PHYS4010 Advanced Laboratory

FACULTY INSTRUCTORS

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Course site:
https://spots.augusta.edu/tcolbert/default.htm
Colbert: Office schedule

WEB PAGES MAY BE KILLED by A.U.---IF SO DOCUMENTS POST ELSEWHERE/TBA

Office hours:
TBD

COURSE TIME AND PLACE

This class meets:
Mondays: Noon – 12:50 pm (3064)
Tuesdays 1:00PM – 3:50 PM (3064)
Wed 12:00PM -1:50PM (3064)

See notes on meeting and lab time below

I. COURSE INFORMATION

Term and Year: Spring 2025
Course Prefix, Number, and Title: PHYS, 4010, Advanced Laboratory
Number of Credit Hours: 3

Course Description: Experiments are conducted in various fields of physics including modern physics and optics. Evaluation, analysis and interpretation of experimental data is emphasized.

Prerequisite(s): PHYS 3300 (C or better) or permission of the instructor.
Department Name: Department of Physics and Biophysics
College: College of Science and Mathematics

Midterm Last Day for Withdrawal, March 4th

II. GRADING AND ASSIGNMENT DESCRIPTIONS

COURSE EXPECTATIONS

WHAT IS EXPECTED FROM YOU

General

- Arrive to lab on time.
- Be prepared for your lab activities (read handouts and background ahead of time)
- Be proactive in understanding what is needed to do well in lab. Ask questions when you don't understand something.

- Bring all needed materials to each lab: Lab notebook, calculator, etc.
- Arrive on-time with a can-do attitude. There will be times when things don't work the first time (this is the real world of lab so get used to it); keeping a positive outlook and avoiding frustration are important for a good lab experience.
- In order to complete each lab you will need to come to lectures, listen carefully, and read lab handouts beforehand. You will be provided with support videos for many (maybe not all) of the labs
- Leave your area neat, clean and organized.
- Comment on meetings
    - Typically Mondays will always be used for lecture on background, demonstrations, or course logistics (schedule planning). Intro of new lab per schedule.
    - Tuesday and Wed times this might be used for YOUR lab data acquisition time, or similar to Mondays, or for peer review presentations, and other course logistics--.
    - In general you are expected to perform lab /data acquisition on your own time (I am arranging for room access 24/7). In some cases we will not use full Tuesday or Wed. times for lectures/demos/other. During such times and with my permission, you may (if needed) schedule your lab times during these blocks of time on Tuesday or Wed. Since we have ONE SETUP—You will typically schedule your own lab data acquisition time (with your rotating partner). There will be a signup sheet.

Experiments

- Read all lab handouts before coming to lab. You must consider the physical principles involved with each lab experiment. Your notes on lab procedures and data acquisition steps should be in your lab notebook before you come to the lab.
- Complete your assignments and submit them on time.

WHAT YOU CAN EXPECT FROM ME

- Arrive to lab on time, plan the course and make adjustments as needed.
- Give you feedback – both written and oral. Each lab assignment in this should be considered the equivalent of an exam in most courses. I will give feedback.
- Specifics on handing in labs and course components will be detailed on my website.

COURSE GRADES

Your final course grade stems from the following grading opportunities below:
Course grades will be assigned as follows:

A = 90 – 100%; **B** = 80 – 90%; **C** = 70 – 80%; **D** = 60 –70%; **F** = <60%

ASSIGNMENT DESCRIPTIONS:

A. LABS (several components)

For each lab you will complete data acquisition with a partner (in general I will assign partners). The lab work will be graded based on three components.

- **Data Analysis 20% of course grade**

A data analysis component, where you are expected to have completed all data acquisition, all graphs and numerical analysis including uncertainty. What you hand in must contain a clear set of data, theory and math used to analyze, and clear description.

A reader must be able to take their own data set (raw) and apply what you have presented to yield the end result. The result must be interpreted by you.
This will be due one week after the initial demonstration/assignment. You will hand in a neat edited document (no handwriting). This should have length needed to complete the analysis and any graphs you intend to include in your final draft.

- Collected data (with uncertainty)
- Graphs
- Fitting curves (with uncertainty)
- Calculations
- Comparison with the theoretical, known, or standard value (when possible)
- You don't need to discuss detailed procedure or produce experimental figures.

Grades will be based on clarity, neatness, correctness, uncertainty, significant figures, properties of plots or graphs, and any other items needed to determine results. This should be well organized, so anyone can explain your calculations just following your write up. This work will be written using LaTex or other document preparation tools/software ---keep it neat.

I'll be providing a rubric to help guide you.

- **Final Report 35% of course grade**

The final report is written as a research styled paper. This includes an abstract, properly formatted (to be discussed) writing, references, analysis, graphs, figures, experimental description and setup, captions, tables, etc---To be discussed in more detail separately. Here you are writing as if you did this lab first as research. This will be the final draft of your lab report. It will have the style and quality of a research paper, like for example AJP (American Journal of Physics) which is the same as the American Physical Society template. You will use LaTex (or other document prep). You must have a thorough understanding of all components of the lab, and clearly communicate the lab procedures and any relevant technical issues relevant to the performance of the experiments. You must thoroughly interpret and discuss your results. More detail on my web site.

- **Oral lab review and lab notebook 10 % of the course grade**

For each lab you will have a scheduled session with me on your own, with your lab notebook. I will personally mess up the setup, and you will have a limited time to take some sample data and do a rough analysis as requested. This may use any features of the instrumentation and require understanding of any of the material within background for a given experiment. I will also inspect your lab notebooks during these sessions. You are expected to have complete, accurate, legible and well maintained lab notebooks. Lab notebooks contain notes, contents, handouts, data, notes to yourself on how to analyze and use the instrument. Don't underestimate the power of the ……..well maintained lab notebook.

The lab notebook is the component that says you were in lab and performed the experiment. Your lab notebooks should contain all the information you need to enter lab and understand how to complete data acquisition, as well as your rough analysis. You should leave several pages for contents to start, and about 8 or so pages for each lab. Have the lab title, and each of the sections discussed below (a,b,c,d) in your lab notebook. Your lab notebooks will be checked for:

a. notes regarding "today's lab" (indicates you are prepared for today's lab).
    i. These are your handwritten notes prior to the start of lab.

ii. This section is not the handout ---which you may have externally/separately with you in lab.

b. Your data for today's lab
   i. In general if your data is in a file---include the file name /date/time and where you store it
   ii. If you know you will make a graph/plot—leave room for it in this part.
c. If possible there should be a rough check on "today's result" before you are done with lab
d. Your rough analysis from last week (if you make a plot or perform a calculation to obtain a result, include it in your lab notebook).
e. It's fine to include lab handouts in your notebook (do so). Just don't confuse my instructions with your own "legwork" and instructions to yourself.

- **Peer Review of labs 5% of course grade**

You will be assigned a paper with names stripped off/redacted. You will complete a comprehensive review of the papers and present this orally to the class during one of our meetings (document camera). Your goal is to give honest, useful constructive criticism of the paper you are looking at. The end result should be advice to the author for ways to improve the paper. We will have open discussions about whether the paper should be making changes or whether the reviewer has misunderstood. You will be graded based upon whether you have done a diligent review. A diligent reviewer will have credible suggestions to improve the paper. Ultimately, if the reader is diligent, then the Author is the only person responsible for possible mis-readings or understandings. It is always the task of the Author to clear up any possible mis-readings or misunderstandings.

B. Above and Beyond/Projects (20% of the course grade)

As you complete each lab you are building and using skills that you develop in this course and or bring from other experiences. You are expected to make strong connections in your own way between course material and your own skillset. You will complete a course project (with a partner) on a topic of your choosing. This may be a significant extension of labs we have done, or a new project of your own. I'll give a list of some suggested project ideas.

Projects are your choice—again—you may be creative.

As part of grading I will prompt early **proposals** (though you may look ahead at labs not done yet). You may have more than one potential idea. In addition I will prompt you to complete and demonstrate your project to my satisfaction (it must be at least as substantial as any of the labs we have done—you are creating the writeup, description, analysis etc). The results of your project will be presented to faculty ---my choice—as either oral power point, or poster. .

C. HOMEWORK: (10% course)

There will be various assignments throughout the course on topics such as error analysis, curve fitting, or specific support work for specific experiments. I may give pre-lab assignments to help you get started on some of the lab understanding.

Late work will generally not be accepted without a confirmed non-academic valid emergency. Missing an assignment deadline may result in zero credit for that assignment. You must have all components of a given lab completed (analysis must be completed on time and certainly before the final report).

While it is expected to work with lab partners, <u>ultimately the writing and production of figures will be your own. Handing in plagiarized work may result in penalty of zero on all lab components for that lab (and has happened before). Equivalent penalty for all collaborators (don't give your work to others).</u>

Lab experiments

1. Speed of Light
2. Schawlow's Ruler
3. Michelson Interferometer
4. Zeeman Effect and Bohr magneton
5. Hydrogen/Deuterium (new) and Sodium Spectra
6. Planck's Constant

III. LAB SCHEDULE

TENTATIVE COURSE SCHEDULE

Week		Lab Start	Comments
1	Jan 6	Speed of light • Intro Monday Jan. 6 • Data done by Jan. 13 • Analysis draft Due by 15th • Final Draft Jan. 22nd	
2	Jan. 13		Individual **Oral Reviews** will be scheduled during Analysis due week. (between Jan. 13th and 17th) Your responsibility.
3	Jan 20 MLK-No Monday	Schawlow Ruler Start – • Data Start on Tuesday 21st (Demo/Intro). • Data done Jan. 29 • Analysis Due Feb. 5th • Final Feb. 12th	Division of wavefront I've built extra time to analyze this lab. **PROJECT PROPOSALS SHALL BEGIN**
4	Jan. 27		I expect a fit of the non-linear "exact" description. We'll discuss **Oral-lab review during this week**
5	Feb 3		**BEGIN PEER REVIEWS DURING M,T,W TIMES**
6	Feb 10	Michelson • Intro Feb. 10 • Data done Feb. 17th • Analysis Due Feb 19th • Final due Feb 26th	Division of Amplitude
7	Feb 17		Oral lab review
8	Feb 24	Zeeman (New write up) • Intro Feb. 24th • Data done Mar. 3rd • Analysis Due Mar. 5th • Final Due March 12th	
9	Mar 3 (Spring Pause MARCH 6, 7)		Oral Lab Review
10	Mar 10	Hydrogen • Intro Mar. 10 • Data done by Mar. 17th • Analysis Mar. 19th • Final Due Mar. 26	
11	Mar 17	•	Hydrogen Oral
12	Mar 24	Planck and Photoelectric • Intro March 24th • Data Done by March 31st • Analysis April 2nd. • Final Due April 14th	

13	Mar. 31		Planck Oral
14	April7-11	**NO CLASS**	Masters Week
15	Apr 14	Project Time	
16	Apr 21	Project Time	
17	Apr 28-30	Presentations	

Lab groups/lab partner information will be determined during the first week of class.

IV. POLICIES

ATTENDANCE POLICY

If you are unable to attend classes you should communicate with your instructors. You are responsible for all material, assignments, etc. I will consider any missed assignments, lab or any class activity as an absence. Excessive absence or tardiness may result in your being withdrawn or receiving a failing grade in the course. Ultimately it is the student responsibility to make sure that the proper paperwork has been handed in by midterm (or later on, if that is the case) in order to ensure withdrawal (or WF). Under no circumstances will I send this paperwork for you. Failure to handle this properly may result in receiving a failing grade in the course.

Make ups for work missed will be scheduled individually, but only for acceptable reasons. You must notify me beforehand if possible.

In addition to the above-mentioned instructor policy, you are also obligated to follow the Augusta University Attendance Policy, which is available at AU student manual (section 5.4). This university policy essentially states that you are expected to punctually attend all classes from the first to the last day of the term, that your instructor will monitor both your attendance and participation, and that there are academic penalties for excessive absenteeism.

ACADEMIC INTEGRITY

You are encouraged to study together and to discuss information and concepts covered in the lecture and the lab sessions with other students. You can give "consulting" help or receive "consulting" help from such students. However this permissible cooperation should never involve one student having possession of a copy of all or part of the work done by someone else, in the form of an e-mail, an e-mail attachment file, a picture, a flash drive, a hard copy, or code etc. For example you may share a matlab graph viewing with another student, but not the code---not line by line, etc.

It is the duty of the student to practice and preserve academic honesty. Each student should be aware of the specific policies governing academic conduct for the course, as well as the grievance and appeals processes put in place for adjudicating such policies. If the student has any doubt about a situation, he or she should consult with his or her instructor. It is also the student's responsibility to maintain his/her correct address of record with Augusta University so that official notification of the student regarding academic misconduct can be carried out in timely fashion.

Violations of academic integrity may range from penalties on graded work such as receiving a grade of zero for particular assignments, or may result in receiving WF in the course. You should consider lab reports in this course, each the equivalent of a major exam—so any violations of academic integrity on any component of lab work is a serious violation!

More information is available at AU student manual (section 5.2).

DISORDERLY CONDUCT

Augusta University prohibits behavior that disrupts the academic, research or service mission or activities of the University, or disrupts any activity or event of the University community. Some examples of disorderly conduct include, but are not limited to, the following: conduct which causes a breach of the peace; lewd, obscene or indecent conduct; conduct which interferes with or disrupts activities or functions sponsored or participated in by the University or by members of the University community; conduct that is disruptive to a classroom lecture, lab, or other teaching or research entity of the University, interfering with or obstructing pedestrian or vehicular traffic; obstructing or interfering with ingress or egress of campus buildings or facilities; conduct which interferes with the rights of others; unauthorized use of electronic or other devices to make an audio or video record of any person without his or her expressed or implied consent when such recording is likely to cause injury or distress.

In addition to the above-mentioned policy, you are also obligated to follow the Student Manual guidelines which is available at AU student manual.

MORE COURSE INFORMATION

General Learning Outcomes

- Learn to employ high scientific standards in written work as demonstrated in lab reports.
- Students will interpret experimental work from other papers (peer review)
- Students will give oral presentations (peer review and projects).
- Practice clearly and concisely articulate scientific ideas and arguments through written works.

Specific Course Objectives

- Students will use experimental equipment such as lockin amplifier, oscilloscopes, and spectrometers.
- Students will interpret and explain experimentally observed phenomenon
- Analyze data and make conclusions about physical phenomena

V. DISCLAIMER

RESERVATION TO CHANGE THE SYLLABUS

The course instructor reserves the right to make changes to the course syllabus and schedule with reasonable notice to the students.