### CRN: 33413, F01

### MWF 2:15-3:15, REIC 165 (Lecture) R 8:30-11:30 AM, REIC 113 (Laboratory)

Instructor:	Ataur R. Chowdhury	
Office:	REIC 118	
Office Hours:	MW 3:30-5:00 PM	
Contact:	Phone         (907) 474-6109           Fax         (907) 474-6130           Email         archowdhury@alaska.edu	
Prerequisites:	PHYS 213X; PHYS 301; or permission of instructor.	
Text:	Required: Optics by Eugene Hecht, 5th Edition, Addison Wesley.	
Reference Texts:	<ol> <li>Modern Optics by R. Guenther, Wiley.</li> <li>Statistical Optics by J. Goodman, Wiley.</li> </ol>	

**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 be to master 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.

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#### **Course Requirements/ Policies:**

#### Class Attednence/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 both geometrical and physical optics, 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. 5% of your total grade is designated for the participation.

#### 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 you own best effort. Copying homework from someone or from some online sources, including AI resources is not acceptable and will result in a grade of zero for the assignment. Make-up homework, if you miss it for valid reasons, may be arranged with approval from the instructor

#### **Examinations**:

There will be one midterm examination (March 22, Friday, 2;15 PM-3:15 PM) and a final comprehensive examination (May 3, Friday, 1:00 PM-3:00 PM) 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 be comprehensive and will include material covered during the entire semester. 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 register for and attend the lab section and perform all labs. <u>All labs and reports must be completed</u>. 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 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 and the lab policy will be provided in class and will be posted on the blackboard.

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### **Grading Policy:**

25%
5%
20%
20%
<u>30%</u>
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 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 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: <u>https://catalog.uaf.edu/academics-regulations/students-rights-responsibilities/</u>.

**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

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these services can contact the Student Advocacy Director by visiting the ASUAF office or emailing <u>asuaf.office@alaska.edu</u>.

### Student Academic Support:

- Speaking Center (907-474-5470, <u>uaf-speakingcenter@alaska.edu</u>, Gruening 507)
- Writing Center (907-474-5314, <u>uaf-writing-center@alaska.edu</u>, Gruening 8th floor)
- UAF Math Services, <u>uaf-traccloud@alaska.edu</u>, 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 (<u>https://www.uaf.edu/advising/lr/SKM\_364e19011717281.pdf</u>)

### Student Resources:

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

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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: <a href="http://www.alaska.edu/nondiscrimination">www.alaska.edu/nondiscrimination</a>.
- 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.
- 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: <u>http://alaska.edu/bor/policy-regulations/</u>.
- 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 <u>click here</u>.

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### Tentative Schedule

## Lecture, Reading, and Exam

Date	Topics	Reading Assignment
Jan 17	syllabus, introduction	
19	propagation of light, Fermat's principle	4.1, 4.5
22	electromagnetic approach	4.6
24	electromagnetic approach	4.6
26	internal reflection	4.7
29	Stokes theorem	4.10
31	thin lenses	5.1-5.2
Feb 2	ray tracing, combination of lenses	5.2
5	stops	5.3
7	mirrors, ray tracing	5.4
9	fiberoptics	5.6
12	microscope	5.7
14	telescope	5.7
16	eye, correcting lenses	5.7
19	thick lenses and lens systems	6.1
21	analytic ray tracing	6.2
23	optical aberrations	6.3
26	remedies for optical aberration	6.3
28	polarization of light	8.1
Mar 1	polarizers, analyzers	8.2
4	dichroism	8.3
6	birefringent crystals	8.4
8	scattering and polarization	8.5-8.6
11 15 Sm	wing Prools (no classes)	

#### 11-15 Spring Break (no classes)

18	retarders and circular polarizers	8.7-8.8
20	mathematical description of polarization	8.13

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22	Midterm Examination	
25	interference of light	9.1-9.2
27	wavefront-splitting spectrometer	9.3
29	amplitude-splitting spectrometers	9.4
Apr 1	multiple-beam interferometers	9.6
3	applications of interferometry	9.8
5	diffraction of light	10.1
8	Fraunhofer diffraction	10.2
10	Fraunhofer diffraction continued	10.2
12	Fresnel diffraction	10.3
15	Fresnel diffraction continued	10.3
17	Fourier optics, introduction	11.1
19	Fourier transforms	11.2
22	optical applications	11.3
24	coherence theory, introduction	12.1
26	fringes and coherence, visibility	12.2
29	visibility	12.3

May 3 Final Examination 1:00 PM-3:00 PM, Friday, REIC 165