

**Physics 331: Optics**  
**MW 7:05 pm - 9:55 pm in room BBH 209**  
**College of Arts & Sciences Syllabus**

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## **COURSE INFORMATION**

**Credit Hours:** 4.000

**Course Description:** The fundamental principle of geometrical and physical optics and their application to the design of modern instruments as well as atomic spectra, properties of photons and lasers. Principles discussed in the lecture will be explored in various lab exercises. Lecture 2 hours, Lab 4 hours.

**Course Prerequisites:** PHYS-204 minimum grade of D and (PHYS-202 minimum grade of D or PHYS-207 minimum grade of D).

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## **FACULTY INFORMATION**

**Instructor:** Dr. Orin Harris

**Office Location:** BBH 217B

**Office Hours:** MW 1:30 pm - 2:30 pm, MW 6:00 pm - 7:00 pm, or by appointment

**Phone Extension:** 5561

**Email:** O-Harris1@neiu.edu

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## **COURSE MATERIALS**

**Required Text:** *Optics* by Eugene Hecht, 5th Edition (Pearson, 2016). ISBN-13: 9780133977226

*Note: This is the standard optics text, and it is very good and comprehensive. The 5th edition is nicely bound and printed, but it is on the expensive side. You can find a flimsy international 4th edition online for significantly cheaper, but it has re-arranged homework problems. If you get the 4th edition let me know, and I will provide you with copies of the homework from the 5th edition.*

**Other materials:** You will need a lab notebook. You can use any form of notebook as long as the pages are bound and as long as it is only used for the labs in this course (please, no grocery lists or class notes).

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## COURSE OBJECTIVES / STUDENT LEARNING OUTCOMES

The objective of this course is to provide students with a broad understanding and appreciation of the physical principles and laws governing optics, that is, the behavior and properties of light (electromagnetic radiation), and its interactions with matter. Topics will include: waves, classical and quantum mechanical electromagnetic theory, reflection and refraction, geometrical optics (lenses, mirrors, and prisms), polarization, interference, diffraction, and lasers. There is an associated lab course, in which you will explore many of these topics in an experimental setting. The labs will cover: He-Ne laser beam characteristics and alignment, geometrical optics, diffraction and interference, reflection and refraction, polarization, and wave guides.

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## STUDENT TASKS / ASSIGNMENTS / REQUIREMENTS:

**Assignments:** Homework will be assigned each week on D2L and collected the same day the following week unless otherwise specified. I cannot stop you from finding homework solutions online, but note that the purpose of the homework is good-natured: to help to you learn the material and prepare you for the exams. Credit for homework problems will only be given if you show your work, as well as draw illustrative diagrams when necessary to understand what the symbols you have written refer to. Further, units must be specified when giving numerical results, and points will be deducted for incorrect use of significant figures. Homework assignments turned in late will be given a 10% penalty, and homework will not be accepted more than one week beyond the due date.

**Lab Reports:** I will assign a lab roughly every other week. You must keep a lab notebook and use it to record your measurements and procedures (with dates and times), including drawing diagrams of your lab setup when appropriate. It must be a bound notebook and not a loose collection of papers, and I *will* ask to see it! Your writing should be legible and should provide enough information for you or someone else to reconstruct your experimental setup and to understand the context of the data you recorded. If data is recorded on a computer, you must either print it out and paste it in your notebook, or make a plot of the data and paste it in your notebook, as appropriate. I will provide a lab manual for each lab that will help guide you through it, but as this is a course that helps prepare you for experimental research, often you will be expected to think for yourself in coming up with solutions to experimental problems as you encounter them. Each lab group should have 2 or 3 partners, who will collaborate on writing a single report for the group. Lab report guidelines will vary and will be given in each lab manual. Copying data from other groups will not be tolerated; I will periodically alter certain elements of the lab setup/equipment between groups so that it will be obvious to me if they copy each other's data! Units must be given for all data, and points will be deducted for incorrect use of significant figures. Lab reports turned in late will be given a 10% penalty, and will not be accepted more than one week beyond the due date.

## Grading Policies and Formulae:

Homework	25% of the total grade
Lab notebook and lab reports	25% of the total grade
Mid-term 1	10% of the total grade
Mid-term 2	10% of the total grade
Mid-term 3	10% of the total grade

Any student who achieves a percentile score of above 90%, 80%, 70%, 60% is guaranteed to receive an A, B, C, or D respectively. These percentile scores may be adjusted downwards based on a class curve and other considerations.

### Tentative Course Schedule and weekly readings:

Week 1&2	..... Wave motion, and Lasers (Read 2.1-2.9 and 13.1 through p. 627)
Week 3	..... Electromagnetic Theory (Read Chapter 3)
Week 4	..... Mid-term 1
Week 5	..... The propagation of light (Read 4.1-4.9, 4.11)
Week 6	..... Mid-term 2
Week 7	..... Geometrical Optics (Read 5.1-5.7, 5.9)
Week 8	..... Mid-term 3
Week 9	..... Superposition of Waves (Read Chapter 7)
Week 10	..... Polarization (Read 8.1-8.8)
Week 11&12&13	..... Interference and Diffraction (Read 9.1-9.4, 9.6, 9.8, 10.1-10.3)
Week 14	..... Final

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## COURSE POLICIES AND STATEMENTS

**Reading:** Reading assignments for each week will be provided on D2L. I expect you to have finished reading each week's assignment before lecture. The lecture is meant to be a supplement to the text, not a substitution for it.

**Course communication:** All pertinent class communications between the instructor and students is conducted exclusively through NEIU e-mail. Thus it is the responsibility of students to check their NEIU e-mail account for all significant information and updates on class cancellations in the event of threatening weather conditions.

I will send information weekly with updated reading assignments, homework, lab reports and associated due dates, and/or exam times.

**Class meeting times and lab scheduling:** Each class period is nearly 3-hours long. Roughly half of this time will be devoted to lecture, with the remaining time to be used for lab. Because there is not enough lab space for everyone to do each lab concurrently, each lab group will be expected to schedule time during the week to access the lab to complete the assignment. Generally each lab assignment will require a few hours of lab time, and two weeks will be given to complete the lab and turn in a lab report. I will give an introduction to the labs and lab materials during class time, and will be periodically available to help in person, but as this is an 'advanced' lab, for the most part you will be expected to complete the labs "on your own." Note that due to time constraints, you will often encounter topics in lab before we have studied them in class. In such cases the lab manual will help guide you to understand the topic from an experimental point of view, and later you will learn the theory in more depth.

**Absence Policy:** Lecture attendance will not be enforced but will sometimes cover material not in the textbook that will be covered in the exams. Lab attendance is mandatory. Each lab that is missed will result in a forfeiture of 5% of your total grade.

**Academic Integrity Policy:** By enrolling in this course, you are bound by the NEIU Student Code of Conduct: <http://www.neiu.edu/university-life/student-rights-and-responsibilities/student-code-conduct> You will be informed by your instructor of any additional policy specific to your course regarding plagiarism, class disruptions, etc.: Plagiarism is forbidden. No headphones, cell phones being used, or other distractions in class.

**ADA Statement:** Northeastern Illinois University (NEIU) complies with the Americans with Disabilities Act (ADA) in making reasonable accommodations for qualified students with disabilities. To request accommodations, students with special needs should make arrangements with the Student Disability Services (SDS) office, located on the main campus in room D104. Contact SDS via (773) 442-4595 or <http://www.neiu.edu/university-life/student-disability-services>.

**Campus Safety:** Emergency Procedures and Safety Information can be found on NEIUport on the MyNEIU tab or as follows: [http://homepages.neiu.edu/neiutemp/Emergency\\_Procedures/MainCampus/](http://homepages.neiu.edu/neiutemp/Emergency_Procedures/MainCampus/).

**Incomplete Grade Policy:** An Incomplete (“I”) grade is temporary and exceptional, and can be given only to students whose completed coursework has been qualitatively satisfactory but who have been unable to complete all course requirements because of illness or other circumstances beyond their control. An “I” grade is not to be awarded in place of a failing grade or when the student is expected to attend additional class meetings or to re-register to complete the course requirements. Additionally, an “I” grade is not a means for the student to raise his/her grade by doing additional work.

A request for an “I” grade must be made by the student to the faculty member before the last official day of the semester or term. The faculty member retains the right to make the final decision on granting a student’s request for an “I” providing the student meets the provisions above, even though the student may meet the eligibility requirements for this grade. Students have up to one semester, excluding summer, to complete the work.

It is the responsibility of the student to complete and submit the remaining coursework before the assigned deadline. The faculty member will submit a grade change converting the “I” to a letter grade by or before the last day of the semester in which the outstanding coursework is to be completed. If the student does not meet the deadline, the “I” will be converted automatically to a final grade of an “F.” Since the “I” grade is temporary, faculty may not issue a terminal “I” grade.

Upon receipt of the grade change, the Registrar Services Office will post the grade to the student’s record and recalculate the GPA. Although students have up to one semester, excluding summer, to complete the work to change the grade of Incomplete, the student’s academic standing will be reassessed only if the grade change is received by the Friday of the first full week of the semester immediately following the one in which the “I” grade was assigned.

Students will not be allowed to graduate with “I” grades on their records.