

# **OPTI 505L: Physical Optics Laboratory** **Spring 2022**

## **Syllabus and Introduction**

### List of Experiments:

1. Orientation: Gaussian beams, alignment and collimation of a laser beam
2. Polarization
3. Basic Interference: Mach-Zehnder Interferometer
4. Fizeau Interferometer
5. Diffraction I: Fresnel (straight edge, pinhole), Fraunhofer (square aperture, circular aperture, multiple slits)
6. Diffraction II: Gratings, zone plates, volume diffraction, scattering
7. Shearing Interferometry
8. Coherence I: Young's double slit experiment, multiple slits, laser diodes
9. Coherence II: Michelson Interferometer
10. White-light Profilometry
11. Home-Kit Michelson

## OPTI 505L Spring 2022 Schedule

<u>Labs</u>	<u>Dates</u>
1, 2	Jan. 24 ~ Feb. 4
3, 4	Feb. 7 ~ Feb. 18
5, 6	Feb. 21 ~ Mar. 4
	Mar. 7 ~ Mar. 11 (Spring recess)
7, 8	Mar. 14 ~ Mar. 25
9, 10	Mar. 28 ~ Apr. 8
11	Apr. 11 ~ Apr. 22

Last day of classes May 4

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Recitation: Every Monday, 11:00-11:50am, @ room 410

Laboratory: 3-hour weekly session, @ room 440

Prerequisite: OPTI 505R lecture recommended

Textbooks: recommended references are listed in each lab

Class website: [d2l.arizona.edu](http://d2l.arizona.edu)

## OPTI 505L Spring 2022

### Introduction

The purpose of this class is to:

- Learn how to operate optics equipment.
- Reinforce the theory behind the material.
- Learn to work with other scientists.

As shown on the tentative list of experiments, there are 11 experiments to be performed during the semester. The references to review before each lab are listed on the instructions for that lab. Students will be able to perform all the required work for the lab during the 3-hour lab session. An exception is Lab 11, which will be a take-home experiment. You may need extra time to prepare for the labs and answer the questions. The TA will be available for questions during his office hours, TBA.

**Any student who does not complete all 11 labs will fail the course.** Any missed labs must be made up. A lab may only be made up when it is set up - each lab is set up for two weeks. If you know you are going to miss a lab, contact your TA **before** you miss it to schedule a makeup time. If you miss a lab due to an unforeseen circumstance, such as illness, contact the TA as soon as possible to schedule a makeup. This is your responsibility!

Lab groups will consist of two to three students per group. Groups will be formed, and time slots will be assigned. Two lab groups will be scheduled for each available time slot. Two labs will be set up at the same time in the room, for two consecutive weeks. The first week, each group will do one lab, and on the second week, the groups will switch. For example, the first week a certain group may do lab #2, the second week it will do lab #1, the third week it will do lab #4, then lab #3, and so on. An exception is Lab 11, where each group will have a take-home experiment to be completed over the two-week span.

The total grade for the class is based on your lab notebooks. The notebooks will be graded on the basis of completeness of the lab write-up and answering the questions. Lab notebooks will be collected during the semester and graded.

The lab notebook is the most important part of the lab. You need to keep your notebook up to date, and write in it as you do the lab. You must use a bound notebook that has numbered pages that cannot come out. Your notebooks must contain everything needed to reproduce the experiment:

1. Date and time
2. Lab title and names of group members
3. The purpose or hypothesis you are testing
4. The diagrams of the experimental setup

5. How measurements are made
6. All observations and comments
7. Data and analysis
8. Conclusions and comparison of your results with the expected outcome
9. Answers to the questions from the handouts

The notebook must be legible and neatly done so somebody else reading your notebook could understand what you did. It is a good idea to cut out and tape relevant material into your notebook where appropriate. It is also useful to keep a table of contents for your notebook.

We will provide up-to-date class information in D2L, including lab handouts, diagrams, and relevant pictures. Please see [d2l.arizona.edu](http://d2l.arizona.edu) for more information. A list of reference material for the OPTI 505 lecture class is included with the material. It is a fairly complete list for our class also. These reference books are on reserve in the Optical Sciences Center library.

Some additional notes:

1. You must prepare for the labs before coming! Please make sure you look over the labs to understand what you'll need to know - and then make sure you know it! Make sure you read any suggested references! Look at the questions so that you can think about them during the lab! Also, it's a good idea to get a head start by writing up the purpose and any initial calculations, before you show up!
2. You should keep a lab notebook. Put everything into your notebook! That includes scribbled calculations, computer printouts, diagrams, etc. Your notebook should contain all the work that got you there.
3. As much as possible, please write all your notes during the lab period - not later. You want to record what happens while it's happening. It's true that three hours isn't much time, but it's important to write things down while they are fresh in your mind.