

Optics and Photonics Syllabus

Department of Physics and Atmospheric Science

PHYC 3540 Fall 2023

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Course Instructor(s)

Name	Email	Office Hours
Chongyin Yang	c.yang@dal.ca	Monday & Wednesday, 2:30 pm - 3:30 pm, or by appointment (email), Dunn 224

Course Description

Topics in physical and geometrical optics will be covered. Selected applications will be presented in certain areas of photonics, including micro-optic sensors, semiconductor lasers and detectors, optical waveguides and fibres, optical signal processing and telecommunications.

It is expected that students are familiar with the mathematics of complex numbers and simple ODE/PDE analysis.

Course Prerequisites

- PHYC 2150 - Physics Tools: Experiment and PHYC 2510 - Electricity and Magnetism and MATH 2002 - Intermediate Calculus II, or
- Permission of instructor

Student Resources

There will be office hours on Monday & Wednesday, 2:30 pm - 3:30 pm, or by appointment (email) in Dunn 224.

Course Structure

Course Delivery

In-person

Lectures

Monday & Wednesday, 1:05 pm - 2:25 pm, Life Sciences Centre - COMMON AREA C216 (Sep 06, 2023 - Dec 07, 2023)

Course Materials

Textbook: Introduction to Optics, by F. L. Pedrotti, L. M. Pedrotti, L. S. Pedrotti, 3rd Edition.

- Hard copy available online for approximately \$76
- PDF version also widely available

Assessment

Assignments

- There will be 6 assignments throughout the term.
- Each has a weight of 10% of final grade.
- Due date will be announced with each assignment.

Mid-term Exam

- There will be one open-book midterm exam.
- Mid-term exam has a weight of 15% of final grade.
- It will be handed out after the class where we finished “Geometric Optics” section and brought back to Dr Yang in the next class.

Final exam

- There will be one open-book final exam.
- The final exam has a weight of 25% of final grade.
- The final exam will be scheduled by the registrar and held during the scheduled exam period.

Conversion of numerical grades to final letter grades follows the

[Dalhousie Grade Scale](#)

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies on Missed or Late Academic Requirements

Assignments: The assignments will be handed out in class and the solutions will be submitted on Brightspace. Instructions for how to submit assignments will be provided with the first assignment. Due date will be announced with each assignment. Any assignment submitted for marking after the due date will incur a 10% per day penalty. Any work submitted more than 5 days late will receive a zero. Due date extensions can be granted for valid medical or other reasons. Please email me before the due date, if requesting an extension.

Missed exams: Students with valid excuse must contact Dr. Yang at least one hour prior to the start of the midterm exam to be excused. There will be no makeup midterm exam and the weight of the midterm will be transferred to the final exam. Generally, there will be no makeup for final exam.

Communications: Announcements will be made in class and also via Brightspace.

Course Policies related to Academic Integrity

Students are expected to complete the assignments on their own. Discussions between students to solve assignments problems is encouraged, however the work submitted by each student for grading should be unique. Copying another student's answer is cheating and doing so will result in a mark of zero on the assignment in question.

Learning Objectives

This course is designed to be an introduction to the principles of geometric and physical optics. On successful completion of this course, you will be familiar with:

- the review of the production and measurement of light.
- the theory of geometric optics (mirrors, lenses, prisms, etc) with applications to some instruments.
- some detail physical optics; that is, light as described by Maxwell's equations.
- the propagation of light, properties of electromagnetic waves in vacuum/linear media, group velocity, polarization, coherence, interference, Fourier analysis, interferometry (i.e., Michelson-Morely & Fabry-Perot), diffraction and time permitting, the optics of solids.

Course Content

(1) Production and Measurement of Light

(2) Geometric Optics: Lenses, Stops, Mirrors, Prisms, Optical Systems, Aberration Theory, GRIN lenses

Midterm exam

(3) Propagation of light: Maxwell's equations, waves, polarization, Fresnel's equations for reflection and refraction, critical reflection

(4) Coherence and Interference: Superposition, Fourier analysis, Fourier transform spectroscopy, Multiple Beam interference, Fabry-Perot interferometry

(5) Diffraction: Fraunhofer and Fresnel diffraction, Applications to Fourier transform spectroscopy

And time permitting

(6) Optics of solids: Propagation of light in conducting and dielectric media, reflection of light at the boundary of absorbing media.

Final exam

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: <https://www.dal.ca/about-dal/internationalization.html>

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion,

please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (<https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html>)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: <http://www.dal.ca/cultureofrespect.html>

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner - perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission

of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at:

https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.