PHYSICS 411L/611L, ECE 411L/611L
OPTICS FOR SCIENTISTS AND ENGINEERS LABORATORY
Syllabus, Fall Semester 2020

Laboratory: <mark>T 3:30-5:50 or W 3:00-5:20</mark>   **Room:** South Engineering 112
Semester Credit Hours: 1

Instructors:	Department	Office:	Phone:
Dr. Andrew B. Croll	Physics	South Engineering 212B	413-320-3810
		Andrew.Croll@ndsu.edu	
Dr. Ivan T. Lima Jr.	Electrical & Computer Engineering	101-E E.E. Bldg	231-6728
		Ivan.Lima@ndsu.edu	
Dr. David A. Rogers	Electrical & Computer Engineering	101-J E.E. Bldg	231-7216
		David.Rogers@ndsu.edu	

Office Hours: (Dr. Croll) 9:00-12:00 M, **Zoom**
Meeting ID: 941 1650 9880
Passcode: 277338

Reference Text: *Optics* (Fifth Edition) by Eugene Hecht

Physics/ECE 411L Prerequisite: Physics 252, University Physics II
Physics/ECE 611L Prerequisite: Physics 252, University Physics II or equivalent
Corequisite: Physics 411/611 or ECE 411/611

Course Objective
The goal of this course is to provide students with the fundamentals necessary to enable them to successfully apply optics in their respective disciplines. This will be accomplished through hands-on use of state-of-the-art equipment in conjunction with classroom discussions in the corequisite lecture course to experience and understand the most important concepts and phenomena of optics.

Classroom Expectations

According to NDSU Policy 333 (www.ndsu.edu/fileadmin/policy/333.pdf), attendance in classes is expected. We can make some accommodations for missed lab due to COVID, but this is not a Hyflex class, it is in person only. If you feel at risk, contact Dr. Croll to discuss options.

Veterans and student service members with special circumstances or who are activated are encouraged to notify the instructor as soon as possible and are encouraged to provide Activation Orders.

Attendance at laboratories is mandatory unless excused for a valid University approved reason. **Do not attend if you are ill.** Excused absences must be made-up and zero credit will be awarded for unexcused absences.

Composition of Final Course Grade
The final grade will be determined as follows:

Updated 8/10/2016

Ten basic labs	70%
Project	30%

Graduate students will be graded separately and will be expected to have a more comprehensive understanding of the material. A total average of 89.5% of the possible points or more ensures an A, 75.5 to 89.4% ensures a B, 59.5 to 75.4% ensures a C, 49.5 to 59.4 ensures a D and below 49.5 will be an F. Depending on the class average, curving may be applied to grades; however the **lowest** passing final grade (C or higher) in the course will always be 50% or higher.

Americans with Disabilities Act for Students with Special Needs

Any students with disabilities or other special needs, who need special accommodations in this course, are invited to share these concerns or requests with the instructor and contact the Disability Services Office (www.ndsu.edu/disabilityservices) as soon as possible.

Academic Honesty Statement

The academic community is operated on the basis of honesty, integrity, and fair play. NDSU Policy 335: Code of Academic Responsibility and Conduct applies to cases in which cheating, plagiarism, or other academic misconduct have occurred in an instructional context. Students found guilty of academic misconduct are subject to penalties, up to and possibly including suspension and/or expulsion. Student academic misconduct records are maintained by the Office of Registration and Records. Informational resources about academic honesty for students and instructional staff members can be found at www.ndsu.edu/academichonesty.

Laboratory results must represent the work of your two-person lab team.

Course description

This is a 1 semester-credit-hour senior undergraduate/first year graduate level laboratory course with minimum course prerequisites (University Physics II, electricity and magnetism). The corequisite lecture course based on the text *Optics, Fifth Edition*, by Hecht will provide the background required for performing the experiments. Students will be paired to maximize their hands-on experience.

The anticipated schedule is as follows:
> First and third weeks—no lab
> Ten weeks—one three-hour lab per week
> Three weeks—laboratory five-hours per week to work on major-related experiment
> Dead week—students present results—three classroom hours

All students will perform ten experiments to be completed in three-hour blocks. A major experiment related to the student's academic major (engineering, chemistry, physics, etc.) using optics will be selected by groups of three to four students for the last four-week project. Students will present their results to the class during Dead Week and write a research paper on this experiment. Students will be graded in this course on their experimental apparatus and approach and will receive a separate grade in the lecture course based on their paper, their presentation and their explanation of the results.

Lab Notebooks

All students must have a lab notebook, with the pages numbered consecutively, in which all notes and experimental data, including graphs and tables, will be entered. The suggested notebook is Lab Book Large, 43-581, available in the NDSU Bookstore.

Lab Report Preparation

General comments

1. Read the experiment description posted on BlackBoard before coming to lab.
2. Lab reports will be prepared using Microsoft Word (pdf format will not be accepted).
3. Images, plots, etc. will be prepared in MatLab, Excel, or your favorite software and inserted into the Word document. MatLab and Excel are available on the SE112 computers.
4. Lab reports will be submitted using BlackBoard Assignment. Reports are due 1 week after the lab is scheduled to be completed. **Late reports will not be accepted and will result in no credit** (except for exceptional excused delays such as medical or blizzards).
5.

Tentative Laboratory Schedule

Week	Lab Number	Topic
1	No Lab	
2	1	Detection of light
3	No Lab	
4	2	Absorption
5	3	Index of refraction, total internal reflection, and critical angle
6	4	Lenses and simple lens systems
7	5	Preparing optical fibers and fiber optic numerical aperture
8	6	Fiber optic light attenuation
9	7	Single-mode fibers
10	8	Optical polarization
11	9	Interference and diffraction
12	10	Spectrometry
13	Major Project	Optics project related to student's academic major
14	Major Project	Optics project related to student's academic major
15	Major Project	Optics project related to student's academic major
16	Present Results	Attendance is mandatory for all presentations
17	Paper due	Wednesday, December 12 at 1:00 PM

Updated 8/10/2016

Optics Lab Report Rubric

Name

Description

Rubric Detail

Criteria	Levels of Achievement			
	A	**B**	**C**	**D**
Lab notebook	9 to 10 points Information entered neatly in ink. Corrections crossed out with a single line. Notes clearly describe what was done as it was accomplished. Graphics or tables generated by computer neatly taped into notebook.	8 to 8 points Most information is provided. Neatness could use improvement.	7 to 7 points At least one major component is missing or notes are not legible.	6 to 6 points Notes have been copied into notebook. They should be entered directly as you work.
Lab instructions followed	18 to 20 points A clear and correct understanding of the purpose and physics of the experiment is demonstrated.	16 to 17 points Some significant aspect of the experiment or theory is incorrect or missing.	14 to 15 points Only partial understanding of the purpose and physics of the experiment is demonstrated.	12 to 13 points Little understanding of the purpose and physics of the experiment is demonstrated.
Data and images	18 to 20 points Data/images for every measurement are provided. Data/images are clearly presented.	16 to 17 points Data sets are not clearly presented. Images are distorted.	14 to 15 points Data sets are incomplete. Images are missing.	12 to 13 points Data sets/images are inadequate for determining results.
Plotting and fitting data	18 to 20 points Best-fit functions are properly chosen and presented as solid lines in your plots. Experimental points are plotted as individual points on the same graph. Axes and legends are properly labeled. Images include a clear caption.	16 to 17 points Fits are provided but not fully described. Labeling is not complete.	14 to 15 points Labeling and legends are missing.	12 to 13 points Fits are not appropriate for data. Images are mislabeled.
Lab report questions	18 to 20 points Answers are clearly presented.	16 to 17 points Some answers are inconsistent or incorrect for the collected data/images.	14 to 15 points Significant aspects of the experiment and theory are discussed incorrectly.	12 to 13 points Answers are missing.
Composition and grammar	9 to 10 points Prose is clear and in a logical styles. Words are correctly spelled. Punctuation is correct.	8 to 8 points Prose is mostly clear but parts seem out of place or are unsupported. A few misspelled words and/or incorrect punctuation.	7 to 7 points Numerous misspellings and words used inappropriately. Sentences are incomplete.	6 to 6 points Sentences don't make sense.

Major Project Lab Component Rubric

Major Project Lab Component Rubric

Name

Description This rubric is used to grade the portions of the presentation and paper relevant to the 411L/611L lab course.

Rubric Detail

Levels of Achievement

Criteria	A	B	C	D
Selection of topic	**18 to 20 points** Project selected is within the level of scientific difficulty covered in 411/611. Project is ambitious enough to constitute a 3 week project. Equipment is available to complete the project.	**16 to 17 points** Level of difficulty is more appropriate for a 2 week project or parts of the project are not possible due to lack of appropriate equipment.	**14 to 15 points** Level of difficulty is more appropriate for a 1 week project or project is impossible due to poor planning of equipment requirements.	**12 to 13 points** Relation of optics to project is unclear.
Description of Experiment	**18 to 20 points** All experimental details are covered, and all trends and data comparisons are interpreted correctly. A good understanding of results is conveyed. Group displays a good grasp of data and uncertainty analysis techniques.	**16 to 17 points** Important experimental details are covered, but some minor details missing. Most results have been correctly interpreted and discussed. Group has some familiarity –but not facility– with data and uncertainty analysis techniques.	**14 to 15 points** Missing important experimental details, but some results have been correctly interpreted and discussed. Group displays rudimentary understanding of data and uncertainty analysis techniques.	**12 to 13 points** Missing several important experimental details. Very incomplete or incorrect interpretation of trends and comparison of data. Group displays no understanding of data and uncertainty analysis techniques.
Data	**18 to 20 points** Data for every measurement are provided. Data are clearly presented.	**16 to 17 points** Data sets are not clearly presented.	**14 to 15 points** Data sets are incomplete.	**12 to 13 points** Data sets are inadequate for determining results.
Plotting and fitting data	**18 to 20 points** Best-fit functions are properly chosen and presented as solid lines in your plots. Experimental points are plotted on the same graph. Axes and legends are properly labeled.	**16 to 17 points** Fits are provided but not fully described. Labeling is not complete.	**14 to 15 points** Labeling and legends are missing.	**12 to 13 points** Fits are not appropriate for data.
Results	**18 to 20 points** Results found and conclusions reached are clearly presented.	**16 to 17 points** Some conclusions are inconsistent or incorrect for the collected data.	**14 to 15 points** Significant aspects of the experiment and theory are discussed incorrectly.	**12 to 13 points** Discussion of results is missing.