nanoparticles; X-ray diffraction and light scattering; optical microscopy; thermal conductivity and expansion; electrical measurements; heat capacity; computational materials design.

Pre-requisite: ENMA 300; Co-requisite: ENMA 460

Textbook:
1. Faculty notes and written instructions on how to do the experiments. Laboratory instructions from last year are available at canvas. Notes available in PDF (please note that the instructor reserves the right to add any notes that she feels may clarify some of the points given during class – these may or may not be added to the PDF file).

Course Objectives:
At the end of this course, the student should be able to
1. Describe a variety of experimental methods and identify when they should be applied (see 3).
2. Identify what materials' properties a particular method probes.
3. Identify the most appropriate method(s) to probe specific materials characteristics. Be able to design experiments, based on this knowledge.
4. Identify the limitations of a specific characterization method.
5. Understand how different characterization methods complement each other.
6. Become familiar with modern methods of materials characterization, similar to those encountered in industrial and testing facilities, and government laboratory.
7. Communicate effectively their results and findings through reports and orally.

Laboratory Exercises (Topics Covered):
I. Introduction
II. Safety
III. Synthesis of Nanometer-Size Nanoparticles
IV. Diffraction – Light Scattering and X-Ray Diffraction
VI. Optical Microscopy
VII. Thermal Conductivity and Expansion
VIII. Electrical Measurements/LED
IX. Heat Capacity
X. Computational Materials Design

Class Schedule:
Lecture: Tue 2PM – 3:15PM or Thursday 2 PM – 3:15PM
Laboratory: 1135, Kim Building, M 9AM-12 Noon (Tuesday lecture) or W 9AM - 12 noon (Thursday
Grading:
1. Attendance to class is required because this is a laboratory. This will be taken into consideration when evaluating your grade (see below).

2. Grading will be based on written reports submitted at the end of each exercise, the laboratory notebook, student participation in the laboratory and in the class, the quizzes, and the oral evaluations.

Occasional quizzes referring to the upcoming experiment will be given during the lecture time. The number and frequency of these quizzes will be determined by the instructor. There is no makeup for the quizzes, unless there is a justifiable excuse (see note on excuses).

Reports, including the notebook reports and homeworks (when given) will be due approximately a week after the completion of the experiment. Laboratory notebooks are due at the end or the beginning of each month (please check the calendar for the dates). After the deadline, the report, homework and laboratory notebook will lose 1.43 out of 10 points per day (double when we have an assignment good for 20 points), until one (1) week afterwards, when the total points will be taken from them. In other words, homework turned in after one week will not be graded, and will be given a zero.

3. Note that in addition to what is asked for the reports (both content and form – your grade in a particular report will depend on whether:
   a. You have completed what is asked in the assignments (see the beginning of the experiments).
   b. You bring your notebook to class. Not bringing it will cost you 1 point out of ten (2 out of twenty) depending on how much the report is worth that week.
   c. In addition to the reports, selected exercises may include "thought questions", which will be graded independently. The thought questions may be included in the oral presentations. The purpose of the thought questions and the orals is to help students design experiments and measurements to characterize a particular material based on the laboratories they have just completed, or to see how the technique applies to other materials.
   d. Participation is important especially if you are on the borderline between one grade and the next highest.

Grading

Reports, homework, and participation (including the oral presentations, quizzes, tardiness to class and attendance): 80%

Laboratory notebook: Includes notebook reports and notebook organization (regular notebook check), 20%

Deadline to submit last report: Friday, December 6, 2013. For the deadlines for other reports, see calendar in Canvas.

Orals:
This year the orals are expected to be on:
Oct. 16, 2013
Nov. 20, 2013
Make-Up

Because of the equipment used, the capacity use of the undergraduate lab and the size of the class, make-ups will vary depending on the experiment. Some of the equipment will not be available except on the days the instructor has arranged for them. The capacity use of the undergraduate lab may mean there is no day available to do the make-up, in which case another type of make-up will be arranged, if the excuse is valid.

Religious holidays:
It is your responsibility to inform the instructor which religious holidays you are observing. If you will be absent on a certain day due to a religious holiday, please let the instructor know at least a week before you will be absent, so that arrangements can be done for you to make up the class. Sometimes the class cannot be made up because the equipment is not available. In that case an equivalent make-up will be given. Informing after the fact will not be accepted. The same applies to a professional meeting.

Attendance:
Attendance is required both to the laboratories and the lecture. Failure to do so will result in a lowering of your grade, since participation in the class means doing the laboratories and being aware of the safety issues (discussed during the lecture).

Contribution of course to meeting the professional component: This course is a laboratory course aimed at introducing the students to the methods used to characterize materials in order to explain and improve the material's behavior as specified by certain design criteria or needs.

Relationship of course to program objectives: This course is a required junior level course in Materials Science and Engineering. Its purpose is to allow the students to become familiar with characterization methods and data analysis techniques, through a combination of hands-on experience, measurement demonstration and data analysis.

Honor Code: The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit http://www.shc.umd.edu.
To further exhibit your commitment to academic integrity, remember to sign the Honor Pledge on all examinations and assignments: "I pledge on my honor that I have not given or received any unauthorized assistance on this examination (assignment)."

Instructors-Coordinators: Profs. Luz Martinez-Miranda and Marina S. Leite