

Syllabus for Geometrical and Physical Optics, PHYS 462 Spring 2025

CRN: 32730, F01

MWF 3:30-4:30, REIC 207 (Lecture)
R 2:30-5:30 PM, REIC 113 (Laboratory)

Instructor: Ataur R. Chowdhury

Office: REIC 118

Office Hours: MWF 3:30-5:00 PM

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Prerequisites: PHYS 213X; PHYS 301; or permission of instructor.

Text: **Required:** *Optics* by Eugene Hecht, 5th Edition, Addison Wesley.

Reference Texts: 1. *Modern Optics* by R. Guenther, Wiley.
2. *Statistical Optics* by J. Goodman, Wiley.

Course Objectives: To acquire a basic understanding of the fundamentals of geometrical and physical optics.

Student Learning Outcomes:

1. Students should be able to understand the logistics of geometrical and physical optics.
2. Students should be able to set up equations for relevant optical phenomena and be able to solve for relevant quantities of interest.
3. Students should be able to simulate approximate optical properties where analytical solutions are not possible.
4. Students should understand the fundamentals of most geometrical and physical phenomena in optics.

Course Outline: (1) Propagation of light; (2) geometrical interpretation of optical phenomena; (3) Polarization of light; (4) Interference of light; (5) Diffraction of light; (6) Fourier and non-linear optics; and (7) Coherence theory.

Credits: 4 credits: 3 hr. of lecture, and 3hr. of lab per week.

Syllabus for Geometrical and Physical Optics, PHYS 462

Spring 2025

CRN: 32730, F01

Course Requirements/ Policies:

Class Attendance/Participation:

For a better understanding of the course material attendance and participation in classroom activities are very important. This particular course is generally regarded as one of the founding courses that deal with the fundamentals of classical physics, and it is highly expected that the students will commit themselves to attend the class regularly. There will be supplemental materials for this course and the students will be held responsible for all the materials that will be brought in from outside the text. The students will be expected to participate in class activities, and take part in meaningful discussion and ask questions to better comprehend the subject material.

It is highly expected that the students will cause least disruption of class activities by showing up before the class starts, not leaving the class before it stops, keeping cell phones in silent mode, and refraining from talking during the class.

Homework:

On the average, 6-8 problems/exercises/questions will be assigned each week on Fridays. The homework will be due back at the beginning of class the following Friday. **NO LATE HOMEWORK WILL BE ACCEPTED. NO EXCEPTIONS** (barring emergencies and extreme situations). Group work is highly encouraged for solving problems, and for additional help with the homework the students are most welcome to consult the instructor during the office hour or any other time by prior appointment. Any homework you submit should reflect your own best effort. Copying of homework is absolutely not acceptable and will result in a grade of zero for the assignment.

Examinations:

There will be two midterm examinations (February 28, Friday, 2:15-3:15 PM, and April 7, Friday, 2:15-3:15) and a final comprehensive examination (May 2, Friday, 10:45-12:45) for this course. Examinations will consist of, in most part, problems similar to those in the homework and those worked out in class. Midterm will cover the material covered in class and homework prior to the date of test, and the final will cover material covered in chapters 1-10, with more weight on material covered after the midterm. **Make-up exams, for valid reasons, may be arranged with approval from the instructor.**

Laboratory:

The laboratory is an integral part of this course, and each student must attend the lab section and perform all labs. All labs and reports must be completed. Every effort must be made to make up a lab during the same week if possible. Lab reports must be turned in on time, any lab

Syllabus for Geometrical and Physical Optics, PHYS 462

Spring 2025

CRN: 32730, F01

turned in late will get deducted 20% for each week after the date it is due. A PASSING GRADE IN THE LAB IS REQUIRED TO PASS THE COURSE. A list of the labs, lab handout, and the lab policy will be provided in class and will be posted on the canvas.

University AI Policy:

UAF does not have yet a central university policy for AI to be abided by. Depending how you use this, this could be very useful tool for learning. However, please make sure you are not using AI to cheat and copy things out of online sources of any kind. The university takes cheating seriously and it reserves the right to take lawful actions.

Grading Policy:

Homework	25%
Participation	5%
Lab	20%
Midterm I	15%
Midterm II	15%
<u>Final</u>	<u>20%</u>
Total	100%

The final grading for this course will be based on a curve, the average of which is usually taken to be the break-point of letter grade B and C, and the standard deviation of the grade point distribution will separate subsequent letter grades. For a given score, your letter grade will not likely be lower than what it would be expected based on standard grading scale (90-100 = A, etc.). No plus-minus letter grades will be given for this course.

Syllabus Addendum (Revised 8/22/2022)

COVID-19 statement: Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

<https://sites.google.com/alaska.edu/coronavirus/uaf?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

Student protections statement: UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required

Syllabus for Geometrical and Physical Optics, PHYS 462 Spring 2025

CRN: 32730, F01

to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site: <https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/>.

Disability services statement: I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities.

ASUAF advocacy statement: The Associated Students of the University of Alaska Fairbanks, the student government of UAF, offers advocacy services to students who feel they are facing issues with staff, faculty, and/or other students specifically if these issues are hindering the ability of the student to succeed in their academics or go about their lives at the university. Students who wish to utilize these services can contact the Student Advocacy Director by visiting the ASUAF office or emailing asuaf.office@alaska.edu.

Student Academic Support:

- Speaking Center (907-474-5470, uaf-speakingcenter@alaska.edu, Gruening 507)
- Writing Center (907-474-5314, uaf-writing-center@alaska.edu, Gruening 8th floor)
- UAF Math Services, uaf-traccloud@alaska.edu, Chapman Building (for math fee paying students only)
- Developmental Math Lab, Gruening 406
- The Debbie Moses Learning Center at CTC (907-455-2860, 604 Barnette St, Room 120, <https://www.ctc.uaf.edu/student-services/student-success-center/>)
- For more information and resources, please see the Academic Advising Resource List (https://www.uaf.edu/advising/lr/SKM_364e19011717281.pdf)

Student Resources:

- Disability Services (907-474-5655, uaf-disability-services@alaska.edu, Whitaker 208)
- Student Health & Counseling [6 free counseling sessions] (907-474-7043, <https://www.uaf.edu/chc/appointments.php>, Gruening 215)
- Center for Student Rights and Responsibilities (907-474-7317, uaf-studentrights@alaska.edu, Eielson 110)
- Associated Students of the University of Alaska Fairbanks (ASUAF) or ASUAF Student Government (907-474-7355, asuaf.office@alaska.edu, Wood Center 119)

Nondiscrimination statement: The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of

Syllabus for Geometrical and Physical Optics, PHYS 462 Spring 2025

CRN: 32730, F01

race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact:

UAF Department of Equity and Compliance
1692 Tok Lane, 3rd floor, Constitution Hall, Fairbanks, AK 99775
907-474-7300
uaf-deo@alaska.edu

Additional syllabi statement for courses including off-campus programs and research activities:

University Sponsored Off-Campus Programs and Research Activities

We want you to know that:

1. UA is an AA/EO employer and educational institution and prohibits illegal discrimination against any individual: www.alaska.edu/nondiscrimination.
2. Incidents can be reported to your university's Equity and Compliance office (listed below) or online reporting portal. University of Alaska takes immediate, effective, and appropriate action to respond to reported acts of discrimination and harassment.
3. There are supportive measures available to individuals that may have experienced discrimination.
4. University of Alaska's Board of Regents' Policy & University Regulations (UA BoR P&R) 01.02.020 Nondiscrimination and 01.04 Sex and Gender-Based Discrimination Under Title IX, go to: <http://alaska.edu/bor/policy-regulations/>.
5. UA BoR P&R apply at all university owned or operated sites, university sanctioned events, clinical sites and during all academic or research related travel that are university sponsored.

For further information on your rights and resources [click here](#).

Syllabus for Geometrical and Physical Optics, PHYS 462

Spring 2025

CRN: 32730, F01

Tentative Schedule

Lecture, Reading, and Exam

Date	Topics	Reading Assignment
Jan 13	syllabus, introduction	
15	propagation of light, Fermat's principle	4.1, 4.2
17	electromagnetic approach	4.6
20	AK Civil Rights Day (no classes)	
22	electromagnetic approach	4.6
24	internal reflection	4.7
27	Stokes theorem	4.10
29	thin lenses	5.1-5.2
31	ray tracing, combination of lenses	5.2
Feb. 3	stops	5.3
5	mirrors, ray tracing	5.4
7	fiberoptics	5.6
10	microscope	5.7
12	telescope	5.7
14	eye, correcting lenses	5.7
17	thick lenses and lens systems	6.1
19	analytic ray tracing	6.2
21	optical aberrations	6.3
24	remedies for optical aberration	6.3
26	polarization of light	8.1
28	Midterm I	
Mar. 3	polarizers, analyzers	8.2
5	dichroism, birefringent crystals	8.3, 8.4
7	scattering and polarization	8.5-8.6
10-14	Spring Break (no classes)	

Syllabus for Geometrical and Physical Optics, PHYS 462

Spring 2025

CRN: 32730, F01

17	retarders and circular polarizers	8.7-8.8
19	mathematical description of polarization	8.13
21	mathematical description of polarization cont'd	8.13
24	interference of light	9.1-9.2
26	wavefront-splitting spectrometer	9.3
28	amplitude-splitting spectrometers	9.4
31	multiple-beam interferometers	9.6
Apr. 2	applications of interferometry	9.8
4	diffraction of light	10.1
7	Midterm II	
9	Fraunhofer diffraction	10.2
11	Fraunhofer diffraction continued	10.2
14	Fresnel diffraction	10.3
16	Fresnel diffraction continued	10.3
18	Fourier optics, introduction	11.1
21	Fourier transforms	11.2
23	optical applications	11.3
25	coherence theory, introduction	12.1
28	fringes and coherence	12.2
30	visibility	12.3
May 2 Final Examination 10:45 AM-12:45 PM, Friday, REIC 207		