Department of Physics Physics 133/219 Class Syllabus — Spring 2015

Instructor:	Richard D. Averitt	raveritt@ucsd.edu
	4591 Mayer Hall Addition	-

Instructor Office Hours: By appointment

TAs:

Alexander B.	[email]
Naveen P.	[email]

TA Office Hours: By appointment.

Lab Hours: To be determined. Lab room:

Weekly Meetings: Time and location to be determined

<u>Course description</u>: In this variant of PY133/219, there will be an emphasis on materials characterization using a PPMS (Physical Property Measurement System). For this course we will use the Versalab from Quantum Design. The Versalab permits measurements that include electrical and thermal transport, heat capacity, and magnetization as a function of temperature and magnetic field. The first several weeks of the course will introduce these capabilities through measurements of specific materials. In addition, students will pursue a measurement project of their choosing that is discussed with and approved by the TAs and course instructor. This research project will require a final research paper and presentation at the end of the quarter. It is advised that the students begin thinking about and discussing potential research projects with the TAs and course instructor early in the quarter to facilitate timely progress.

<u>Grading Policy</u>: Grades will be determined from performance on the measurement modules, a final research paper, an oral presentation, lab notebooks, weekly progress reports, and overall performance in the lab.

<u>Measurement Modules</u>: Each research team will be required to learn the basic background and methodology of electrical transport, heat capacity, and magnetization measurements, completing several experimental modules. The results of these measurements should be recorded in your laboratory notebook, which may include answering specific questions assigned by the instructor.

<u>Final Research Paper</u>: A final paper detailing the experimental research project will be turned in at the end of the quarter. This paper must be written in the format of a professional research letter.

<u>Oral Presentation</u>: At the end of the quarter, each research group will give an oral presentation on research performed during the quarter. Presentations should be approximately 20 minutes.

Lab Notebooks: Each student should keep a neat and well-maintained lab notebook. Notebooks should be bound and preferably be ruled or quad-ruled. Loose-leaf paper or 3-ring binders will not be accepted. Computer-generated graphs or other computer printouts should be cut and glued or stapled into your lab notebook. All writing in notebooks should be done in pen; work in pencil will not be accepted. Lab notebooks should be readable, but remember the purpose of a notebook is to thoroughly document your research and experiments; therefore sketches, drawings, and mistakes are acceptable and expected. If proper documentation requires that you scratch something out of the notebook that is incorrect, then do so by striking out the word(s) with one horizontal line. Even words that are stricken out should still be legible. Notebooks will be collected periodically.

<u>Weekly Progress Reports</u>: In lieu of a midterm/written progress report, informal verbal progress reports will occur weekly with the whole class present. Although informal, students should be prepared to present their progress from the last week. TAs should not have to elicit the information. This holds for the measurement modules and research projects. This will allow for the progress report as well as the discussion of any hindrances you and your group may be experiencing. This discussion of problems should result in expedited solutions and simulate a real research environment.

<u>Overall Lab Performance</u>: Lab performance will consist of time spent in the lab (expect to spend 10-12 hours a week) and your proficiency at both research and group work.

Calendar

Week #	Dates	Objectives/Material Due Dates
1	4/1 - 4/3	Introduction – Course Overview
		Measurement Modules and Project Examples*
		Form teams
		Schedule Lab times, lectures/weekly meetings
		Informational Meeting Wed. 4/1 2:00 p.m Mayer Hall 4322
2	4/6 - 4/10	Electrical transport
		Hall effect in copper
		Weekly Meeting
		Last day to add class
3	4/13 - 4/17	Electrical transport continued
		Hall effect in p-type Ge, measuring T _c in superconductor
		Weekly Meeting
		Notebooks due
4	4/20 - 4/24	Heat Capacity
		Vanadium dioxide (VO ₂) powder
		Weekly Meeting
		Last day to drop a class w/o a W and change grade option
5	4/27 - 5/1	Heat Capacity continued
		V_2O_3 pellet, Gd foil, etc.
		Weekly Meeting
		Notebooks due
6	5/4 - 5/8	Magnetization -Vibrating Sample Magnetometry (VSM)
		Ferromagnetic wire, paper clip
		Weekly Meeting
7	5/11 - 5/15	Magnetization –VSM continued
		PM to FM transition in Gd, antiferromagnetism in Cr, Mn
		Notebooks due
8	5/18 - 5/22	Research Project Measurements
		Detailed outline of research measurements / paper
		Weekly Meeting
9	5/25 - 5/29	Research Project Measurements
		Rough Draft of paper due
		Last day to drop a class w/o an F
10	6/1 - 6/5	Research Project Measurements
		Presentations/Final Draft of paper due 6/6 (Saturday)

Note: While the first several weeks of the quarter will focus on learning/performing experimental measurements, it is important to begin thinking about the "final" experimental measurement projects.