Optics

Physics 360
Gustavus Adolphus College
Spring 2021

Instructor: Tom Huber (huber@gustavus.edu)
Office: Olin 209
Textbook: *Optics*, Eugene Hecht, Fifth Edition (Pearson, ISBN: 0133977226)

Course Policy and Evaluation

1. **Lecture & Recitation**: The class will meet Monday, Wednesday, and Friday for lecture, recitation and homework review. The student is expected to read the assigned chapters in the text **before** coming to class. See the schedule for reading assignments. Lab meets on Wednesday at 1:30 pm in Olin 112.

2. **Ask for Help:** If you have trouble with any aspect of the course, make sure you let me know as early as possible. By being proactive in reaching out for assistance, I can better help you identify strategies for success. If you have any questions about assignment values, attendance, or other course components that are part of course grades, please contact me before the close of the semester grading period. I will have online office hours and welcome the opportunity to talk with you. See **http://physics.gustavus.edu/~huber/schedule.htm**

   The background of the students in the class is varied, some have had E&M and Quantum while others have not. This will present a challenge to all of us. I will try not to assume things which are an integral part of the text or a standard optics course. This means that some material may be a review for some of you, please be patient!

3. **Course Communication:** Students are expected to check their Gustavus email at least once every day to ensure that they receive email messages from their instructor. Assignments and additional resources will be posted on the course Moodle site.

4. **Homework**: Homework problems will be assigned according to chapters in the textbook. ***Important Note: The problem set numbering is for the US 5th Edition; if you are using an International Edition, the problem numbering may be different.*** The due dates for these assignments are listed in Moodle. ***All assignments must be submitted as a single easily readable PDF file into Moodle; other file formats will be accepted at the discretion of the instructor.*** Homework sets should be neat and organized, with the problems appearing in the order assigned. Each student will submit their own assignment, but you are encouraged to discuss and work problems with each other, and your instructor. Copying of homework from classmate ***or any other source*** is considered a violation of the academic honor code. Late homework will be accepted at the discretion of the instructor and with some reduction in credit.

5. **Exams**: There will be three one-hour exams and a two-hour final exam. Students are expected to arrange in advance to take an examination at other than the announced time. Permission to make up a missed exam "after the fact" will be at the discretion

of the instructor and cannot be assumed.

6. **Quizzes/Group Problems**: There will be reading quizzes, in-class quizzes, and group problems throughout the semester based on the assigned reading.

7. **Laboratory:** There will be required laboratory experiments and an Optics Lab Project as described in the laboratory portion of the syllabus. Each group will be expected to keep a good laboratory notebook and turn in one short formal paper on each experiment and for the project.

8. **Attendance:** Students are expected to attend all class sessions as listed on the course calendar, including online synchronous sessions. Students who are required to self-quarantine due to COVID-19 or as the result of a SARS-CoV contact trace are not required to inform the instructor of their reason for missing in-person classes, but should contact the instructor via email giving the duration of their absence. These students will be provided with options that will allow them to be counted as participating remotely. Quarantined students who remain active and on track in an existing online class component (for example, Moodle activities) will be considered as "in attendance".

9. **Preliminary Exam Schedule**
   Friday, February 26, Exam 1 on Chapters 2 – 5
   Wednesday, March 31, Exam 2 on Chapters 6 - 9
   Friday, April 30, Exam 3 on Chapters 10 - 13
   Tuesday, May 11 (10:30-12:30), Comprehensive Final Exam
   If these dates need to be moved, the instructor will let students know at least a week in advance

10. **Evaluation**:

Hour Exams	40%	A	94 - 100	C+	74 – 78
Final Exam	20%	A-	90 - 94	C	70 – 74
Homework & Quizzes	20%	B+	86 - 90	C-	66 - 70
Lab & Project	20%	B	82 - 86	D+	62 – 66
		B-	78 - 82	D	58 – 62

Assignment of final letter grades will also take into account the instructor's subjective evaluation of the student's attendance, initiative, class participation, preparation, and evidence of improvement.

11. **Incompletes:** A grade of incomplete may be awarded at the discretion of the instructor, if requested by the student, under the following conditions: 1) the last day to withdraw has passed, 2) and unforeseen circumstances beyond the student's control (usually restricted to illness or family emergency) preclude completion of the remaining work for the course by the semester deadline. Note that poor planning or having a lot of work to complete at the end of the term are not, in fairness to other students, considered circumstances beyond a student's control. This additional time to

complete coursework may not extend beyond the final day of the following semester, and earlier limits may be set at the discretion of the instructor.

12. **Pass/Fail Grading** Due to the extraordinary stresses, hardships, and exacerbation of inequities imposed by the COVID-19 pandemic, Gustavus faculty have decided to continue to offer students the option of pass/fail grading for the vast majority of courses through Spring 2021. Students must request pass/fail grades by 4:00 p.m. on the final day of classes (Thursday, May 6, for Spring 2021).

13. **Academic Honesty:** Having signed and agreed to abide by the College's Honor Code, students thereby pledge that, in all academic exercises, examinations, papers, and reports, they shall submit their own work. Footnotes, or some other acceptable form of citation must accompany any use of another's words or ideas. In the context of this course, students are expected to collaborate and to discuss their out-of-class assignments. However, submitting under one's own name work that is merely copied from another is a violation of the Honor Code. (Full descriptions of the Academic Honesty Policy and the Honor Code can be found in the Academic Catalog, online at https://gustavus.edu/general_catalog/current/acainfo. For more information about the Honor Code, contact Dean Valerie Banschbach (vbanschbach@gustavus.edu or x7541).

14. **Requesting Accommodations:** Gustavus Adolphus College is committed to ensuring equitable and inclusive learning environments for all students. If you have a disability and anticipate or experience barriers to equal access, please speak with the accessibility resources staff about your needs. A disability may include mental health, attentional, learning, chronic health, sensory, physical, and/or short-term conditions. Students with a documented elevated risk of COVID-19 may also request academic accommodations. When appropriate, staff will guide students and professors in making accommodations to ensure equal access. Accommodations cannot be made retroactively; therefore, to maximize your academic success at Gustavus, please contact them as early as possible. Accessibility resources staff are located in the Academic Support Center (https://gustavus.edu/asc/accessibility/) (x7227). Accessibility Resources Coordinator, Corrie Odland, (codland@gustavus.edu), can provide further information.

15. **Multilingual Student Support:** Some Gusties may have grown up speaking a language (or languages) other than English at home. If so, we refer to you as "multilingual." Your multilingual background is an incredible resource for you, and for our campus, but it can come with some challenges. You can find support through the Center for International and Cultural Education's (https://gustavus.edu/cice/) Multilingual and Intercultural Program Coordinator (MIPC), Pamela Pearson (ppearson@gustavus.edu). Pamela can meet individually for tutoring in writing, consulting about specific assignments, and helping students connect with the College's support systems. If you want help with a specific task (for example, reading word problems on an exam quickly enough or revising grammar in essays), let your professor and Pamela know as soon as possible. In addition, the Writing Center

(https://gustavus.edu/writingcenter/) offers tutoring from peers (some of whom are themselves multilingual) who can help you do your best writing

16. **Mental Wellbeing:** The Gustavus community is committed to and cares about all students. Strained relationships, increased anxiety, alcohol or drug problems, feeling down, difficulty concentrating, and/or lack of motivation may affect a student's academic performance or reduce a student's ability to participate in daily activities. If you or someone you know expresses such mental health concerns or experiences a stressful event that can create barriers to learning, Gustavus services are available to assist you, and include online options. You can learn more about the broad range of confidential health services available on campus at https://gustavus.edu/counseling/ and https://gustavus.edu/deanofstudents/services/.

17. **Title IX: Sexual Misconduct Prevention and Resources:** Gustavus Adolphus College recognizes the dignity of all individuals and promotes respect for all people. As such, we are committed to providing an environment free of all forms of discrimination including sexual and gender-based discrimination, harassment, and violence like sexual assault, domestic violence, dating violence, and stalking. If you (or someone you know) has experienced or is experiencing these types of behaviors, know that you are not alone. Resources and support are available; you can learn more online at https://gustavus.edu/titleix/.

    Please know that if you choose to confide in me, I am required by the College to report to the Title IX Coordinator, because Gustavus and I want to be sure you are connected with all the support the College can offer. Although it is encouraged, you are not required to respond to outreach from the College if you do not want to. You may speak to someone confidentially by contacting the Sexual Assault Response Team (SART/CADA), Chaplains, Counseling Center, or Health Service staff; conversations with these individuals can be kept strictly confidential. SART/CADA can be reached 24 hours a day at 507-933-6868. You can also make a report yourself, including an anonymous report, through the form at https://gustavus.edu/titleix/.

18. **Masking:** It is the policy of Gustavus Adolphus College that all students must abide by rules and standards designed to protect the community. During the Spring 2021 semester, policies set by the Gustavus COVID-19 Response Plan and the ROAR Pledge require that fitted face coverings or face masks be worn in public spaces within buildings on campus at all times, this includes academic buildings and classrooms at all times. ***In this course, students are required to cover both nose and mouth with a mask!*** Wearing an appropriate face covering protects oneself, other students and community members. For this reason, refusal to wear a fitted face covering is considered disruptive to normal classroom activities, and any student who refuses to wear or put on ("don") a mask will be required to leave the classroom immediately. Refusal to comply with such a request will be handled through the College student disciplinary sanction process and will be reported to the Office of Student Life.

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- In this class, upon first offense, I will ask you to leave the classroom to go and retrieve a mask. Upon retrieval, you will be allowed to come back into the classroom.
- Upon second offense, I will ask you to leave the classroom and you will not be invited back on that day. You will receive a score of zero for class attendance, participation and the daily class activity.
- Upon the third offense, I will ask you to leave the classroom and you will lose all of the participation and attendance points for the semester.
- Upon the fourth offense, I will ask you to leave the classroom and you will fail the class.

Preliminary Schedule of Course Coverage

Week Beginning	Chapter	Title
February 1	Chapters 2 & 3	Wave Motion & Electromagnetic Theory, Photons, and Light
February 8	Chapters 3 & 4	E&M Theory and The Propagation Of Light
February 15	Chapters 4 & 5	The Propagation Of Light & Geometrical Optics - Paraxial Theory
February 22	Chapter 5 & 6	Geometrical Optics-Paraxial Theory & More On Geometrical Optics
Feb 26	***** Exam 1 on Chapters 2 - 5 *****	
March 1	Chapter 7	The Superposition of Waves
March 8	Chapter 8	Polarization
March 15	Chapter 8 & 9	Polarization and Interference
March 22	Chapter 9	Interference
March 29	Chapter 10	Diffraction
March 31	***** Exam 2 on Chapters 6 - 9 *****	
April 5	Chapter 10 & 11	Diffraction and Fourier Optics
April 12	Chapter 11	Fourier Optics
April 19	Chapters 12 & 13	Applications
April 26	Chapters 12 & 13	Applications
April 30	***** Exam 3 on Chapters 10 - 13 *****	
May 3	Presentations and Review	
Tues, May 11 (10:30-12:30)	***** Comprehensive Final Exam *****	

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LABORATORY

INTRODUCTION:

You are a research physicist during the 21st century. Your job is to conduct experiments, make discoveries, and publish results. You hope to become famous and win a Nobel Prize before the age of thirty, so the quality of your publications is very important. The results of your research are to be published in Optics Letters. As the name implies this journal accepts results published in "scientific letter" style (see attached example). You are to publish your results in Optics Letters and orally defend your experimental results in 10 minute scientific presentations (see attachment). Good luck making history!

INSTRUCTOR'S NOTES:

Philosophy of Reports - I want you to take your role as a research physicist seriously! I am the editor of the journal in which you are trying to get your papers published. Whether or not your papers are accepted for publication (and your lab grade) depend on how well the paper is written and the quality of the scientific evidence you present to support your findings. You must convince me that your results are real and not just experimental noise!

Freedom - This method of conducting a laboratory has been chosen to give you considerable freedom in the planning, execution, and presentation of experiments. I wanted to avoid "cookbook labs". You decide what to present or include in your paper and what not to. One laboratory/research notebook is to be kept by each group - it will be collected for grading at midterm and at the end of the semester. Full points will be given for an Experimental Modern acceptable notebook.

Group Size - You are to work in groups of two. One joint paper per group.

Safety - Observe safety precautions at all times. You will be taught appropriate laboratory safety procedures the first day of lab.

Equipment - The equipment is expensive and in short supply, so I ask you to treat it with appropriate respect. You will be taught correct handling procedures. Each group will be issued an "optics tool kit" which will be inventoried at the beginning and end of the course. It is your responsibility to care for and keep track of all equipment and optical components in your kit.

Final Project - Each group will do a laboratory project during the final weeks of the semester. The results of this project will be presented orally and submitted in letter format.

Described below are the two methods that you will use to present your experimental results.

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I. Scientific Letter Format - The scientific letter style of presenting experimental results is a short paper used to announce significant new findings or discoveries (see example which follows). The paper should be no longer than three typed pages or its equivalent and should contain the following items. The paper should have a title, statement of authorship, abstract, body, and a reference list. The abstract is a brief summary statement about what was done and the significant results that were obtained. The body of the paper should contain an introductory paragraph that places the work in context and states why it is important. Next the experimental setup (no procedure information), results, data analysis, and theory are described. You are trying to convince the reader that you know what you are talking about. Include anything that you feel supports your conclusions, for example, data tables, diagrams, graphs with captions, and equations. Finally, the body of the text should include a concluding paragraph which restates the most important results or findings. Any references used should then be listed. All figures should have complete captions so that the reader can understand what is being shown without referring back to the main text.

II. Oral Presentation of Experimental Results - Due to the large number of scientists working today a brief oral presentation style has been developed, called "the 10 minute talk". This is an oral presentation in which the scientist is given 10 minutes to state his or her case and the audience is then given 5 minutes for questions. The presentations usually include very short text, graphs, tables, and equations as appropriate. These talks are usually given using overhead transparencies. Practice your talk before giving it to the class since ten minutes goes bye very quickly and you will therefore only have time to include the most essential things (8 to 12 transparencies is usually appropriate).

Preliminary Laboratory Schedule

February 3	LABORATORY I	FRED: Introduction to Optical Modeling
February 10	LABORATORY II	Introduction to Optics Lab
February 17 & 24	LABORATORY III	Waves At An Interface
March 3	LABORATORY IV	Superposition of Waves
March 10 & 17	LABORATORY V	Polarization
March 24 & 31	LABORATORY VI	Interference
April 7	LABORATORY VII	Diffraction
********<u>March 31</u>	<u>Project Proposal Due</u>	<u>One Page</u> ********
Remainder of semester	PROJECT	Student's Choice