Physics 310, Advanced Laboratory/ Experimental Analysis Spring 2020

Meeting: Trexler 272 Time: TR 8.30–11.30AM Instructor: Matthew C. Fleenor
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Office Hours: W R 1–2.30PM or by appt
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Required Textbook: An Introduction to Error Analysis, 2nd ed., J. Taylor (1997), University Science Books
Required (Co-)Prerequisites: Physics 203

I. Components of Learning

There are several factors that make a course "good" (by good, I mean a healthy combination of the intellectual and the affective). Good courses are also clear about their essential components. Below is an attempt to be clear about how I will operate within PHYS 310, as well as my expectations of a student who is enrolled in PHYS 310.

Descriptions

Aspiration: I am really excited about the opportunity that we both have this semester. It is an opportunity to explore new fields of research and to deepen in areas where you may already feel comfortable. It is an opportunity to teach your colleagues, and me, about some areas of physics. It is an opportunity to learn physics from experts in their own environment.

I have (sub-)titled the 310 course, Advanced Lab, because this course is a threshold to performing your own independent research project (here at Roanoke, or off-campus). As a result of the course, you should have a greater comfortability with discipline-specific instrumentation and software, creating research-quality figures, and publishing articles of journal-quality. It is my job to help guide you in these activities.

Intended Learning Outcomes

The successful student will–

1. explore open-ended questions that highlight course-related phenomena.
2. challenge (and be challenged by) colleagues regarding their current understanding of physical concepts as they are implemented within the lab.
3. write reports that pertain to physical phenomena, graphical results, and error uncertainties in ameaningful way.

4. present graphical, quantitative, and qualitative results, both through written and oral communication.

5. deepen understanding and application of errors, both systematic and statistical, as they apply tophysical results.

6.

Attendance Policy

Students are expected to attend every class, unless otherwise announced. Attendance is checked at each meeting. If a student is going to be absent from class, the instructor must be notified. You are working in a collaboration for most of these labs, so you are letting down the member(s) of your group if you miss class. All of the work does not need to be completed within the hours of the class. Your advisor and the registrar will be contacted at the the third unexcused absence. After the third unexcused absence, you will be dropped (forcibly, with a "DF" or "DP," or willingly with a "W" before the ninth week) from the class. Students are accountable for all work missed because of an absence.

Academic Integrity

All freedoms imply responsibility, and your responsibility to the RC AI policy ensures your academic freedom. I want to foster a mutual respect for the classroom hours that we have together, and AI is primarily about mutual respect (because responsibility and accountability accord). In light of this, please silence cell phones to vibrate before class and come prepared (e.g., book, paper, and pencil). Classroom computers are designed for academic learning and should be used in this manner during class; i.e., no email exchanges and/or surfing during class.

Reading, reflection, and research all involve the activity of recognizing the good thinking of others. Plagiarism exists when someone takes personal credit for another's creative (usually written) work. Hacker's *A Writing Reference* gives very clear examples for citing the work of others from a broad spectrum of sources (including the internet). Please use this guide when citing work during the writing that you will complete in the course.

Lastly, please be advised that the RC AI policy will be upheld within this course as detailed online at `https://www.roanoke.edu/inside/a-z_index/academic_integrity`

Included here is an explanation of how violations of the College's academic integrity policy are handled.

Grading

Written lab reports for each exercise are due when noted on the Course Outline. Typed reports are required that generally follow in the order presented below. In the name of conserving paper, the course will (attempt to) conduct all-electronic submission in `PDF` only and grading via the `NQR` site.

Please note the following grading policy: 25% deduction for the first week past the due date, and a 50% deduction for the second week. After the second week, i.e., two weeks after the specified due date, NO work will be accepted.

We will discuss lab writing at length within the course itself, and you have a working knowledge of what is a "good report".

II. Modes of Learning

Rubric

Your grade is determined according to the following distribution:

Mid-Term Exam	10%	Classwork/homework	10%	Notebook	10%
Final Oral Exam	10%	Critique & Review	10%	Reports	50%

Descriptions

Written Reports

All physical science papers have a similar structure that includes the following: title & author information, abstract, introduction (background or overview), quantitative methodology (experimental approach & methods, data collection, modeling), results, discussion & conclusions. We will discuss the differences between different disciplines and the way each section can be altered or adjusted depending on the focus of the research.

Critique & Review

You will be required to observe and reflect on your colleague's work, both written and oral. You will be evaluated on your completion and your thoughtfulness in carrying out your review.

Class/Homework

Part of the course objectives relates to the proper understanding of uncertainty and its propagation when multiple variables are involved. The Taylor text will aid us in our development of understanding, and we will complete some work from that book (in class or at home).

Mid-Term Exam

The work from Taylor will include a mid-term exam related to error propagation and determination. It will only cover the topics that are discussed in class.

Notebook

All scientists keep a journal of their data, thoughts, reflections, and imaginative ideas. Creativity is part of the science process, and one cannot be certain when creativity will reveal itself. Therefore, it makes sense to carry with you a notebook of some sort. I want to facilitate the creative science process by requiring you to (at least) take data, notes, and some thoughts about the research you conduct.

Final Oral Presentation

One of the primary means of communicating scientific activity is through oral presentation, even more so than writing. We will focus some of our time on presenting science to others this semester. I look forward to learning from each of you about the research you conduct.

III. Lab Outline

There is an attached outline of the semester calendar. We will attempt to follow this schedule closely, since the professors are primarily avialable on THU mornings for consultation, troubleshooting, and orientation.

For a detailed description of the specific assignments during each rotation, please consult a document entitled “Rotation Assignments”.

PHYS 310 Course Outline Spring 2020

Week	Date	Schedule	Topic	Submission
1	14-Jan 16-Jan	Rotation 1	Introduction: What we are trying to do!	
2	21-Jan 23-Jan		Taylor: Chapter 1	
3	28-Jan 30-Jan		Taylor: Chapter 2	
4	4-Feb 6-Feb	Rotation 2	Taylor: Chapters 2 & 3	Project 1
5	11-Feb 13-Feb		Taylor: Chapter 3	
6	18-Feb 20-Feb		Taylor: Chapter 4	
7	25-Feb 27-Feb	Rotation 3	Taylor: Chapter 5	Project 2
8	3-Mar 5-Mar	No Classes – Spring Break		
9	10-Mar 12-Mar		Taylor: Mid-Term	
10	17-Mar 19-Mar		Taylor: Chapter 6	
11	24-Mar 26-Mar	Rotation 4	Taylor: Chapter 7	Project 3
12	31-Mar 2-Apr		Taylor: Chapter 9	
13	7-Apr 9-Apr		Taylor: Chapter 11	
14	14-Apr 16-Apr		Taylor: Chapter 12	Project 4
15	21-Apr			
	23 & 24 April	Final Presentations, 8.30-11.30AM, TR		EX 272