

Department of Physics Duquesne University**Instructor: Michael Huster, PhD**

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Office Hours: Mon., Wed. 10:00 – 12:00

Class Schedule

Location: Fisher 221

Time: Tu. 10:50 – 1:30

Texts and Materials

There is no text. A free account on SageMath Cloud is required. The instructor will upgrade your “project” associated with this course.

Course Description

Laboratory demonstrating optical principles and applications. Experiments may vary ranging from basic single optical component set-ups to multicomponent set-ups, basic and advanced interferometry, polarization and holography. Three hours. Prerequisites: PHYS 302 (can be taken concurrently) and C or better in PHYS 212L. Laboratory. Offered fall only.

Introduction

Optics lab provides you with a hands-on approach to understanding and using optical devices. The optics lab at Duquesne allows you to use research grade equipment, but this also means you have to proceed with greater care than in normal instructional labs. Part of your grade will be based on how well you take care of this equipment as well as putting it back in its proper location. As there is limited equipment, you will work in groups of 2 – 3 students determined by your lab instructor. Important details regarding the handling optical components are below.

You will also be introduced to some research-quality programming, analysis, and report writing skills. This will be done through the amazing web site SageMath Cloud which integrates a python programming environment with Jupyter notebooks on virtual Linux computers.

Student Learning Outcomes

By the end of the course, a successful student will be able to:

- qualitatively and quantitatively use a ray model of light to analyze optical components.
- qualitatively and quantitatively use a wave model of light to analyze diffraction and interference.
- qualitatively and quantitatively analyze light polarizations.
- design and analyze optical system with multiple, research grade optical components.
- carry out an optical experiment including uncertainty in measurement.
- effectively communicate about a lab experiment.

Evaluation of Learning

There will be several requirements for the lab course including pre-lab assignments, lab exercises, evaluation tasks, and a poster. For the first 11 labs the points will be:

Pre-Lab 5 points

Lab Exercises 5 points

Task 10 points

Keep in mind that optical equipment is fragile and absolutely requires delicate handling. As such, you can lose points due to improper usage of the equipment (see below).

You will also be evaluated on report writing and analysis skills. These will be done through your SageMath Cloud account. There will a number of these skills evaluated throughout the semester. For planning purposes I think there will be five evaluations worth 10 points each.

During the last 3 weeks of class (time permitting), you will be working on a final group project. These group projects require you to assemble an optical system to accomplish a set of goals. As you will not have a great deal of time to accomplish this, you will be graded on how effectively you accomplish the goal. Eventually, you will report the results in the form of a poster.

Total Grading Scheme

First 11 Labs	220 points
Final Project	50 points
Skill Evaluations	50 points
Total	320 points

The First 11 Labs

Pre-Lab

The pre-lab is a necessary part of lab experience. Its purpose is to get you thinking about aspects of the upcoming lab and to allow the instructor insight into what you are currently thinking. As a result of this, pre-labs must be turned in no later than Monday at 10:00 AM. Pre-labs will not be accepted just before class. I need time to grade and comment on them before class on Tuesday.

Lab Exercises

During the lab exercises portion, you and your partners will be expected to investigate phenomena and then discuss it with the entire class. If you never discuss anything with the class, you will lose points. It is your job to keep notes using SageMath Cloud so that you will ***always*** have them with you in the laboratory. Part of your grade for the week will be on the notes you keep.

The Task

The task portion of the investigation will be done differently than you likely have experienced. At the start of the task, ***everyone*** will first write down how they would approach the problem without consulting their partners or anyone else beyond the instructor. Once everyone in the group has a plan, the instructor will initial those plans. The group will then decide as a whole how to proceed, explain why they chose to use that plan, and then proceed to accomplish that task. 3 of the 10 points will be based upon your individual plan, 2 of the 10 points will be based upon the description of why the group chose the group plan, and the remaining points on how well the task was accomplished.

Handling Optics

Minor violations of these guidelines may result in points being deducted from your points for the week.

- 1) All equipment must be returned to the cabinet in the same (or better) condition than you found it. It is your job to do this once you are done with the equipment. Make sure you notice how it was protected and keep track of the drawer or box it came from. Note: keeping equipment out longer than necessary can damage it (dust and debris can settle on it) and keeps it at greater risk for accidental damage.
- 2) If you accidentally smudge or dirty an optical component, you must clean it immediately. If you break or damage equipment, you must inform the instructor. Trying to sneak it back (un-noticed) into the cabinet in a

dirty or broken state will result in a penalty of up to 5% of your total grade. If the instructor does not know equipment needs cleaning or is damaged, he or she won't know it needs attention before another student needs it. Accidents happen and no penalty will occur for these. However, there is no excuse for covering them up in a way that will only hurt future students.

- 3) If you discover already dirty or damaged equipment in the cabinet, it is your job to report it to the instructor. Failure to do so could result in suspicions that you violated the previous rule.
- 4) Anything in the cabinets is considered equipment. Even the black masks and cardboard screens. If you grossly mishandle department made objects (i.e., any action that obviously would prevent the object being returned in the same state in which you found it), you will have to make two of this object outside of class hours or you will lose 5% of the total grade for course.
- 5) You may use any equipment you find in the cabinet provided you use it with care. Taking optical equipment from other set ups (or collections of equipment) without permission is essentially the same as stealing equipment from your classmates. Repeated violations can result in a deduction of up to 5% of your total grade.

Grading Scale

The grading scale is based on the percentage of possible points earned. The following scale is used:

A: 93+	C+: 77 – 79
A-: 90 – 92	C: 70 – 76
B+: 87 – 89	D: 60 – 69
B: 83 – 86	F: <60
B-: 80 – 82	

All grades will be reported in Blackboard.

Attendance Policy

Attendance is mandatory at all labs. If a lab must be missed, please inform the instructor before the lab begins, if possible. Make up time may be provided at the discretion of the instructor.

If you are late to class (without permission), the instructor can deduct points from your lab score. The amount of points deducted depends upon how late you were and is entirely at the discretion of the instructor.

If you miss a class, you need to make up the work **before** the next lab period, otherwise you will permanently lose all the points available in that lab period. This make up work must be done with the instructor's permission. Claiming that you did the work is not sufficient (even if you have the notes). If you know you must miss class for personal reasons, you may "make up" the class before it actually happens at the instructor's discretion.

Missing more than three labs will result in failure of the course.

Behavior Guidelines

- **Keep clean!** Grease, oil, and particles are the enemies of optics. Please wash your hands with soap before lab starts. Do not use *Purell* or a hand sanitizer because those products leave a deposit on your hands. (Just smell your hands after you use it some time!)
- **Do not eat in the lab.** You may keep a beverage on the ledge of the hall leading into the lab.
- **Late arrival & early departure.** Please come to lab on time and do not leave early. The lab is only two hours long, so it starts promptly. Repeated late arrivals or early departures will result in points lost from your weekly lab score.

- **Respect your classmates.** Everyone attending class has the right to expect the best possible learning conditions. Please stay on your lab tasks and avoid disruptive behavior. Web searches will be encouraged to support lab activities, but please avoid non-course related browsing. The same with texting and messaging. Before checking or answering a text or message ask yourself if it will be distracting to your lab partner or the class.

Academic Honesty

Integrity is an important part of the scientific process and is required by school policy. Violations will be handled according to the Bayer School Policy. It can be found at:

<http://www.duq.edu/academics/schools/natural-and-environmental-sciences/academic-integrity-policy>

Information for Students with Disabilities

Duquesne University is committed to providing all students with equal access to learning. In order to receive reasonable accommodations in their courses, students who have a disability of any kind must register with the Office of Freshman Development and Special Student Services in 309 Duquesne Union (412-396-6657). Once a disability is officially documented, the office of Special Student Services will meet with you to determine what accommodations are necessary. With your permission, your instructors will receive letters outlining the reasonable accommodations they are required to make. Once I have received this letter, you and I should meet to coordinate the way these accommodations will be implemented in this course. For more information, go to www.duq.edu/special-students.

Schedule Note: The actual schedule may change.

Dates	Lab
8/23	Lab 1 – Introduction, Handling Optics
8/30	Lab 2 – Point & Extended Sources
9/6	Lab 3 – Refraction
9/13	Lab 4 – Image Formation
9/20	Lab 5 – Lenses I
9/27	Lab 6 – Lenses II
10/4	Lab 7 – Lenses III
10/11	Lab 8 – Reflections
10/18	Lab 9 – Curved Mirrors
10/25	Lab 10 – Polarization I
11/1	No Lab – School Holiday
11/8	Lab 11 – Polarization II
11/15	Lab 12 – Project I
11/22	Thanksgiving Break
11/29	Lab 13 – Project II
12/6	Lab 14 – Project III
Finals	Poster Presentation During Finals Week