

## Syllabus: 33-353, INTERMEDIATE OPTICS

Fall 2010

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Office: Wean Hall 6311 (Lösche), Doherty Hall A301A (Luukkala)  
Textbook: E. Hecht, *Optics*, 4th ed., Addison Wesley (2002), ISBN 0-8053-8566-5  
Schedule: Lectures: WF 11:30–12:20, Doherty Hall A200; R 9:30 – 10:20 Wean Hall 5304  
Laboratory: T 9:00–11:50, Doherty Hall A324  
Course Website: <http://www.cmu.edu/biolphys/smsl/teaching/IntOptics.html>

### Goal and Motivation

Optical instrumentation and optical devices are all around us and determine many aspects of our daily life. This course provides an introduction to the basic principles of optics, both in theoretical terms, covered in three weekly lectures, and in practical terms in a once-a-week laboratory exercise.

- What is light and how does it interact with matter?
- What are the basic properties that define electromagnetic waves and affect their propagation?

Most of these questions can be answered by confining our considerations to the wave aspects of light, and therefore quantum aspects will be considerably short-changed. Nevertheless, the primary goal of this course is that you become comfortable with the basic principles of geometrical and wave optics that lay the foundations for an enormous body of technology from optical instrumentation to modern-day cable communications. This should also prepare you to move on into advanced topics on your own and to apply your hands-on knowledge to real-world situations in academic or corporate R&D.

### Course Material

This course will cover most of the material in the textbook, *Eugene Hecht, Optics* (4th edition, Pearson/Addison Wesley, San Francisco 2002). We will cover this material primarily in the order of the chapters, but will deviate from it occasionally. Day-by-day schedules of reading assignments for the material covered in class will be posted on the course website in advance. You will be responsible for all the material listed in these postings.

### Laboratory Exercises

One three-hour laboratory period is scheduled each week. ***Attendance is mandatory in all laboratory units.*** If you do not attend a laboratory unit you will receive a grade of zero for that portion of the laboratory exercise. Unavoidable absences due to illness or family emergencies should be cleared with the instructor prior to the laboratory unit. We will meet in the laboratory during the first week of classes for an introduction/review of laboratory procedures. There will be five or six laboratory exercises. Advance copies of the laboratory exercises will be posted on Blackboard. Some of the exercises take more time

than others, with the number of weeks required listed at the top of each exercise description. A formal report covering one of the more advanced labs will be required at the end of the term and will be graded.

More details on the *Requirements for Lab Write-ups* are discussed in a separate document. See also *Policies* below.

## **Homework**

There will be a number of homework assignments, approximately nine in all. Homework assignments will also be posted on the course website, with their due date listed on the posting (generally the assignments are due one week after the posting date).

## **Examinations**

There will be two one-hour exams near mid-term and near the end of the semester. There will not be a final examination in Finals Week for this course.

## **Grading**

You will receive a single final letter grade for the entire twelve-unit course. Because the work is divided nearly equally between class-work (lectures, homework assignments, and exams) and laboratories, your class-work grade and your laboratory grade will be weighted equally in the determination of the final course grade. The grade for the laboratory part will be a weighted average grade for the individual laboratories, with weights assigned in accordance to how many weeks the laboratory exercise extended over. The grade for the class-work part of the course will be based primarily on the examinations, with a small contribution from homework. The weighting factors for the entire course will therefore be, 50% laboratories, 30% for exams (*i.e.* 15% for each hour exam), and 20% for homework assignments.

## **Policies**

For homework assignments you are welcome to discuss the problems with your classmates, but any work you submit should, of course, be your own. Similarly for the labs, discussion during and after the labs is encouraged, but again any work that you submit needs to be your own. This also applies to the writing of lab reports. Neither your lab book nor the formal report should be a carbon copy of your lab partners.

Lab notebooks are thought to provide a *permanent* record of your work. Use the bound notebooks provided. **No spiral loose leaf writing pads.** Graphics, computer printouts, etc. need to be *permanently* attached to the bound notebooks using staples or tape. Lab books will be evaluated by the instructors and *must be legible*. Please use a ballpoint or other permanent form of pen to document your experiments and evaluate the results. **No pencils!** No erasing or tearing out of pages. If you make a mistake, cross it out and add a note on the margin of the page what went wrong. The goal of your lab book is to convey information. If you cannot read your own book, then no one else will be able to read it. Plots of

data, and fitting of theoretically predicted functions to the data, must be done using a computer graphing package. Hand-drawn graphs of functions are not sufficient to compare your experimental results with outcomes expected from theoretical predictions. The instructors reserve the right to *not grade* illegible sections of your lab book or entirely *reject extremely sloppy work*. Just take a little extra time to write clearly, with sufficiently large characters, and your lab notebooks should be fine. For more on the relevance and justification of these policies (as well as in-depth discussions of the assessment of experimental errors and data fitting), refer to PART I of the Laboratory Manual for 33-104 (Experimental Physics) by Barry Luukkala.

While you're perfectly welcome to bring your personal laptops to the lab units, open laptops are *not* permitted in lectures. If you need to finish work on your computer for other classes (or homework for this course), check e-mail, or browse the Web, *please do this outside of class*. Similarly, please silence your phones before attending class.