

GEOMETRICAL AND INSTRUMENTAL OPTICS LAB II OPTI 202L, Spring 2016

Lab Schedule: (Room 438, Meinel)

Tuesday	Wednesday	Thursday
8:00-10:50- pm -- sec. A	---	8:00-10:50 pm -- sec. F
2:00-4:50 pm -- sec. B	1:00-3:50 pm -- sec. D	2:00-4:50 pm -- sec. G
5:00-7:50 pm -- sec. C	5:00-7:50 pm -- sec. E	5:00-7:50 pm -- sec. H

Lab Lecture: Friday, 11:00-11:50 am –in Room 410, Meinel

Dr. Mike Nofziger

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Office location: Meinel, Rm 412A

Office Hours: Wed. (1-2pm), Thurs. (1-2pm), and by appointment.

Objectives:

This lab course will attempt to closely follow OPTI 202R, "Geometrical and Instrumental Optics II", and OPTI 240 "Semiconductor Physics and Lasers" (to a lesser extent). It provides hands-on experience with most of the concepts taught in these two courses. If you are majoring in Optical Sciences & Engineering, then 202L is a required course. It is strongly recommended that 202L be taken concurrently with 202R and 240, to optimize your learning. The main objectives for this lab are to review the basics of geometrical optics and image formation, understand aberrations, the optical design of various instruments, basics of electronic measurements, and the basic properties and characterization of photoconductors, photodiodes, and solar cells. A variety of optical lab techniques will be used.

Textbook:

Class Notes will be available online at www.optics.arizona.edu/nofziger

You are required to keep lab notes in some type of bound lab notebook (no loose sheets of paper).

Grading:

Labs (100 points per Post-Lab Report x 13 labs):	POINTS
(including any pre-lab and/or post-lab questions)	1300
Lecture Session <u>Pop Quizzes</u>	100
Final Analysis	100
TOTAL	1500

- * ***ALL of the Post-Lab Reports “count.” Unlike last semester in 201L, we are NOT dropping the two lowest scores!***

- * Final grading for the class will be done on a curve. If your score falls “in-between” letter grades, input from your TA will be used to assess how you performed in lab, to make a final decision on your grade.

- * **LATE POLICY:** All Lab Summaries are due at the start of your lab session, one week after you did that particular lab. **Late material will be accepted up to a week after it was due, and will be graded at 75% off. If you miss a lab, it may be made up only because of medical reasons or a family emergency. Sharing of data for lab makeup is NOT allowed. The lab should be made up by noon on the Monday following the lab session that you missed. If you miss a lab for other than an excused medical reason, no Lab Summary will be accepted. *Missing Lab Summaries count as a “0”.***

Weekly Lab Summary:

Due *one week* after you have done the lab. The summary is to be turned in at the start of the following week's lab.

“Each lab handout contains specific work tasks that need to be performed, and questions that need to be answered. They generally will be marked and easy to spot, but not always. Read the handout carefully and make sure you do all of the tasks, and answer all of the questions. The weekly “Lab Summary” that you turn in for a grade must include the following:”

- One page of writing, in your own words, that contains the following sections:
 - Objectives (describe the purpose of the lab)
 - Procedures and Equipment (a general description, NO step-by-step details!)
 - Summary (what was learned)
- All of your “raw” data (the actual readings you took in lab).
- All of your “processed” data (the results you calculated based on your raw data).
- Graphs of data (if appropriate—enlarge to fit at least half of a page).
- Results of computer work (if asked for).
- Answers to all of the pre- and post-lab questions, and questions in the lab handout.

Lab Summaries MUST be typed (computer-printed), and double-spaced. Hand-written Summaries will NOT be accepted. Lab Summaries MUST be written individually, in your own words. You may use data taken by your lab group, but the Lab Summary must be entirely your own work. If written as a group effort, it will be considered as plagiarism by everybody involved, and will be dealt with accordingly. (This includes a “group-written” summary where only a few words were changed—that does NOT make it your own work.)

Pre- and Post-Lab Questions:

These will be clearly marked in the lab handout:

- (Q1) will mark a question.
- will mark something in the lab handout that needs to be included in the post-lab report (questions, observations, findings, etc.).

Pre-lab questions are due at the start of your week's lab session.

Weekly Lab Summaries are due at the start of your following week's lab session.

Final Analysis:

This will take the place of a traditional final lab report. Identify 3 specific things that you don't understand about material covered in OPTI 202R, OPTI 202L, and/or OPTI 240. Think critically about what it is that you don't understand about each item, and why you have had trouble understanding it. Write at least a half page for each item, explaining this.

Full credit will be earned for length (writing at least half of a page for each item), and content (the extent to which you demonstrate ‘critical’ thinking about your misunderstandings, NOT just complaining about something).

Final Analysis due by 5pm, Wed. May 4, 2016.

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Week 0: 11 January 2016

Lab Lecture on Friday, Jan. 15 to get started.

NO LABS this week—Get a bound notebook, read Lab #13, and answer the Pre-Lab Questions.

Week 1: 18 January 2016

Lab 13: **Opto-Mechanics and Optical Alignment: An Introduction**

Week 2: 25 January 2016

Lab 1: **Multiple Lens Systems—The Zoom Lens**

Paraxial design of a simple two-lens zoom system. SLR camera zoom lens.

Week 3: 1 February 2016

Lab 2: **Aberrations**

Week 4: 8 February 2016

Lab 3: **Stops, Pupils, and F/#**

Week 5: 15 February 2016

Lab 4: **The Simple Magnifier, Eyepieces**

Week 6: 22 February 2016

Lab 5: **Refracting Telescopes**

Afocal systems, Galilean and Keplerian designs, angular magnification, FOV, vignetting, field and relay lenses.

Week 7: 29 February 2016

Lab 6: **The Golfscope...**

Real-world example of a Keplerian Refracting telescope with a reticle.

Week 8: 7 March 2016

.....Lab 6: **The Golfscope (...continued.)**

.....complete optical prescription entered into ZEMAX.

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Week 9: 14 March 2016
NO LABS--*SPRING BREAK*

Week 10: 21 March 2016
Lab 7: **Reflecting Telescopes**
Optical properties of the individual mirrors and of the system.
Angular magnification, FOV.

Week 11: 28 March 2016
Lab 8: **Binoculars.**
Keplerian telescope folded using a prism.

Week 12: 4 April 2016
Lab 9: **The Compound Microscope**
Magnification of the objective, the eyepiece, and the overall system.
Telecentricity. Commercial microscopes.

Week 13: 11 April 2016
Lab 10: **Optical Materials and Dispersion**
The prism spectrometer, optical layout and alignment.
Dispersion curves, comparison to theoretical data.
The Abbe Refractometer, TIR, unknown samples, optical layout of the instrument.

Week 14: 18 April 2016
Lab 11: **Photoconductors and Basic Electrical Measurements**

Week 15: 25 April 2016
Lab 12: **Photodiodes, Solar Cells, LED's and Diode Lasers**

Week 16: 2 May 2016
NO LABS--*Last Week of Classes*
Final Analysis due by 5pm, Wed. May 4.

Week 17: 9 May 2016
NO LABS--*FINAL EXAM Week*