PHYSICS

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The Physics program places an emphasis on laboratory courses with a hands-on approach. The students have the opportunity to take a variety of courses in disciplines such as math and chemistry allowing them to tailor their education. The Physics curriculum is flexible enough that one can double major in computer science, mathematics, electrical engineering, and mechanical engineering. National interest in our program has been generated by our basic physics courses that use new methodologies of teaching such as studio format lectures.

We have a wide range of research programs accessible to undergraduates including areas such as: Astronomy, Solid State Devices, Electro-optics, Non-linear Optics, X-ray absorption, Semiconductor Materials and Devices, Magnetics, Chaos, Lasers, Fiber Optics, Holography, Microsensors. In addition, we are very successful in placing our students in summer internship positions with various research facilities such as NASA, Argonne National Laboratory, Sandia National Laboratory, National Radio Astronomy Observatory, and CSPAAR.

Requirements

Physics

Summary of Graduation Requirements for Physics Major

1. Fifty-six (56) of the credits listed below by the number, with one credit in PH 490 .
2. Fourteen credits of physics courses, besides those listed by number.
3. The program must be approved by the advisor.
4. Twenty credits of technical electives of which at least eight must be in courses other than physics courses (cannot include ECE 340).
5. Cross reference for the following courses:
   ECE 340 and ECE 341 for PH 316 and PH 317
   ES 312andES 214for PH 235
6. Twelve credits of free electives (cannot include ECE 340).
7. Thirty-six credits of humanities or social sciences courses. The distribution of these courses must meet the requirements of the Department of Humanities, Social Sciences, and the Arts.
8. A technical elective is any RHIT course at or above 200 level in biology, biomathematics, chemistry, computer science, engineering, mathematics, or physics.
9. A free elective is any course offered at RHIT.

Code	Title	Hours
Physics Course work		56
Physics Electives [1]		14
Chemistry and Mathematics Course work [2]		43
Humanities, Social Sciences, and the Arts (Standard requirement)		36
Technical Electives [3]		20
Free Electives [4]		12
Miscellaneous Courses [5]		11
Total Hours		**192**

[1] Listed below are the PH elective courses, from which a physics major is required to take 11 hours.
[2] Chemistry and Mathematics Course work (43 hours)
[3] Twenty credits of technical electives are required for a physics major, of which at least eight must be in courses other than physics courses (cannot include ECE 340 Electromagnetic Fields).
[4] A physics major may take twelve credit hours of free electives, which may include any offered at RHIT.
[5] Miscellaneous Courses

Listed below are the Physics Core Courses (56 hours):

Code	Title	Hours
PH 111	Physics I	4
PH 112	Physics II	4
PH 113	Physics III	4
PH 200	Career Preparation	1
PH 235	Many-Particle Physics	4
PH 255	Foundations of Modern Physics	4
PH 290	Directed Research	2
or PH 490	Directed Research	
PH 292	Physical Optics	4
PH 314	Theoretical Mechanics I	4
PH 316	Electric & Magnetic Fields	4
PH 317	Electromagnetism	4
PH 325	Adv Physics Laboratory I	4
PH 327	Thermodynamics & Statistical Mechanics	4
PH 401	Introduction to Quantum Mechanics	4
PH 405	Semiconductor Materials & Applications	4
PH 499	Physics Ethics & Communication	1
Total Hours		**56**

Listed below are the Physics Thesis or Capstone Courses (14 hours):

Code	Title	Hours
PH 496	Senior Thesis	2
PH 497	Senior Thesis	4
PH 498	Senior Thesis	2
PH Electives [1]		6
Or		

PH 425	Advanced Physics Lab II	4
PH Electives [1]		10

Note: The Physics thesis option is intended for students who complete a substantive research project in this field. Students wanting to pursue the Senior Thesis option must find a faculty advisor (from the Physics, Optical Engineering and NanoEngineering Faculty) by the Fall Term of their Senior Year. At that time, the thesis topic should be decided and the research plan developed. Students in the thesis option should enroll in Senior Thesis courses for a total number of 8 credit hours over the three-quarter sequence. Students working on a Senior Thesis will write and submit the thesis to the department and give an oral research presentation as part of PH499.

[1] PH elective courses are any courses at or above 200 level with the PH, OE or NE designation that are not named required courses

Chemistry and Math Courses (43 hours):

Code	Title	Hours
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 330	Vector Calculus	4
MA 336	Boundary Value Problems	4
MA 371	Linear Algebra I	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		**43**

Miscellaneous Courses

Code	Title	Hours
RHIT 100	Foundations for Rose-Hulman Success	1
EM 104	Graphical Communications	2
OE 450	Laser Systems & Applications	4
Computing Elective		4
Total Hours		**11**

Second Major in Physics

Listed below are the Physics Second Major Courses (72 hours) :

Code	Title	Hours
PH 111	Physics I	4
PH 112	Physics II	4
PH 113	Physics III	4
PH 235	Many-Particle Physics	4
PH 255	Foundations of Modern Physics	4
PH 292	Physical Optics	4
PH 314	Theoretical Mechanics I	4
PH 316	Electric & Magnetic Fields	4
PH 317	Electromagnetism	4
PH 325	Adv Physics Laboratory I	4
PH 327	Thermodynamics & Statistical Mechanics	4
PH 401	Introduction to Quantum Mechanics	4
PH 405	Semiconductor Materials & Applications	4
PH 425	Advanced Physics Lab II	4
OE 450	Laser Systems & Applications	4
PH Electives [1]		12

[1] PH elective courses are any courses at or above 200 level with the PH, OE or NE designation, except for the NE majors, who need to take PH courses for their PH electives.

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		
EM 104	Graphical Communications	2
MA 111	Calculus I	5
PH 111	Physics I	4
HUM H190	First-Year Writing Seminar	4
RHIT 100	Foundations for Rose-Hulman Success	1
	Hours	**16**
Winter		
MA 112	Calculus II	5
CHEM 111	General Chemistry I	3
CHEM 111L	General Chemistry I Lab	1
PH 112	Physics II	4
Computing Elective [1]		4
	Hours	**17**
Spring		
MA 113	Calculus III	5
CHEM 113	General Chemistry II	3
CHEM 113L	General Chemistry II Laboratory	1
PH 113	Physics III	4
HSSA Elective		4
	Hours	**17**
Sophomore		
Fall		
MA 221	Matrix Algebra & Differential Equations I	4
PH 235	Many-Particle Physics	4
PH 292	Physical Optics	4
Free Elective [2]		4
	Hours	**16**
Winter		
MA 222	Matrix Algebra & Differential Equations II	4
PH 200	Career Preparation	1
PH 255	Foundations of Modern Physics	4
HSSA Elective		4
Select one of the following:		4
MA 373	Applied Linear Algebra for Engineers	

MA 371	Linear Algebra I [3]	
	Hours	**17**
Spring		
MA 330	Vector Calculus	4
Tech Elective		4
PH 314	Theoretical Mechanics I	4
HSSA Elective		4
	Hours	**16**
Junior		
Fall		
MA 336	Boundary Value Problems	4
PH 316	Electric & Magnetic Fields	4
Physics Elective		2
HSSA Elective		4
PH 290 or PH 490	Directed Research or Directed Research	1
	Hours	**15**
Winter		
PH 317	Electromagnetism	4
PH 401	Introduction to Quantum Mechanics	4
ENGL H290	Technical & Professional Communication	4
Technical Elective [2]		4
	Hours	**16**
Spring		
OE 450	Laser Systems & Applications	4
PH 325	Adv Physics Laboratory I	4
PH 327	Thermodynamics & Statistical Mechanics	4
HSSA Elective		4
	Hours	**16**
Senior		
Fall		
HSSA Elective		4
PH 405	Semiconductor Materials & Applications	4
Technical Elective [2]		4
Free Elective		4
*For Thesis Track - additionally take PH 496 (see Requirements page for more details on selecting the Thesis Option)		
	Hours	**16**
Winter		
PH 425 or PH 497	Advanced Physics Lab II (for Non-Thesis Track only) or Senior Thesis	4
HSSA Elective		4
Technical Elective [2]		4
Free Elective [2]		4
	Hours	**16**
Spring		
Select one of the following:		4
Physics Elective (for Non-Thesis Track only)		
or PH 498 (Thesis Track)		
Technical Elective [2]		4
PH 499	Physics Ethics & Communication	1
Physics Elective		4
PH 490	Directed Research	1
	Hours	**14**
	Total Hours	**192**

[1] Computing elective: ME 123 Computer Programming or CSSE 120 Introduction to Software Development

[2] Free, Math and technical electives are only suggestions and can change subject to offering. Electives must be approved by PHON advisor.

[3] MA 371 Linear Algebra I (F or S) can be substituted for MA 373 Applied Linear Algebra for Engineers (W)

Learning Outcomes

Physics Student Learning Outcomes

Fundamental Knowledge: Demonstrate a broad working knowledge base in physics.

Problem Solving: Demonstrate competency in applying the skills and knowledge necessary for scientific solutions to mathematical, scientific, and engineering problems.

Experiments: Design and conduct experiments and interpret and analyze acquired data while demonstrating understanding of the underlying scientific theory, method, and process.

Modeling: Formulate questions and produce an appropriate physical model to represent and describe real-world physics problems.

Ethics: Explain professional and ethical responsibility to the field and public and behave with integrity and accountability.

Communication: Communicate effectively, accurately, and succinctly scientific problems and solutions to a range of audiences via appropriate methods.