



PEP209 Modern Optics

School of Engineering and Science

Physics Department

Fall 2017

Meeting Times: Mon. 2:00-3:40 PM; Fri. 15:00-15:50 PM
Classroom Location: MORTON 105
Instructor: Stefan Strauf
Contact Info: B724, strauf@stevens.edu, x5639
Office Hours: Mondays/Fridays 11AM-noon or by appointment
Prerequisite(s): PEP112

COURSE DESCRIPTION

Optics is the branch of physics which involves the behavior and properties of light, including its interactions with matter and the construction of instruments that use or detect it. The study of optical phenomena and the desire to utilize light dates back thousands of years. Nowadays applications in optics and photonics constitutes a multi-billion dollar market and encompass almost any technology from optical communication to display technologies, lasers and solid-state lighting, to energy harvesting solar cells and surgery, and also holds great promise for future technologies such as optical (quantum) computing and quantum cryptography.

In this course we will introduce the basic concepts of geometrical optics for reflecting and refracting surfaces, thin and thick lens formulations and study optical aberrations. Equipped with these practical tools of geometrical optics (ray optics) we will get a deeper understanding of optical instruments in modern practice including magnifiers, microscopes, telescopes, spectroscopes, and optical fibers, and further introduce the principles of light dispersion with refractive materials. The second part of this course focusses on physical optics involving the electromagnetic nature of light and specifically the phase, which leads to the understanding of phenomena such as superposition, interference, coherence, polarization of light and diffraction effects.

COURSE MATERIALS

Textbook:

The textbook for this course is **Introduction to Optics**, 3rd edition, by Pedrotti3, from Pearson Prentice Hall, 2007 (ISBN 0-13-149933-5).

You will need access to this book as homework will be drawn from text problems and reading assignments. The text will also help you to get a better grade in my course. In addition, the book provides much more material than we will cover in **PEP 209** and thus provides a useful reference, i.e. for **PEP 509** Intermediate Waves and Optics, your **SKIL** class, or courses like “Laser Optics” and “Fourier Optics”. 2

OTHER READINGS

There are many other text books that introduce optics – here are some that I found useful:

- Optics, 4th ed., by Hecht, Addison-Wesley, 2002, Comparable to the current text with many nice figures and photos.
- Principles of Optics, 6th ed., Born & Wolf, Pergamon Press, The classic book and standard reference.
- Fundamentals of Optics, Jenkins & White, McGraw-Hill, More simplistic but a classic.

FORMAT AND STRUCTURE

This course is comprised of two weekly lectures. Each lectures includes a brief recitation of the content of the previous lecture.

COURSE REQUIREMENTS

Attendance Poor attendance will have in most cases a negative effect on your grade. Make sure to sign the attendance sheet.

Homework Weekly homeworks will be handed out. There will be about 10 HWs, one every week but no HWs before tests or final. The HW is due within one week, typically on Mondays, unless specified otherwise. The submitted papers must be your work only, although you are invited to discuss what is asked for with your colleagues. HW count 40% towards your final grade, i.e. about 4% each. **Late homework will not be accepted.**

Midterm We will have two in-class tests on Mondays – see schedule at the end. These “midterm” tests counts 15% each towards the total grade.

Exams There will be one in-class exam in this course. It counts 30% of the total grade.

GRADING PROCEDURES - Grades will be based on:

Homework (40 %)

Test 1 (15 %)

Test 2 (15 %)

Exam (30 %)

ACADEMIC INTEGRITY

Undergraduate Honor System

Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the [Honor System Constitution](#). More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at <http://web.stevens.edu/honor/>

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

“I pledge my honor that I have abided by the Stevens Honor System.”

Reporting Honor System Violations

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

Graduate Student Code of Academic Integrity

All Stevens graduate students promise to be fully truthful and avoid dishonesty, fraud, misrepresentation, and deceit of any type in relation to their academic work. A student's submission of work for academic credit indicates that the work is the student's own. All outside assistance must be acknowledged. Any student who violates this code or who knowingly assists another student in violating this code shall be subject to discipline.

All graduate students are bound to the Graduate Student Code of Academic Integrity by enrollment in graduate coursework at Stevens. It is the responsibility of each graduate student to understand and adhere to the Graduate Student Code of Academic Integrity. More information including types of violations, the process for handling perceived violations, and types of sanctions can be found at www.stevens.edu/provost/graduate-academics.

Special Provisions for Undergraduate Students in 500-level Courses

The general provisions of the Stevens Honor System do not apply fully to graduate courses, 500 level or otherwise. Any student who wishes to report an undergraduate for a violation in a 500-level course shall submit the report to the Honor Board following the protocol for undergraduate courses, and an investigation will be conducted following the same process for an appeal on false accusation described in Section 8.04 of the Bylaws of the Honor System. Any student who wishes to report a graduate student may submit the report to the Dean of Graduate Academics or to the Honor Board, who will refer the report to the Dean. The Honor Board Chairman will give the Dean of Graduate Academics weekly updates on the progress of any casework relating to 500-level courses. For more information about the scope, penalties, and procedures pertaining to undergraduate students in 500-level courses, see Section 9 of the [Bylaws of the Honor System](#) document, located on the Honor Board website.

EXAM ROOM CONDITIONS

The following procedures apply to midterm and exams for this course. As the instructor, I reserve the right to modify any conditions set forth below by printing revised Exam Room Conditions on the midterm or exam.

1. Students may use the following devices during midterm and exams. Any electronic devices that are not mentioned in the list below are not permitted.

Device	Permitted?	
	Yes	No
Laptops		x
Cell Phones		x
Tablets		x
Smart Watches		x
Google Glass		x
Other (Nonprogrammable calculator)	x	

2. Students may use the following materials during midterm and exams. Any materials that are not mentioned in the list below are not permitted.

Material	Permitted ?	
	Yes	No
Handwritten Notes <i>Conditions: one 8x10 sheet (front and back) is permitted</i>	x	
Typed Notes		x
Textbooks		x
Readings		x

3. Students are not allowed to work with or talk to other students during quizzes and/or exams.

LEARNING ACCOMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. Student Counseling and Disability Services works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, and psychiatric disorders in order to help students achieve their academic and personal potential. They facilitate equal access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from SCDS staff. The SCDS staff will facilitate the provision of accommodations on a case-by-case basis. These academic accommodations are provided at no cost to the student.

Disability Services Confidentiality Policy

Student Disability Files are kept separate from academic files and are stored in a secure location within the office of Student Counseling, Psychological & Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies. For more information about Disability Services and the process to receive accommodations, visit <https://www.stevens.edu/sit/counseling/disability-services>. If you have any questions please contact: Lauren Poleyeff, Psy.M., LCSW - Disability Services Coordinator and Staff Clinician in Student Counseling and Disability Services at Stevens Institute of Technology at lpoleyef@stevens.edu or by phone (201) 216-8728.

INCLUSIVITY STATEMENT

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in education and innovation. Our community represents a rich variety of backgrounds, experiences, demographics and perspectives and Stevens is committed to fostering a learning environment where every individual is respected and engaged. To facilitate a dynamic and inclusive educational experience, we ask all members of the community to:

- be open to the perspectives of others
- appreciate the uniqueness their colleagues
- take advantage of the opportunity to learn from each other
- exchange experiences, values and beliefs
- communicate in a respectful manner
- be aware of individuals who are marginalized and involve them
- keep confidential discussions private

TENTATIVE COURSE SCHEDULE

Day	Topic	Chapter
Aug. 28, Mon.	Introduction/Reflection and Refraction	Ch. 1, Ch 2.1
Sep. 1, Fri.	Reflection and Refraction	Ch. 2.1-2.4
Sep. 04, Mon	Labor day – no class	
Sep. 8, Fri.	Refraction and imaging	Ch. 2.5-2.7
Sep. 11, Mon.	Thin lenses	Ch. 2.8, 2.9
Sep. 15, Fri.	Thin lenses	Ch. 2.10-2.12
Sep. 18, Mon.	Thick lenses, Seidel Aberrations	Ch. 18.1-18.7, 3.2, 20
Sep. 22, Fri.	Seidel Aberrations	Ch. 20.1-20.2
Sep. 25, Mon.	Chromatic Aberrations	Ch. 20.7
Sep. 29, Fri.	Optical systems, The eye	Ch. 3.1, 3.3, Ch. 19
Oct. 02, Mon.	Optical instruments	Ch. 3.4-3.5
Oct. 06, Fri.	Optical Instruments	Ch. 3.6-3.7
Oct. 9, Mon.	Fall recess - no class	
Oct. 10, TUE!	Test 1: Geometrical Optics	Ch. 1-3
Oct. 13, Fri.	Waves	Ch. 4.1, 4.2
Oct. 16, Mon.	Waves	Ch. 4.5, 4.8
Oct. 20, Fri.	Superposition	Ch. 5.1-5.2
Oct. 23, Mon.	Superposition, Coherence	Ch. 5.2-5.4
Oct. 27, Fri.	Interference	Ch. 5.5,5.6
Oct. 30, Mon.	Polarization and 2beam Interference	Ch. 4.9, 7.1
Nov. 03, Fri.	Double Slit Experiment,	Ch. 7.2,
Nov. 06, Mon,	Thin Films, Polarization I	Ch. 7.4, 7.5, 7.6, 15.1
Nov. 10, Fri.	Polarization II	Ch. 15.2, 15.3
Nov. 13, Mon.	Test 2: Physical Optics	Ch. 4, 5, 7, (15)
Nov. 17, Fri.	Briferingence I	Ch. 15.4
Nov. 20, Mon.	Birefringence II, (cancelled)	Ch. 15.5-15.7
Nov. 22-26, Fri.	Thanksgiving recess, no class	
Nov. 27, Mon.	Fraunhofer Diffraction	Ch. 11.1, 11.2
Dec. 01, Fri.	Fraunhofer Diffraction	Ch. 11.3-11.5
Dec. 04 Mon	Fraunhofer Diffraction	Ch. 11.6
Dec. 8 Fri.	Last class, Spectrometer, The laser	Ch.12, Ch. 6
Dec, XYZ	In class final	Ch. 1-5, 7, 11, 15.1-15.4