OPTI 200 Light, Color, and Vision

Description: Explore optical technology and phenomena, including color and vision, light in art and nature, lasers, telescopes, cameras and fiber optics. This course, designed for non-science majors, will feature demonstrations and hands-on learning, with only basic math.

Locations and Times
Optical Sciences (Meinel Bldg.) Room 422
MWF (2:00 – 2:50 pm)

Instructor Information
Dr. Mike Nofziger (a.k.a. Dr. Mike)
Office: Meinel, Room 412A
520-626-8363 nofziger@optics.arizona.edu
Office Hours: Tuesdays 1:00-3:00 pm; other times by appointment – email first.

Graduate Teaching Assistants
No TA this semester—Dr. Mike will be your grader this semester

Course Objectives and Expected Learning Outcomes
Upon successful completion of this course, you will:
- be able to communicate effectively (in writing) information about the subject of optics
- have a good understanding of what light is and how it is used.
- learn about through lab experiments the various light sources. [LAB]
- understand how lasers work.
- understand how optical images (real and virtual) are formed. [LAB]
- understand the reflection, refraction, and dispersion of light. [LAB]
- be able to make calculations that describe the images formed by lenses and mirrors.
- be able to trace rays of light that describe the images formed by lenses and mirrors.
- understand the optics of the human eye. [LAB]
- understand why we need to wear eyeglasses or contacts to correct vision.
- have an understanding of what the LASIK procedure is and does.
- understand how various optical instruments work (telescopes, binoculars, microscopes, DVD players).
- understand the optics and processes of photography.
- be able to explain how a digital camera works.
- have a fundamental understanding of color (additive and subtractive).
- be able to explain how rainbows are formed.
- have been introduced to the world of infrared optics [LAB]
- be able to apply the basic technology of optics in own careers!

Topics
<table>
<thead>
<tr>
<th>Light</th>
<th>Shadows</th>
<th>Plane Mirrors</th>
<th>Photography</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electromagnetic Radiation</td>
<td>Reflections</td>
<td>Kaleidoscopes</td>
<td>Eye and Vision</td>
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<tr>
<td>Properties of Waves</td>
<td>Refraction</td>
<td>Spherical Mirrors</td>
<td>Optical Instruments</td>
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<tr>
<td>Resonance</td>
<td>Optical Fibers</td>
<td>Spherical Lenses</td>
<td>Color</td>
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<tr>
<td>Artificial Lighting</td>
<td>Dispersion</td>
<td>Fresnel Lenses</td>
<td>Art and Optics</td>
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<tr>
<td>Light Sources</td>
<td>Rainbows</td>
<td>Magnification</td>
<td>Infrared</td>
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<td>The Laser</td>
<td>Real vs. Virtual Images</td>
<td>Aberrations</td>
<td>???</td>
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**Course Methodology**
Generally curriculum-centered with content presentations and lectures

**Teaching Format**
Lectures, in-class demos, and in-class labs

**Required Texts**
- **Seeing the Light: Optics in Nature, Photography, Color Vision and Holography**, (Falk, Brill, and Stork)
  
  2nd ed. Hardcover, 494 pages, © 2020, Publisher: John Wiley & Sons Inc. ISBN: 1635619238
  Available for purchase at the UA Bookstore, amazon.com
  (either edition is OK for our class)

- **Optics Made Clear: The Nature of Light and How We Use It**
  (William L. Wolfe, Professor Emeritus, Optical Sciences Center)

**Required or Special Materials**
- ONE Notebook for lab and activity notes, and Journal writing
- Calculator (cell-phone calculator OK), Graph Paper (free online)

**Required/Recommended Knowledge**
- Basic Math

  (Any student who has successfully completed the Math Foundations requirement is prepared for the math used in OPTI 200. The only math we use is the solution of simple, linear, algebraic equations, and y vs. x data-plotting.)

**Required Examinations and Papers**
- Multiple quizzes, (1) Midterm Exam, (1) Final Exam ([Final Exam Regulations](https://opti.arizona.edu/), [Final Exam Schedule](https://opti.arizona.edu/))
- OPTI 200 Final Exam Schedule: (sec. 001—Dec. 8 at 1:00 pm – 3:00 pm)
- Research Paper (details in "Writing Requirements" section below)

**Grading Policy**
- Homework: 25%
- Lab: Notebook and Activities: 10%
- Research Paper: 25%
- Journal Writing: 10%
- Midterm Exam (in-class): 10%
- Final Exam (in-class): 10%
- Unannounced In-class Quizzes: 10%

*Final grades will be calculated on a 'curve' for the entire class.*

Extra credit, if offered to the entire class, will be added only to your Homework point total. Extra credit points can only increase your total homework score up to the maximum possible points without extra credit.

**Late Work Policy**
Homework will be accepted late (up to a week after it was due), but will be graded at 50% off.
**Safety on Campus and in the Classroom**

For a list of emergency procedures for all types of incidents, please visit the website of the Critical Incident Response Team (CIRT):  [https://cirt.arizona.edu/case-emergency/overview](https://cirt.arizona.edu/case-emergency/overview)

**Attendance Policy**

It is important to attend all classes, as what is discussed in class is pertinent to adequate performance on assignments and exams. If you must be absent, it is your responsibility to obtain and review the information you missed. Unannounced quizzes will be given to encourage attendance, and to help you gauge your progress in learning the material.

*If you miss the midterm or final exams, they may not be made up unless you have a documented medical or family emergency. Quizzes may not be made up for any reason.*

"All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion. Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored."

**Classroom Behavior Policy**

The Arizona Board of Regents’ Student Code of Conduct, ABOR Policy 5-308, prohibits threats of physical harm to any member of the University community, including to one’s self. See:  [http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students](http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students)

**Special Needs and Accommodations Statement**

Students who need special accommodation or services should contact the Disability Resources Center, 1224 East Lowell Street, Tucson, AZ 85721, (520) 621-3268, FAX (520) 621-9423, email: uadrc@email.arizona.edu, [http://drc.arizona.edu/](http://drc.arizona.edu/). You must register and request that the Center or DRC send me official notification of your accommodations needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate. **The need for accommodations must be documented by the appropriate office.**

“At the University of Arizona, we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, [https://drc.arizona.edu/](https://drc.arizona.edu/)) to establish reasonable accommodations.”

**Student Code of Academic Integrity**

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See:  [https://deanofstudents.arizona.edu/policies/code-academic-integrity](https://deanofstudents.arizona.edu/policies/code-academic-integrity)

**Nondiscrimination and Anti-harassment Policy**

The University of Arizona is committed to creating and maintaining an environment free of discrimination. In support of this commitment, the University prohibits discrimination, including harassment and retaliation, based on a protected classification, including race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity, or genetic information. The University encourages anyone who believes he or she has been the subject of discrimination to report the matter immediately as described in the section below, “Reporting Discrimination, Harassment, or Retaliation.” All members of the University community are responsible for participating in creating a campus environment free from all forms of prohibited discrimination and for cooperating with University officials who investigate allegations of policy violations.

Confidentiality of Student Records
https://www.registrar.arizona.edu/privacy-ferpa/ferpa-compliance

Subject to Change Statement
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor.

Writing Requirements

Research paper (25% of the overall course grade)
The requirement is a 10-page paper, double-spaced, with at least 5 references. I grade these for length, spelling, grammar, technical content, and the clarity and quality of the writing. My grading includes specific corrections and indications of where some aspect of the paper needs to be improved. Components of the research paper will include writing a rough draft/grading/revision writing.

Papers must be uploaded to and checked for originality by "Turnitin.com" (done through our D2L class site). Papers that are plagiarized will result in a grade of "Incomplete" (I) for the course. To receive a different grade, you will be required to submit a new research paper on a completely different topic.

Lab Notebook (10% of the overall course grade)
The course includes a number of lab exercises / activities that we do during normal class time (in our sophomore optics teaching lab). You are expected to keep a lab notebook, writing down your observations, data, etc. during these labs. I will give you handouts which ask you to make both general and specific written observations, to record numerical data, and to answer specific questions. Part of these activities include basic calculations and data plotting.

As an example, one of the assignments, after we have studied various light sources in the lab, is to go out into the world to observe and write about various light sources that you encounter. Your writing assignment is to describe the physical and spectral nature of each light source.

Journal Writing (10% of the overall course grade)
You will be required to maintain a personal journal, making written entries on specific topics relevant to our course of study. The topics are only intended to provide a starting point—their actual writing, content, style, approach, and specifics are totally open-ended. This allows for creative writing, scientific writing, poetry, etc. Topics will change from semester to semester, but recent topics from the course have included: ‘infinity’, ‘luminous’, ‘shadows’, ‘color’, and ‘reflection.’

I keep my own journal, and we may devote class time to sharing our journal entries.

Miscellaneous Writing Assignments
One assignment I always make in this course is to have you go to the Center for Creative Photography and the U of A Art Museum, to make observations of current exhibits. Writing assignments will be assigned, that relate aspects of the exhibits to things we’ve discussed in class.
**Honors Students**

Students taking the course for Honors credit are required to include the following in their Honors contract for this course:

**Required Honors Assignments:**

For OPTI 200, the following activities will be **required** of all Honors students, assigned as part of their individualized Honors Contract:

- Give a 15-minute presentation (“mini-lecture”) to the entire OPTI 200 class on your own selected topic of interest in optics. This can include:
  - any topic in optics that interests you, of your choice. Research it to include 10 references, 5 from professionally-published papers. Use Power Point slides, with graphics and scientific data, to teach the class about this topic.
  - If you are working in a campus lab or in a local company (in a science or engineering field), present your work in a 15-minute mini-lecture to the OPTI 200 class. Relate it to some aspect of optics. Use Power Point slides, with graphics and scientific data, to teach the class the basics of your work and how it relates to light and optics.
- All of the required lab work that everyone does.
- All of the homework that everyone does.
- The 10-page research paper (rough draft and final copy) that everyone does.
- All of the journal writing.
- The midterm and final exam.

**Additional Honors Assignment (pick one):**

For OPTI 200, the following activities are available to Honors students. **Pick one**, to be assigned as part of your individualized Honors Contract:

- Attend some of our Friday Community Speakers Lectures (optics undergraduate and graduate students present their research every Friday at noon) and/or our Thursday Colloquium talks (talks given by optics professionals and researchers). Write a 1-page summary of 6 of the presentations, including the relevance and real-world application of the optics involved.
- Meet with 3 members of our faculty and/or our graduate students to learn about their research. Write a 2-page summary of each meeting, including the relevance and real-world application of the optics involved.
- Visit 3 of our research labs to interact with our students doing research. Interview each student about the work they are doing. Read a published paper from each lab that pertains to the research they are doing. Write a 2-page summary of each meeting, including connections to the published paper. Discuss the relevance and real-world application of the optics involved.
- Customize your own assignment, per the approval of the instructor.