OPTICAL ENGINEERING

The science of light, once confined to research labs and science fiction novels, has found its way into our everyday lives. The applications of optics can be seen everywhere. A list of more common examples of these applications include laser printers, fiber optic communication, internet switches, fiber optic telephone lines, compact disc players, credit cards bearing holograms, grocery checkout scanners, computers and eye surgery. The field of optics is an enabling technology and is growing at a rapid pace. Optical techniques are found in a wide range of areas such as surveying and construction, measurements of material parameters and deformation, flow measurements, communications, machine vision, laser cutting, drilling and welding, data storage, internet switches, optical computers and sensors etc. Surveys show that there is a growing demand for optical designers/scientists/ engineers every year. Opportunities for graduates in Optical Engineering are available in many industries, including automated inspection, consumer electronics, fiber optic communications, optical instrumentation, laser devices, radar systems, data storage etc.

The Optical Engineering bachelor's degree program is one of the few in the country. This program provides a firm foundation for those interested in continuing thier studies in optics at the graduate level, as well as for those going into industry. The curriculum was developed by the faculty with input from industrial representatives as well as from renowned national and international optics educators. Because of the diverse applications of optics, the curriculum contains a mix of courses in physics and mathematics as well as humanities and social sciences. The Optical Engineering program at Rose-Hulman stresses laboratory instruction. We also encourage students to look at options for a double major, especially Optical Engineering with electrical, computer or mechanical engineering.

Optical Engineering graduation data http://www.rose-hulman.edu/media/1262267/oe.pdf

Students majoring in degree programs other than Optical Engineering are eligible to obtain an area minor in Optical Engineering.

The Department of Physics and Optical Engineering also offers an M.S. (Optical Engineering) degree. The masters level degree program complements the B.S. (Optical Engineering) degree program. Highly motivated students may obtain both a B.S. and an M.S. in Optical Engineering in a five-year period. A plan of study for this program must be approved by the end of the student's junior year.

You may view all information regarding Physics and Optical Engineering at our website: https://www.rose-hulman.edu/academics/academic-departments/physics-and-optical-engineering/index.html (https://www.rose-hulman.edu/academics/academic-departments/physics-and-optical-engineering/)

Current Students should visit the POE page (https://rosehulman.sharepoint.com/sites/POE/SitePages/Home.aspx) under the Academics section of My Rose-Hulman for additional information.

Requirements
Optical Engineering

Summary of Graduation Requirements for Optical Engineering

1. All the courses listed above by the number.
2. The program must be approved by the advisor.
3. A technical elective is any RHIT course in biology, biomathematics, chemistry, computer science, engineering, mathematics, or physics

Classes by subjects

Code	Title	Hours
Optics Coursework		50
Physics Coursework		16
Freshmen Physics, Chemistry and Mathematics Coursework		47
Humanities and Social Science (Standard requirement)		36
Electives (8 credits engineering electives, and 12 credits of free electives) [1]		20
Miscellaneous		25
Total Hours		**194**

[1] Cannot include ECE 340 Electromagnetic Fields

Physics Classes

Code	Title	Hours
PH 235	Many-Particle Physics	4
PH 255	Foundations of Modern Physics	4
PH 292	Physical Optics	4
PH 316	Electric & Magnetic Fields	4
Total Hours		**16**

Freshman Physics, Math and Chemistry Classes

Code	Title	Hours
PH 111	Physics I	4
PH 112	Physics II	4
PH 113	Physics III	4
MA 111	Calculus I	5
MA 112	Calculus II	5
MA 113	Calculus III	5
MA 221	Matrix Algebra & Differential Equations I	4
MA 222	Matrix Algebra & Differential Equations II	4
MA 381	Introduction to Probability with Applications to Statistics	4
CHEM 111	General Chemistry I	3
CHEM 111L	General Chemistry I Lab	1
CHEM 113	General Chemistry II	3
CHEM 113L	General Chemistry II Laboratory	1
Total Hours		**47**

Miscellaneous and Engineering Classes

Code	Title	Hours
RHIT 100	Foundations for Rose-Hulman Success	1
EM 104	Graphical Communications	2
ME 123	Computer Programming	4

EM 103	Introduction to Design	2
ES 213	Electrical Systems	3
ES 213L	Electrical Systems Lab	1
Total Hours		**13**

Minor

The course requirements and advisors for Minors in Optical Engineering, Solid State Physics/Materials Science, and Electronics are listed below. Successful completion of a Minor is indicated on the student's grade transcript. A student interested in pursuing a minor should consult with the appropriate advisor.

Plan of Study

Below is a sample plan of study that illustrates one way to achieve the program requirements. Any given student's plan of study may differ based on a variety of factors (e.g., advanced credit, placement exams, adding a minor). Enrolled students will work with their academic advisor; utilize the degree audit/planner to create a specific plan of study.

Course	Title	Hours
Freshman		
Fall		
MA 111	Calculus I	5
PH 111	Physics I	4
PH 111L	Physics I Lab	0
RHIT 100	Foundations for Rose-Hulman Success	1
EM 104	Graphical Communications	2
CHEM 111	General Chemistry I	3
CHEM 111L	General Chemistry I Lab	1
	Hours	**16**
Winter		
PH 112	Physics II	4
PH 112L	Physics II Lab	0
MA 112	Calculus II	5
HUM H190	First-Year Writing Seminar	4
CHEM 113	General Chemistry II	3
CHEM 113L	General Chemistry II Laboratory	1
	Hours	**17**
Spring		
PH 113	Physics III	4
PH 113L	Physics III Lab	0
MA 113	Calculus III	5
ME 123 or CSSE 120	Computer Programming or Introduction to Software Development	4
OE 172	Lasers and Fiber Optics [1]	2
EM 103	Introduction to Design	2
	Hours	**17**
Sophomore		
Fall		
PH 235	Many-Particle Physics	4
PH 292	Physical Optics	4
MA 221	Matrix Algebra & Differential Equations I	4
ES 213	Electrical Systems	3
ES 213L	Electrical Systems Lab	1
	Hours	**16**
Winter		
HSSA Elective		4
PH 255	Foundations of Modern Physics	4
MA 222	Matrix Algebra & Differential Equations II	4
OE 280	Geometrical Optics	4
	Hours	**16**
Spring		
OE 295	Photonic Devices and Systems	4
ECON S151 or ECON S152	Introduction to Microeconomics or Introduction to Macroeconomics	4
MA 381	Introduction to Probability with Applications to Statistics	4
Free Elective		4
	Hours	**16**
Junior		
Fall		
OE 480	Optical System Design	4
OE 395	Optomechanics & Optical Engineering Lab	4
PH 316	Electric & Magnetic Fields	4
HSSA Elective		4
	Hours	**16**
Winter		
OE 392 or OE 360	Linear Optical Systems or Optical Materials	4
ENGL H290	Technical & Professional Communication	4
Free Elective		4
Engineering Elective [2]		4
	Hours	**16**
Spring		
OE 415	Optical Engineering Design I	4
OE 450	Laser Systems & Applications	4
HSSA Elective		4
OE 393	Fiber Optics and Applications	4
	Hours	**16**
Senior		
Fall		
OE 416	Optical Engineering Design II	4
OE 460	Silicon Photonic Devices and Applications	4
PH/OE/EP Elective [3]		4
HSSA Elective		4
	Hours	**16**
Winter		
OE 417	Optical Engineering Design III	4
OE 495	Optical Metrology	4
OE 392 or OE 360	Linear Optical Systems or Optical Materials	4
Engineering Elective [2]		4
	Hours	**16**
Spring		
HSSA Elective		4
HSSA Elective		4
Engineering Elective [2]		4
Free Elective		4
	Hours	**16**
	Total Hours	**194**

Notes

1. If OE 172 Lasers and Fiber Optics is not taken during the freshman or sophomore year, the requirement must be replaced with a 300 or 400-level OE course of at least 2 credits.
2. An engineering elective is any 200, 300,or 400-level course listed as OE, EP, ECE, ME, CE, BE, EM or ES.
3. A PH/OE/EP elective is any 200, 300,or 400-level course listed as OE, EP or PH.

Program Objectives
OE Program Educational Objectives

1. Our graduates will set their career path and advance beyond their entry-level position or progress toward the completion of an advanced degree.
2. Our graduates will make a positive impact on society.
3. Our graduates will behave ethically and act as responsible members of the engineering and science community.
4. Our graduates will continue to develop professionally

Learning Outcomes
OE Student Learning Outcomes

- Outcome 1: An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- Outcome 2: An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- Outcome 3: An ability to communicate effectively with a range of audiences
- Outcome 4: An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- Outcome 5: An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- Outcome 6: An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- Outcome 7: An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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The optical engineering program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the commission's General Criteria and Program Criteria for Optical, Photonic, and Similarly Named Engineering Programs.