

## General Information

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

**Fall 2015**

#### **Instructors :**

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

#### **TAs :**

- Ruben Rojas (Monday section), 3101 John S. Toll Physics Building, [rrojasg@umd.edu](mailto:rrojasg@umd.edu), phone 5-6191.
- Nightvid Cole (Tuesday, Wednesday, and Thursday sections), 0104 John S. Toll Physics Building, [ncole1@umd.edu](mailto:ncole1@umd.edu), phone 5-8577.

**Course website:** <http://www.physics.umd.edu/courses/Phys375/Hall-Fall-2015/>

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

#### **Class Schedule:**

- Monday Lecture, 2:00 – 03:00 pm; Room PHYS 1410
- Laboratory 3:00 – 5:50 pm : Room PHYS 3203
  - Section 101: Monday
  - Section 102: Tuesday
  - Section 103: Wednesday
  - Section 104: Thursday

#### **Primary Texts:**

- "[Introduction to Optics](#)" (3rd Edition) by F.L. Pedrotti, L.S. Pedrotti, and L.M. Pedrotti. (ISBN-13: 978-0131499331). Suggested pre-lecture reading will be assigned from this textbook.
  - Alternate, optional text: "[Introduction to Modern Optics](#)" (2<sup>nd</sup> Edition), Grant R. Fowles, This text is considerably older than the Pedrotti one and does not contain all modern applications. However it is considerably cheaper than the required text. If you buy a copy get the Dover edition.
- "[An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurement](#)" by John R. Taylor (University Science Books, 1997, ISBN-13: 978-0935702750).

#### **Other Recommended Texts:**

- "[Practical guide to data analysis for physical sciences students](#)" by Louis Lyons. (ISBN-13: 978-0415481519).

**Lab Notebooks:** We will be using an online lab notebook service from [Lab Archives](#). Your notebook will be graded along with your data analysis reports after each lab.

**Course Overview:** PHYS375 is a three (3) credit course that meets four hours a week. The primary

laboratory objective consists of learning physics through experimental investigation. Topics to be covered include electromagnetic waves, geometrical optics, polarization, interference and interferometers, diffraction, and atomic spectra. There will be six experiments, each lasting for two class periods. Each lab will include a lecture component. This is one of the few opportunities in our undergraduate curriculum to learn some 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 learn to make useful written presentations of scientific results.

**Lectures:** The lectures are a required component of this class. This is an excellent opportunity to learn optics and to make connections to your other courses (electromagnetism, quantum mechanics, etc.), and to learn more about data analysis and statistics. Important topics directly related to the labs will be covered in the lectures. **You will not get full credit for the course if you do not attend the lecture.** Attendance will be taken during the lecture class.

**Experiments:** You shall be doing 6 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, a diode laser and a 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, we also desire to make the most accurate measurement we 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:** Because the course emphasizes your own experimental design, we will not be using a traditional Lab Manual. Information necessary for each lab will be made available in the laboratory and will be posted on ELMS and the course website.

**Lab Notebook:** Keeping a detailed record of your experiments is important in Physics 375, and in experimental science in general. 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. 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. We will use an online tool called [Lab Archives](#) for our notebooks. There will be a \$10 charge for this service. Students enrolled in the class will receive an email with instructions for creating an account and paying your \$10. As usual, the email will be sent to your official university email address.

#### **Course Grading:**

Data analysis reports	:	30%
Lab Notebooks	:	30%
Homework 1 - 6 + lab 0	:	20%
Final Exam	:	20%
Attendance (including Lectures):	instructor’s discretion	
<b>Late submission</b> 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:

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- **Lab notebooks:** The purpose of your lab notebook is to create a running and permanent record of your time in the lab. Your notes should be thorough enough that the grader can understand what you were doing during the entire three-hour lab period. For example, imagine that your grader must analyze your data based upon what is in your notebook, or that you must return to your notes two years later and re-analyze your data and write the report. What information will you need to reconstruct your experiment, once your memory of your labwork 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. Summary plots of experimental data should also be included. Lab reports will be graded following this rubric: 50% data analysis, 50% discussion of uncertainties and possible improvements. **You must submit your lab reports on ELMS before your lab section the week following each lab.**

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**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 -- No Exceptions!!!!**

**Missed Labs:** If you should miss any lab for any reason, contact the instructor as soon as possible to make an arrangement for makeup. Labs may be missed only for valid reasons as specified by the University rules book. 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**.

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**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. 7 – 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 reschedule the lab for the following week.

**Academic Integrity:** "The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism." For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.studenthonorcouncil.umd.edu/whatis.html>.