

General Information

PHYS 375 : Experimental Physics III Electromagnetic Waves, Optics and Modern Physics

Fall 2016

Instructors :

- Dr. Carter Hall (Monday and Thursday section): PSC 2114; phone 5-6103, crhall@umd.edu
- Dr. Andris Skuja (Tuesday and Wednesday sections): PSC 3103; Phone : 5-6059 ; E-mail : skuja@umd.edu

TAs :

- Section 0101 (Monday): Nightvid Cole, 0104 John S. Toll Physics Building, ncole1@umd.edu, phone 5-8577.
- Sections 0102 – 0104 (Tuesday – Thursday): Majid Ekhterachian, 0104 John S. Toll Physics Building, ekhtera@umd.edu, phone 5-8577.

Course website: <http://www.physics.umd.edu/courses/Phys375/Hall-Fall-2016/>

- You will use ELMS to submit your data analysis reports.

Class Schedule:

- Monday Lecture, 2:00 – 02:50 pm; Room PHYS 1410
- Laboratory 3:00 – 5:50 pm : Room PHYS 3203
 - Section 101: Monday
 - Section 103: Tuesday
 - Section 102: Wednesday
 - Section 104: Thursday

Primary Texts:

- “[Introduction to Modern Optics](#)” (2nd Edition), Grant R. Fowles.
- ExpertTA lab manuals. See ‘Lab manual’ section below.

Other Recommended Texts:

- “[Practical guide to data analysis for physical sciences students](#)” by Louis Lyons. (ISBN-13: 978-0415481519). OR
- “[Data reduction and error analysis for the physical sciences](#)” by Philip R. Bevington and D. Keith Robinson. (McGraw-Hill, 2003, ISBN: 9780072472271). OR
- “[An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurement](#)” by John R. Taylor (University Science Books, 1997, ISBN-13: 978-0935702750).

Lab Notebooks: You will keep a detailed lab notebook to record your lab work. You may choose to either

- 1) keep two hand-written notebooks (9 ¾” x 7 ½” Roaring Springs bound composition books, \$2.68 each at the bookstore), OR
- 2) you may type notes into a MS word document and upload it to ELMS at the end of each lab section.

See additional information about the lab notebooks below.

Course Overview: PHYS375 is a three (3) credit course that meets four hours a week. The primary objective is to learn physics through experimental investigation. Topics to be covered include electromagnetic waves, geometrical optics, polarization, interference and interferometers, diffraction, and atomic spectra. There are six experiments, each lasting for two class periods, plus an introductory lab exercise that takes one class period. Each lab will include a lecture component. This is one of the few opportunities in our undergraduate curriculum to learn about geometrical and wave optics. You will also learn how to carefully take data, analyze it, understand the origins and propagation of errors, and to better appreciate the subtleties of experimental physics. You will also keep a lab notebook and make useful written presentations of scientific results.

Lectures: The lectures are a required component of this class. **You will not get full credit for the course if you do not attend the lecture. Attendance will be taken during the lecture.**

Experiments: You will perform six experiments during the semester, spending two weeks on each experiment, in addition to the introductory ‘lab 0’ during the first week to learn some basic features of the MATLAB, LAB JACK, diode laser and photodiode. You will not be told exactly how to do the experiment. Instead you will be introduced to some equipment and invited to use it to measure something. You may make the measurement as you see fit, as long as you think carefully about the experiment and analyze your errors properly. Of course, you should attempt to make the most accurate measurement that you can.

Computers: You will accumulate and analyze data with a computer-based system using MATLAB. We will provide some elementary MATLAB code for use in data collection. For data analysis you may use the program of your choice (MATLAB, Mathematica, excel, ect).

Lab Manual: The lab manual must be purchased at <https://www.theexpertta.com/registration/ClassRegistration.aspx> You will be prompted to enter a course code, as follows:

- Section 0101 (Monday): USH22MD-9266D8-1FX
- Section 0103 (Tuesday): USH22MD-7AC52E-1FV
- Section 0102 (Wednesday): USH22MD-071981-1FW
- Section 0104 (Thursday): USH22MD-C73629-1EB

Under the drop down menu below ‘Assignments’, choose ‘View Printable Assignments’. Download the table of contents, all the experiment lab manuals, and the appendix on error analysis to your local machine, print them and bring them to class.

Note that in most cases the lab manuals contain only a brief introduction to the lab material followed by short suggestions about how to go about the measurements in the lab. This is because we intend that you will design your own experimental procedure.

Lab Notebook: It is your responsibility to keep notes on all relevant aspects of your experiment, and these notes will be an important part of your grade. You may choose to either (1) take notes electronically in a MS Word document, to be uploaded to ELMS at the end of each lab period, or (2) purchase **two** 9 ¾” x 7 ½” Roaring Springs bound composition books, \$2.68 each at the bookstore, to be submitted every other week when you submit your data analysis reports. (For option (2), you must purchase two notebooks so you can use one while we grade the other.) Remember that in order to do the analysis in this lab, you will often need a record of how you set up the experiment, including distances, angles, etc.; make sure you have this information recorded before you leave the lab.

Course Grading:

Data analysis reports : 40%

Lab Notebooks	:	20%
Homework 1 - 6 + lab 0	:	20%
Final Exam	:	20%
Attendance (including Lectures):		instructor's discretion
Late submission of homework or lab reports: Loss of 20% of total points / day		

Your coursework will be judged incomplete if missing any homework, lab report, or lab notebook. You must submit all required lab reports and notebooks to pass the course even if you do not get numerical credit for that assignment.

Guidelines for Lab Reports and Notebooks:

- **Lab notebooks:** The purpose of your lab notebook is to create a time-stamped permanent record of your labwork. Your notes for each lab should consist of a series of distinct entries that document what you are doing. Each entry in your notebook should begin with the current time. The grader should be able to understand what you were doing during the entire three-hour lab period by reading your notebook, and the notebook should be detailed enough that the grader could analyze your data if necessary. When taking notes, it may be helpful to imagine that you will return to your notes a year later to re-analyze your data and write a report. What information will you need to reconstruct your experiment, once your memory of it is mostly gone? Lab notebooks will be graded on clarity and thoroughness.
- **Data analysis reports:** The data analysis reports for Phys 375 should be lightweight and focused on the analysis of the data and the statistical and systematic uncertainties, and should include a discussion of how the results could be improved. You do not need to write a description of the apparatus or the experimental procedure. Tables and plots of experimental data should be included, such that the person reading the report could reproduce the analysis if necessary. Lab reports will be graded following this rubric: 50% completeness and effort, 50% discussion of analysis uncertainties and possible improvements, including identification of the dominant uncertainty. **You must submit your lab reports on ELMS in pdf form before your lab section the week following each lab.**

Late Reports: Lab reports submitted after the deadline will receive a 20% penalty for each day they are late, and therefore a 100% penalty for >1 week late.

Missed Labs: Labs may be missed only for valid reasons, known as 'excused absences' as specified by the University policy, which is available at <http://www.ugst.umd.edu/courserelatedpolicies.html>. A typical excused absence would be a religious holiday or major illness. If you plan to **miss any of the six labs for a valid reason it should be PRE-APPROVED by the instructor.** The instructor will attempt to let you take the lab in the same week that it was originally scheduled (if possible). If it proves not possible to do so, you will be able to make-up the lab during one of the designated make-up times (primarily Thanksgiving week). You will get credit for missed labs only if you have made appropriate arrangements with the instructor.

Homework: Homework material is designed to complement the lecture and laboratory segments of the course. Homework is assigned every two weeks, with due dates that fall in between the lab report due dates. **Homework will be collected in the Monday lecture period. Late homework must be submitted to pass the course, even if it received zero credit.** The homework assignment will be posted on ELMS and the course website one week prior to the due date.

Tips for Doing Well:

- Read the lab instructions carefully **before** you go to the lab and attempt an experiment.

- During class, keep a well-organized and **complete record** in your lab notebook of the experiment including diagrams of measurement configurations actually used to obtain data, your results, and the analysis used to obtain the results
- When something in the lab isn't making sense or isn't working raise your hand and discuss with your instructor - **do not hesitate to ask** even the most trivial questions if you are not sure!
- Do not leave class until you understand how to do the data analysis and have discussed your results with your instructor or TA.
- Do the assigned homework and submit it for grading **on time**.

Final Exam: There will be a written final exam. It will likely be held during the lab period during the last week of classes (Dec. 5 – 10). More information on this will be announced in class and posted on the course website.

In case of Bad weather: Should the university be closed due to weather, we will attempt to reschedule the lab for the following week. You will be notified via the course reflector of changes to the schedule.

Academic Integrity and other university policies: All university policies regarding student rights and obligations, including academic integrity (cheating), are available at:

<http://www.ugst.umd.edu/courserelatedpolicies.html>