

PHYS 396
Advanced Techniques in Experimental Physics
Spring 2011
Syllabus

The primary goals of ATEP are (1) to expose you to experimental techniques from modern physics and (2) to deepen your understanding of the relationship between experiment and theory. You will be challenged to understand a variety of experimental setups and interpret the data collected from each.

We will focus on three skill sets:

1. Oral communication
2. Written communication
3. Experimental technique
4. Researching and gathering information

Instructor: David Altman
Email: daltman@willamette.edu
Office: Collins 312
Phone: 650-804-5764
Office Hours: Tuesdays 9-10 and Wednesdays 10-11

Prerequisites: Physics 223

Website: The class website can be found on the *WISE* system (<http://wise.willamette.edu>). The site will contain important handouts.

Weekly Meetings: Tuesday and Thursday, 1-4 pm in Collins 318. Each class will start with a brief group meeting. In these meetings, we will discuss the progress of your projects. We will focus on problems that have been encountered, and we will try to solve these problems together as a team. Active participation in these meetings is mandatory for successful participation in this class. In addition to the weekly meetings, you will be expected to spend time outside of class to complete projects and papers.

Research Seminar: Friday, 3 pm. Attendance at the research seminar is mandatory. If you cannot attend a talk, please let me know ASAP.

Organization of the class: The class consists of a series of three-week projects. The following is a rough schedule for each project:

Week 1	Tuesday	<ul style="list-style-type: none">- Gather information about the project- Develop an experimental strategy- If there is time, start project
	Thursday	<ul style="list-style-type: none">- Work on project
Week 2	Tuesday	<ul style="list-style-type: none">- Work on project
	Thursday	<ul style="list-style-type: none">- Work on project
Week 3	Tuesday	<ul style="list-style-type: none">- Begin writing paper
	Thursday	<ul style="list-style-type: none">- Peer-review of papers- Optimize your paper based on feedback- Finish and submit paper

Lab notebooks: You will be expected to maintain a lab notebook throughout the class. Writing in a lab notebook is informal, but the content must be detailed and thorough enough so that colleagues can *reproduce exactly* your experiments. Except for weeks when you are turning in a lab report, lab notebooks will be collected on Thursday and returned to you on Friday.

Papers: Writing is a major component of this class, and so you will be expected to put together a write-up for each experiment. The format of each paper is detailed below:

- *Project 1:* Technical Paper

This is a document that describes the process, progress, or results of your research. It might also include recommendations and conclusions. Unlike other scientific literature, such as scientific journals and the proceedings of some academic conferences, technical reports rarely undergo comprehensive independent peer review before publication. (adapted from http://en.wikipedia.org/wiki/Technical_report)

Your paper should contain technical information about the experiment, theoretical analysis of how the experiment works, and a comparison to your results. It will also contain results of several tests that you have performed to ensure the experiment is working properly.

- *Project 2:* Thesis Style Report

A thesis contains a lot of detail, and almost cookbook style instructions. It needs to be clear, detailed and thorough so that others can understand what you did, reproduce it, and take the experiment a step further. This will be the style you will use for your senior thesis as well.

- *Project 3:* Publication Style Report

This document is limited to a maximum of 4 pages (in LaTeX), including references. It must be precise and concise. General style: Title, abstract, introduction, apparatus, data, analysis, conclusion, outlook, references (extensive!).

- *Independent Project:* Proposal Style Report (before) and Thesis Style Report (after)

The proposal is limited to 3 pages (1 page of motivation and impact, 2 pages summary of the project), + 1 page of references + 1 budget page. You need to sell your project to the funding agent.

I will provide you with style files for each of these documents. Except for the *Proposal Style Report*, you will be using Latex to write your reports.

Papers will be due at noon on Wednesday of the third week for each project, and should be sent out to the class. Everyone is expected to read and write comments on all submitted papers by the next class (Thursday). During that class, we will peer-review all papers. You will then spend the remainder of the class editing your paper based on this feedback, and you will submit the final draft by the end of the day.

Individual project: The class will culminate in an individual project that you will design and conduct. You should be thinking about ideas for your project right away. Important dates for your independent project are listed below:

2/8 – Discuss ideas for individual project with me.

3/1 – Finalize ideas for individual project.

3/17 – Budget for individual projects due, order parts after checking with me.

3/30 – Proposal for individual project due.

In addition, on the last day of classes, you will give a 20-minute presentation on the results of your individual project.

Senior project: Most of you will be continuing on with a senior year independent research project next year. During the class, you will prepare a proposal for this project. Important dates for your senior project are listed below:

3/1 – Discuss ideas for senior project with me.

4/27 – Senior project proposal due.

Academic honesty:

1) *Honesty in presentation of data:* What you record in your lab notebook and report in your written and oral presentations must be exactly what you have observed in lab. Fabrication of data and falsification of data (using the results of another person's work without acknowledgement) are intellectual crimes as serious as plagiarism.

2) *Honesty in presentation of ideas:* The appropriate way to incorporate an idea which you have learned from a textbook, paper, or other reference is to study the point until you understand it, and then state the idea in your own words. You must then acknowledge the source of the idea. If you are importing text directly from a published work, it must be clear from your presentation that you are quoting the text, and not merely paraphrasing.

Important Dates:

January 17 – 1st day of classes

January 21 – Martin Luther King Jr. Day, no classes after 12:30 pm

January 28 – Last day to add/drop classes

February 28 – Last day to choose CR/NC grading

March 21-25 – Spring Break

April 20 – Student Scholarship Recognition Day (SSRD), no classes

May 3 – Last day of classes

COURSE OUTLINE

Week	Day	Project	Deadlines / Goals
1	1/18	1 st project	
	1/20	1 st project	Lab notebooks are due at the end of the day.
2	1/25	1 st project	
	1/27	1 st project	Lab notebooks are due at the end of the day.
3	2/1	1 st project	Have a copy of your report ready for everyone by Wednesday (2/2) at noon.
	2/3	1 st project	Peer review of reports. Final report is due by the end of the day.
4	2/8	2 nd project	<i>Discuss ideas for individual projects with me</i>
	2/10	2 nd project	Lab notebooks are due at the end of the day.
5	2/15	2 nd project	
	2/17	2 nd project	Lab notebooks are due at the end of the day.
6	2/22	2 nd project	Have a copy of your report ready for everyone by Wednesday (2/23) at noon.
	2/24	2 nd project	Peer review of reports. Final report is due by the end of the day.
7	3/1	3 rd project	<i>Finalize ideas for individual project. Discuss ideas for senior project with me.</i>
	3/3	3 rd project	Lab notebooks are due at the end of the day.
8	3/8	3 rd project	
	3/10	3 rd project	Lab notebooks are due at the end of the day.
9	3/15	3 rd project	Have a copy of your report ready for everyone by Wednesday (3/16) at noon.
	3/17	3 rd project	<i>Budget for individual project due.</i>
<i>SPRING BREAK</i>	3/22		
	3/24		
10	3/29	Write individual Proposal	Have a copy of your proposal ready for everyone by Wednesday (3/30) at noon.
	3/31	Peer review of individual proposal	Peer review of proposals. Final proposal is due by the end of the day.

11	4/5	Individual project	
	4/7	Individual project	Lab notebooks are due at the end of the day.
12	4/12	Individual Project	
	4/14	Individual Project	Lab notebooks are due at the end of the day.
13	4/19	Individual Project	Have a copy of your report ready for everyone by Wednesday (4/20) at noon.
	4/21	Individual Project	Peer review of reports. Final report is due by the end of the day.
14	4/26	Write senior project proposal	Have a copy of your proposal ready for everyone by Wednesday (4/27) at noon.
	4/28	Peer review of senior project proposal	Peer review of proposal. Final proposal is due by the end of the day.
15	5/3	Presentation of individual project 15 minutes + 5 minutes of questions	

Student Learning Objectives

By the end of this class you should

- 1) Be able to use lab equipment and software to collect, analyze, and present experimental data.
- 2) Be able to write papers in various scientific formats and give a talk describing the research methods, data, analysis, and conclusions of experiments that you have carried out
- 3) Be able to design and carry out an independent research project.

Your progress on achieving these goals will be assessed through:

- 1) Lab notebooks
- 2) Lab reports
- 3) Research proposals
- 4) Oral presentation

