The Institute of Optics

Undergraduate Handbook

Fall 2024

Introduction

This Handbook provides a summary of information taken from various University of Rochester publications. It includes program-specific details that are of importance to Optics students and should be read carefully and in its entirety. Policies and procedures that apply to the entire university student body take precedence over the policies and procedures contained in this handbook.

This handbook is updated to reflect the curriculum changes that are effective as of August 2023. Students will follow the curriculum that was in effect at the time when the major or minor was declared.

Requirement for Admission to the Institute of Optics

Students first have the opportunity to declare their Optics or Optical Engineering major during the second semester of their sophomore year.

To be formally admitted to the major students need to satisfy **ALL** of the following requirements:

1. Have an overall grade point average (GPA) of at least 2.0 and not be on probation.
2. Have an **average** GPA of at least a 2.0 in PHYS 121/121P, 122/122P, 123 *or* PHYS 141/142/143 (or comparable courses taken elsewhere, see Transfer Credit on page 4). PHYS 113 is an acceptable substitute for PHYS 121.
3. Have an **average** GPA of at least a 2.0 in MATH 161/162/164 *or* MATH 141/142/143/164 (or comparable courses taken elsewhere, see Transfer Credit section on page 4)
4. Have an **average** GPA of at least 2.0 for all sophomore-level Optics core courses (OPT 241, OPT 201, OPT 261, OPT 202, and OPT 287), with **NO** grade below a C- for any course and no more than **ONE** grade of **C-** in any of these five courses.
5. Have a grade of **C** or better in WRTG 105 (Reason and Writing in The College) or an authorized equivalent.

Students who have not satisfied all of these requirements within four semesters must meet with their faculty advisor to discuss how to apply at a later date. After the Sophomore spring semester, applications are reviewed by the Optics Undergraduate Committee on a case by case basis.

Students may not use the S/F option for any of the above courses.

Students need to declare their major at:
https://secure1.rochester.edu/registrar.edu/registrar/applications/major-minor-declaration.php

Requirements for Graduation

130 credit hours are required for both degrees (OPT and OPE) with a **cumulative GPA of 2.0** or greater in all Optics courses taken at the Institute and an **overall GPA of 2.0** or greater.

In addition, the following requirements must be satisfied:

1. Successful completion of WRTG 105 (Reason and Writing in the College) or an authorized equivalent.
2. Completion of one cluster, with a GPA of 2.0 or better, in either the humanities or social sciences divisions. **A minor in either division usually satisfies this requirement.** See the Undergraduate Program Coordinator for more information.
3. **"Plus One"** is an additional four-credit course that must be taken in the division **not** chosen for the cluster. This is required even if a student declares a minor.
4. **Successful completion** of the MATH 141/142/143/164/165, **or** MATH 161/162/164/165 **or** MATH 171/172/173/**164** sequence with a GPA of 2.0 or better.
5. One semester of introductory chemistry, including the associated lab component. This is commonly satisfied with **CHEM 137, CHEM 131**, or **AP credit.** CHEM 137 is designed as a one-semester course and is preferred over CHEM 131 unless the student intends to take CHEM 132 as well. With a petition, this science requirement may instead be satisfied with BIO 110.
6. Successful completion of PHYS 121/122/123 **or** PHYS 141/142/143. Note: PHYS 121P/113 are accepted substitutes for PHYS 121 and PHYS 122P is a substitute for PHYS 122.
7. Passing grade in each of the following Optics core classes:
    a. OPT 201 Geometrical Optics Lab
    b. OPT 202 Physical Optics Lab
    c. OPT 203 Instrumentation Lab
    d. OPT 204 Sources and Detectors Lab
    e. OPT 211 MATLAB I
    f. OPT 212 MATLAB II
    g. OPT 223 Quantum Theory
    h. OPT 225 Sources and Detectors
    i. OPT 241 Geometrical Optics
    j. OPT 242 Aberrations and Testing
    k. OPT 261 Interference and Diffraction
    l. OPT 262 Electromagnetic Theory
    m. OPT 287 Math Methods for Optics and Physics
    n. OPT 310 Senior Design I (Optical Engineering Majors Only)
    o. OPT 311 Senior Design II (Optical Engineering Majors Only)
    p. OPT 320 Senior Thesis I (Optics Majors Only)
    q. OPT 321 Senior Thesis II (Optics Majors Only)
8. Demonstrated competency in the design and implementation of simple analog and digital electronic circuits. This requirement is satisfied by taking OPT/ECE 210.
9. Completion of twelve credits of technical electives. These electives are intended to form a "technical cluster," either one suggested by the department of one proposed by the student and discussed with the advisor (see "Technical Electives" description below)
10. Completion of WRTG 273 (Communicating Your Professional Identity).

11. Satisfactory/Fail option: Courses with a grade of “S” may **NOT** be used in the major, minor, or cluster requirements. In other words, a student may choose to S/F any course, but after doing so, that course may no longer be used toward major, minor, or cluster requirements unless that grade is uncovered.
12. Taking a course for credit after auditing it is not permitted for any class going towards the optics or optical engineering degree.

Students may not use the S/F option for any of the above courses

Overlap Policy

For students who are seeking to complete more than one major or at least one minor, the following degree overlap rules should be kept in mind:

A. No more than **three** courses may overlap between any two majors.
B. No more than **two** courses may overlap between a major and a minor.

Advising on Course Selection

Program planning begins during the First-Year Orientation and continues throughout a student’s academic career. Each entering student is assigned an academic advisor who helps with program planning and course scheduling during the undergraduate years.

Failure of an Optics or Core Course

As of this writing, the UR Undergraduate Advising Handbook says, “Students who earn an unsatisfactory grade (i.e., C- and below) in a course can repeat that course for a grade as long as they have the dean’s approval through CCAS.” Students are allowed to repeat any Optics course if allowed by current College policy. Students who are attempting to progress to the next Optics course without satisfying course pre-requisites must obtain permission from the course instructor.

In addition, following a core course failure, **the requirement cannot be met by transferring a subsequent course from another institution without the written express permission of the Undergraduate Committee prior to the student taking the course**. A previously failed course that is taken and successfully completed at another institution will **not** change the grade of the course at The Institute, but will allow the student to progress to the next level.

Transferring Courses

Students may wish to transfer in a course from another university to meet a requirement. Those seeking a transfer course must complete a course approval form prior to registering for the course. Students who fail to get the proper permissions will risk not getting the course approved, and will be unable to transfer it. Approved courses that are completed with a grade of "C" or better will transfer.

Clusters

Students must complete the foundation/distribution requirements by completing one cluster in either the humanities or the social sciences. Students may also complete a minor or additional major in the humanities or the social sciences **in lieu of a cluster.** Those who do this are still required to complete the "Plus One" requirement.

The Plus One course is required and must be from the humanities or social science division **not** chosen for the cluster.

Technical Elective "Cluster"

Technical Elective courses should relate to the student's academic/professional goals and should be discussed with the student's academic advisor. **These courses need to be STEM classes at or above the 200-level.** A minimum of 12 credits are required. The goal is to choose courses that form a coherent Cluster-like experience for the student. Clusters can be based upon department-suggested tracks or proposed by the student with advisor's approval. A student's plan for meeting the technical elective requirement is explicitly discussed each semester by the advisor.

It is the student's responsibility to check semester schedules to know when or if a course will be offered and to check the course descriptions for pre-requisites. All planned electives must be pre-approved but the student's academic advisor before the student registers for the course.

Definition of Senior Thesis (For BS in Optics Degree)

The senior thesis is a scholarly project that includes background analysis of a topic and an element of original research. The thesis can be Optics-specific (experimental and/or theoretical), or it may be cross-disciplinary (e.g. a historical or philosophical analysis of Optics, a pedagogical activity, or an investigation that intersects with other science or engineering disciplines).

The activities may have begun prior to the senior year (as part of employment or scholarly activity in a research group), but will be significantly enriched in breadth and depth as part of the senior thesis. OPT 320 focuses on background research, formulation the question, assembling a bibliography, and establishing a research plan. OPT 321 focuses on completing the research and writing.

Students should be in close contact with both their thesis advisor and their OPT 320/321 instructor during their senior year, so that they may carefully consider and integrate their suggestions. The

thesis will be presented in a public format prior to graduation, typically around the time of Senior Design Day.

Optics Courses and Pre-requisites

The following table includes the pre-requisites (where applicable) for Optics courses. Before enrolling in any Optics course, students ***must have successfully completed all designated pre-requisites***. These requirements are to ensure that students are well-prepared to succeed in all of their courses, as well as to stay on track with their graduation plan.

Take note: Students who try to circumvent the pre-requisite policy independently (i.e. without their advisor's knowledge) are considered to be in violation of the honor code, and are subject to the consequences of academic dishonesty.

Core Courses

Course ID	Pre-requisites
OPT 101	None
OPT 201	None
OPT 202	OPT 201 (or instructor permission)
OPT 203	OPT 202 (or instructor permission)
OPT 204	OPT 203 (or instructor permission)
OPT 211	None
OPT 212	OPT 211
OPT 223	PHYS 123/143, OPT 262
OPT 225	PHYS 123, OPT 241, OPT 261
OPT 241	MATH 161, MATH 162, PHYS 121 (or MATH 141, 142, 143, and PHYS 113), PHYS 122 and MATH 164 taken concurrently
OPT 242	OPT 241, OPT 261
OPT 261	MATH 164 (can be taken concurrently w/instructor permission), PHYS 122/142
OPT 262	MATH 164, MATH 165 (can be taken concurrently w/instructor permission), PHYS 122/142
OPT 210	MATH 165, PHYS 122 (can be taken concurrently)
OPT 310/320	Optics senior standing
OPT 311/321	Optics senior standing

Non-Core Courses

OPT 145	EAS 141 (or instructor permission)
OPT 146	EAS 141 (or instructor permission)
OPT 147	EAS 141 (or instructor permission)
OPT 214	OPT 241
OPT 222	OPT 211, Linear Algebra
OPT 244	OPT 241, OPT 242
OPT 246	OPT 262
OPT 247	OPT 246

Information for Transfer Students

Students who transfer into the Optics major as a junior either from another major within the university or from another institution sometimes find it difficult to complete the Optics degree requirements in only two additional years. The best course of action for any student depends on the details of the student's educational background and should be discussed with the Undergraduate Program Coordinator and/or the student's academic advisor.

Add/Drop

Important note: Lattimore staff will not process add/drop forms that are not signed by an advisor and/or by the Undergraduate Program Coordinator. Email approval in lieu of physical signature is acceptable.

Changes can be made to the student's course schedule online shortly after registration and through the second week of the semester. Beginning with the third week of the semester, Add/Drop forms must be used. For students in the Hajim School of Engineering and Applied Sciences, courses may be dropped through the fourth week of classes by notifying the instructor (although instructor permission is not required) and obtaining the academic advisor's signature, the Undergraduate Program Coordinator's signature and the Associate Dean's (or a surrogate's) signature. **Courses dropped before the end of the fourth week of the semester will be deleted from the transcript and the advising record.**

From the fourth through the eleventh week of classes, students may withdraw from a course by using an Add/Drop form and follow the above procedure. Course withdrawals will appear on the advising record with a grade of "W."

Students wishing to carry fewer than 14 credits (underload) must meet with an advisor in the Dean's Office (Lattimore 301). Full-time students who drop below twelve credits will be sent a warning letter at the end of the semester. **International students who wish to drop below twelve credits are not permitted to do so due to visa implications until the second semester of their senior year.**

Students wishing to carry 20 credits must have a cumulative GPA of at least a 2.0 and the previous semester GPA must be at least a 3.0. Students wanting to carry 21-24 credits must have a cumulative GPA of at least a 2.0 and the previous semester GPA must be at least a 3.4. Students will not be permitted to take more than 24 credits in a semester.

Departmental Awards

To be considered eligible for departmental awards, students must complete an academic honesty waiver form available as an Appendix to this handbook) and return it to Wilmot 106A.

Academic Honesty

Optics students are to be held accountable to the same academic honesty policies and procedures that are applicable University-wide. The enforcement of the honor code is very strict, and students found to be in violation **WILL** face penalties. It is the responsibility of every student to thoroughly read, understand, and to adhere to the academic honesty policies of the university.

The full policy can be accessed here: https://www.rochester.edu/college/honesty/undergraduates.html

Exceptional Circumstances

Occasionally, scheduling conflict or program changes prohibit a student from completing an intended cluster, or a student is unable to complete requirements for the degree as laid out in the University Bulletin. Extenuating circumstances may merit waiving certain requirements or reviewing alternatives that will enable the student to obtain a degree.

If such circumstances are presented via petition, they will be considered on a case-by-case basis. The Undergraduate Committee of the Institute of Optics reviews petitions pertaining to the major and departmental requirements. The Administrative Committee of the College reviews petitions relating to College requirements. Petition forms are available from the Undergraduate Program Coordinator and in this handbook.

Undergraduate Committee

The Undergraduate Committee is responsible for Optics curriculum content and the policies and procedures found in this handbook. The Undergraduate Committee meets approximately once per month during the academic year and is made up of the following:

Prof. Andrew Berger	Goergen 405, 3-4724	andrew.berger@rochester.edu
Prof. Julie Bentley	Goergen 507, 3-1687	bentley@optics.rochester.edu
Prof. Jim Zavislan	Goergen 414, 5-9819	zavislan@optics.rochester.edu
Prof. Brian Kruschwitz	3-5104	bkru@lle.rochester.edu
Prof. Will Renninger	Wilmot 214, 6-3709	william.renninger@rochester.edu
Ed Herger	Wilmot 533, 5-7762	edward.herger@rochester.edu

The primary administrative point of contact for committee matters is the Undergraduate Program Coordinator:

Cynthia Daher	Wilmot 106A, 5-7764	cdaher@ur.rochester.edu

Internships, Co-Ops, and Paid Research

Students are highly encouraged to participate in summer internships throughout their time at the Institute. This is generally done through the Industrial Associates Program or via Handshake, but may be obtained through other means. Internships generally start after classes end and last most of the summer.

Students are welcome to participate in the Hajim Industry Practicum, which is like an extended internship. This is completed during the second semester junior year and summer or summer and first semester senior year. See the Undergraduate Program Coordinator for more information.

There are many opportunities to work with faculty on research projects throughout a student's undergraduate years. For students who are interested, they should seek out the faculty websites and conduct their own research into the faculty projects. Once they find work they are interested in the student should set up time to meet with the professor and learn more about the project and any positions that may be available. To be on payroll you must reside in New York and have an up to date I-9 on file with the University. If you do not meet these criteria, it is possible to work for academic credit. **Note: most faculty prefer students to have already completed OPT 211 prior to starting research.**

Students can work as Teaching Assistants (TA). They can choose to work for pay **OR** credit. Please note that the credit will count towards the 130-credit minimum for graduation and effect their GPA but

will not satisfy any optics requirements. Students are permitted to TA for credit for a up to four cumulative credits during their undergraduate years. Anything beyond that they will be required to be on payroll if they qualify or will not be permitted to work as a TA. **Students must have the instructor's permission to TA the course they want to assist with prior to hiring**.

Take Five Scholars Program

The Take 5 program provides an additional, tuition free, semester or year for students to pursue other coursework that they would not otherwise have had a chance to take due to their major requirements. All information about the program and the application process is available through Blackboard in students Class Year Announcements module.

Study Abroad

The Institute of Optics highly encourages its students to take advantage of the university's study abroad program. The study abroad option is available for juniors, first-semester seniors, and select sophomores. Interested students should consult their advisor to fully understand the options for, and the implications of, studying abroad.

Appendix 1: Optics Technical Electives

Students can think of the requirement as a "cluster." The goal is to study an area that is of interest, but not part of the core requirements. Twelve technical elective credits are required, which is usually completed with three four credit courses. **Suggested** technical themes are listed below. The combinations listed are not a mandatory sequence of technical electives; they serve as a starting point for students considering combinations.

Biomedical Optics	Optics + Math	Lens Design	Photonic Materials/ Devices	Optics & Physics	Lab Special	Lasers and Photonic	Optomechanics
OPT 241*	OPT 287*	OPT 241*	OPT 225*	OPT 223*	OPT 204*	OPT 225*	OPT 242*
OPT 248	MATH 2XX	OPT 243	ME 280	PHYS 235	OPT 253	OPT 465	ME 226
BME 272	MATH 2XX	OPT 244	OPT 421	PHYS 227	PHYS 243W	OPT 468	OPT 232
BME 270	MATH 2XX	OPT 246	OPT 246	PHYS 246	OPT 254	OPT 466	OPT 432
		OPT 247					

Any four-credit 200-level STEM course may be counted as a technical elective with faculty advisor approval.

As noted earlier in this handbook, a student's technical electives should either conform to one of the suggested themes listed above, or should be proposed by the student in consultation with the academic advisor. The student's plan will be discussed by the advisor each semester during course selection. The courses will be declared on the Major Declaration Form.

Note: Any graduate courses used as Technical Electives can **NOT** be used for graduate school at The Institute of Optics.

*Core courses

Appendix 2: Core Courses at a Glance

CHM 131/137*	Chemistry for Engineers (5/4 credits)
OPT 211	MATLAB (2 credits)
OPT 212	MATLAB (2 credits)
OPT /ECE 210	Circuit Analysis for System Thinking (4 credits)
MATH 161**	Calculus I (4 credits)
MATH 162**	Calculus II (4 credits)
MATH 164**	Multidimensional Calculus (4 credits)
MATH 165	Linear Algebra with Differential Equations (4 credits)
OPT 201	Geometrical Optics Laboratory (2 credits)
OPT 202	Physical Optics Laboratory (2 credits)
OPT 203	Instrumentation & Testing Laboratory (2 credits)
OPT 204	Sources and Detectors Laboratory (2 credits)
OPT 223	Quantum Theory of Optics (4 credits)
OPT 225	Sources and Detectors (4 credits)
OPT 241	Geometrical Optics (4 credits)
OPT 242	Aberrations, Interferometers, and Testing (4 credits)
OPT 261	Interference and Diffraction (4 credits)
OPT 262	Electromagnetic Theory (4 credits)
OPT 287	Mathematical Methods for Optics and Physics (4 credits)
OPT 310/311	Senior Design I/II (Engineers only, 4 credits each)
OPT 320/321	Senior Thesis I/II (Optics majors only, 4 credits each)
PHYS 121/121P/113***	Mechanics (4 credits)
PHYS 122/122P***	Electricity and Magnetism (4 credits)
PHYS 123***	Modern Physics
WRTG 105	Reason & Writing in the College (4 credits)
WRTG 273	Communicating your Professional Identity (2 credits)

* BIO 110 may be taken in lieu of CHM 131/137 by petition

** MATH 171, MATH 172, and MATH 173 or MATH 141, MATH 142, MATH 143, and MATH 164

*** Or PHYS 141, PHYS 142, PHYS 143

Appendix 3: Undergraduate Committee Petition Form

UNIVERSITY OF ROCHESTER
SCHOOL OF ENGINEERING AND APPLIED SCIENCES
THE INSTITUTE OF OPTICS

PETITION FOR OPTICS UNDERGRADUATE COMMITTEE

DATE: _____

NAME: _____ ID:_____

CLASS _____ E-MAIL:_____

ADVISOR:_____

I ask that the Optics Undergraduate Committee approve the following petition for the reason(s) noted below:

_____ _____ _____
Applicant Signature Faculty Advisor Signature Date

☐ APPROVED ☐ DENIED ☐ NEED MORE INFORMATION

Comments on reverse side if needed

Appendix 4: Academic Honesty Release Form

I hereby waive my rights of confidentiality in my Board on Academic Honesty records and authorize the Board to report to the person or persons named below any record of violations of the College Academic Honesty Policy for which I have been found responsible.

Completion of this form is voluntary and I understand that this waiver may be revoked at any time by informing the Undergraduate Program Coordinator that I wish to withdraw it.

***Only students with a signed academic honesty release form on file in Wilmot 106 will be eligible for consideration for departmental awards, prizes, and other related honors.**

Print name of student:_____

Signature of student:_____

Date:_____

Board on Academic Honesty report to be released to:

Name: Dustin R. Newman

Title: Undergraduate Program Coordinator

Department: The Institute of Optics

Email: dustin.newman@rochester.edu

Phone: 275-7765

The person or persons to whom this record has been released shall maintain the confidentiality of the information consistent with applicable laws and University policies.

B.S in OPTICAL ENGINEERING (MATH 14X Track)
Sample Schedule
130 Credits is required to graduate

Fall	Credits
MATH 141 (Calculus I)	4
CHEM 137 (Chem. for Engineers)	4
WRTG 105* or cluster course	4
OPT 101 (Recommended)	4
Total Credits	16

Spring	Credits
MATH 142 Calculus II)	4
PHYS 113 (General Physics I)	4
WRTG 105* or cluster course	4
OPT 211 (MATLAB)	2
Total Credits	14

Summer	Credits
MATH 143 (Calculus III)	4

Fall	Credits
OPT 241 (Geometrical Optics)	4
OPT 201 (Geometrical Optics Lab)	2
MATH 164 (Multidimensional Calculus)	4
PHYS 122 (Electricity and Magnetism)	4
Choose: cluster/tech/free/plus one	4
Total Credits	18

Spring	Credits
OPT 261 (Interference and Diffraction)	4
OPT 202 (Physical Optics Lab)	2
OPT 287 (Math Methods)	4
PHYS 123 (Waves and Modern Physics)	4
Choose: cluster/tech/free/plus one	4
Total Credits	18

Fall	Credits
OPT 242 (Aberrations and Testing)	4
OPT 203 (Aberrations and Testing Lab)	2
OPT 262 (Electromagnetic Theory)	4
MATH 165 (Linear Algebra w/ Diff. Eq.)	4
OPT 212 (MATLAB)	2
Total Credits	16

Spring	Credits
OPT 225 (Sources and Detectors)	4
OPT 204 (Sources/Detectors Lab)	2
OPT 210 (Circuits for Engineers)	4
WRTG 273 (Communicating your Prof. ID)	2
OPT 223 (Quantum Theory)	4
Total Credits	16

Fall	Credits
OPT 310/320 (Senior Design/Project)	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Total Credits	16

Spring	Credits
OPT 310/320 (Senior Design/Project)	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Total Credits	16

B.S in OPTICAL ENGINEERING (MATH 16X Track)
Sample Schedule
130 Credits is required to graduate

Fall	Credits
MATH 161 (Calculus I)	4
CHEM 137 (Chem. for Engineers)	4
WRTG 105* or cluster course	4
OPT 101 (Recommended)	4
Total Credits	16

Spring	Credits
MATH 162 Calculus II)	4
PHYS 121 (Mechanics)	4
WRTG 105* or cluster course	4
OPT 211 (MATLAB)	2
Total Credits	14

Fall	Credits
OPT 241 (Geometrical Optics)	4
OPT 201 (Geometrical Optics Lab)	2
MATH 164 (Multidimensional Calculus)	4
PHYS 122 (Electricity and Magnetism)	4
Choose: cluster/tech/free/plus one	4
Total Credits	18

Spring	Credits
OPT 261 (Interference and Diffraction)	4
OPT 202 (Physical Optics Lab)	2
OPT 287 (Math Methods)	4
PHYS 123 (Waves and Modern Physics)	4
Choose: cluster/tech/free/plus one	4
Total Credits	18

Fall	Credits
OPT 242 (Aberrations and Testing)	4
OPT 203 (Aberrations and Testing Lab)	2
OPT 262 (Electromagnetic Theory)	4
MATH 165 (Linear Algebra w/ Diff. Eq.)	4
OPT 212 (MATLAB)	2
Total Credits	16

Spring	Credits
OPT 225 (Sources and Detectors)	4
OPT 204 (Sources/Detectors Lab)	2
OPT 210 (Circuits Analysis)	4
WRTG 273 (Communicating your Prof. ID)	2
OPT 223 (Quantum Theory)	4
Total Credits	16

Fall	Credits
OPT 310 or 320 (Senior Design/Thesis)	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Total Credits	16

Spring	Credits
OPT 311 or 321 (Senior Design/Thesis)	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Choose: cluster/tech/free/plus one	4
Total Credits	16