

B.S. IN APPLIED PHYSICS

<http://www.physics.miami.edu>

Overview

This sequence is available for those intending careers in applied physics. The major is divided into tracks, depending on the student's field of interest. The Physics for the Life Sciences track is designed for premedical students.

Students must complete the core set of courses AND one track in their field of interest. Multiple tracks are allowed with prior authorization from the Department of Physics.

To satisfy the College of Arts and Sciences writing requirement in the discipline, students majoring in Applied Physics should pass at least one writing intensive course within the Physics Department. These are PHY 306, PHY 362, and PHY 506. The requirement can also be fulfilled by passing WRS 233 with a grade of C- or higher.

Core Courses

The core set of courses is required for all tracks and it includes one of the University Physics sequences with two labs (see table below), plus PHY 350, and PHY 360.

Engineering Physics Track

Additional 5 credits in physics at the 300 level or higher, including PHY 340 and one lab, plus 9 credits in Engineering with prior authorization from the Department of Physics.

Computational Physics Track

Additional 5 credits in physics at the 300 level or higher, including PHY 340 and one lab, plus 2 courses from the Computer Science BS core (<http://bulletin.miami.edu/undergraduate-academic-programs/arts-sciences/computer-science/computer-science-bs-students-arts-sciences/>) and a third course in Computer Science with prior authorization from the Department of Physics.

Medical Physics Track

Additional 5 credits in physics at the 300 level or higher, including PHY 351 and one lab, plus BME 265, BME 310, and BME 330 (Note: BIL 150, BIL 151, and CHM 121 are prerequisites for the BME courses).

Physics for the Life Sciences Track

Additional 6 credits in physics at the 300 level or higher, including PHY 321, plus required biology and chemistry courses. In biology, the required courses are BIL 150, BIL 151, BIL 160, BIL 161, BIL 255, and either BIL 360 or BME 265. In chemistry, the students are required to take the three-semester sequence of Chemistry for the Life Sciences (CHM 121, CHM 221, CHM 222) with laboratory (CHM 113, CHM 205, CHM 206).

Chemical Physics Track

Additional 6 credits in physics at the 300 level or higher, including PHY 321, plus CHM 360, CHM 364, CHM 365, CHM 464, and one among CHM 530, CHM 553, or CHM 575.

Marine Science Track

Additional 5 credits in physics at the 300 level or higher, including PHY 321 or PHY 340 and one lab, plus 9 elective credits as follow:

- One computation course between MSC 203, MSC 321, MBE 536, or a CSC course from the Computer Science BS core (<http://bulletin.miami.edu/undergraduate-academic-programs/arts-sciences/computer-science/computer-science-bs-students-arts-sciences/>);
- MSC 401;
- MSC 405;
- Any ATM 300- or 400-level courses (but not ATM306);
- Any OCE or ATM 500-level courses (but not 512 or 522 or 531 or 534).

Curriculum Requirements

Code	Title	Credit Hours
University Physics Sequence		
Choose one of the following options:		10-11
Option 1		

PHY 221	University Physics I	
PHY 222	University Physics II	
PHY 223	University Physics III	
PHY 224	University Physics II Lab	
PHY 225	University Physics III Lab	
Option 2		
PHY 221	University Physics I	
PHY 230	Honors University Physics II-III	
PHY 224	University Physics II Lab	
PHY 225	University Physics III Lab	
Option 3		
PHY 201	University Physics I for the Sciences	
PHY 202	University Physics II for the Sciences	
PHY 106 or PHY 224	College Physics Laboratory I University Physics II Lab	
PHY 108 or PHY 225	College Physics Laboratory II University Physics III Lab	
Option 4		
PHY 211	University Physics I for PRISM	
PHY 212	University Physics II for PRISM	
PHY 106 or PHY 224	College Physics Laboratory I University Physics II Lab	
PHY 108 or PHY 225	College Physics Laboratory II University Physics III Lab	
Core Courses		
PHY 350	Intermediate Electricity and Magnetism	3
PHY 360	Introduction to Modern Physics	3
Track Options		
Choose one of the following tracks:		14-34
Engineering Physics Track		
PHY 340	Classical Mechanics I	
PHY 306 or PHY 506	Intermediate Laboratory Advanced Laboratory	
PHY elective previously approved by the physics advisor		
9 credits in Engineering		
Computational Physics Track		
PHY 340	Classical Mechanics I	
PHY 306 or PHY 506	Intermediate Laboratory Advanced Laboratory	
PHY elective previously approved by the physics advisor		
2 course from the Computer Science BS core		
1 additional Computer Science Course		
Medical Physics Track		
PHY 351	Intermediate Electricity and Magnetism II	
PHY 306 or PHY 506	Intermediate Laboratory Advanced Laboratory	
PHY elective previously approved by the physics advisor		
BME 265	Medical Systems Physiology	
BME 310	Mathematical Analysis in Biomedical Engineering	
BME 330	Foundations of Medical Imaging	
BIL 150	General Biology	
BIL 151	General Biology Laboratory	

CHM 121	Principles of Chemistry	
CHM 221	Introduction to Structure and Dynamics	
Physics for the Life Sciences Track		
PHY 321	Thermodynamics and Kinetic Theory	
3 PHY credits at the 300 level or higher		
BIL 150	General Biology	
BIL 151	General Biology Laboratory	
BIL 160	Evolution and Biodiversity	
BIL 161	Evolution and Biodiversity Laboratory	
BIL 255	Cellular and Molecular Biology	
BIL 360	Comparative Physiology	
or BME 265	Medical Systems Physiology	
CHM 121	Principles of Chemistry	
CHM 221	Introduction to Structure and Dynamics	
CHM 222	Organic Reactions and Synthesis	
CHM 113	Chemistry Laboratory I	
CHM 205	Chemical Dynamics Laboratory	
CHM 206	Organic Reactions and Synthesis Laboratory	
Chemical Physics Track		
PHY 321	Thermodynamics and Kinetic Theory	
3 more credits in Physics at the 300 level or higher		
CHM 360	Physical Chemistry I (Lecture)	
CHM 364	Physical Chemistry (Laboratory I)	
CHM 365	Physical Chemistry II (Lecture)	
CHM 464	Physical Chemistry (Laboratory II)	
CHM 530	Fluorescence Spectroscopy and Microscopy	
or CHM 553	Modern Quantum Chemistry	
or CHM 575	Principles of Nuclear Magnetic Resonance and Multidimensional Spectroscopy	
Marine Science Track (30-31 Credit Hours)		
PHY 340	Classical Mechanics I	
or PHY 321	Thermodynamics and Kinetic Theory	
PHY 306	Intermediate Laboratory	
or PHY 506	Advanced Laboratory	
PHY elective previously approved by the physics advisor		
Marine Science Track Electives (choose from the list below)		
MSC 405	Observing the Ocean	
MSC 401	Ocean Dynamics	
ATM 300- or 400-level courses (not 306)		
OCE or ATM 500-level courses (not 512 or 522 or 531 or 534)		
One Computational course from this list		
MSC 203	Foundations of Computational Marine Science	
MSC 321	Scientific Computing in Marine and Atmospheric Sciences	
MBE 536	Object-Oriented Programming and Agent-Based Modelling	
CSC 315	Introduction to Python for Scientists	
Math Requirement		
MTH 151	Calculus I for Engineers (Fulfills Quantitative Skills Proficiency Requirement)	5
or MTH 161	Calculus I	
or MTH 171	Calculus I	
MTH 162	Calculus II	4
or MTH 172	Calculus II	
MTH 210	Introduction to Linear Algebra	3

MTH 211 or MTH 310	Calculus III Multivariable Calculus	3
MTH 311	Introduction to Ordinary Differential Equations	3
Other Degree Requirements		
CSC 120	Computer Programming I	4
Second Language Proficiency		3-9
UMX 100	The University of Miami Experience	0
General Education Requirements		
Written Communication Skills:		
WRS 105	First-Year Writing I	3
WRS 106 or ENG 106	First-Year Writing II Writing About Literature and Culture	3
Quantitative Skills:		
MTH 151 or MTH 161 or MTH 171	Calculus I for Engineers ^{fulfilled through the major} Calculus I Calculus I	
Areas of Knowledge:		
Arts and Humanities Cognate		9
People and Society Cognate		9
STEM Cognate (9 credits) (fulfilled through the major)		
Electives		41
Total Credit Hours		120

Sample Plans of Study

Engineering Physics Track

Year One		Credit Hours
Fall		
PHY 221	University Physics I	3
MTH 151	Calculus I for Engineers	5
WRS 105	First-Year Writing I	3
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
		Credit Hours
		16
Spring		
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
MTH 162	Calculus II	4
WRS 106 or ENG 106	First-Year Writing II or Writing About Literature and Culture	3
CSC 120	Computer Programming I	4
		Credit Hours
		15
Year Two		
Fall		
PHY 223	University Physics III	3
PHY 225	University Physics III Lab	1
MTH 210	Introduction to Linear Algebra	3
CHM 111	Principles of Chemistry I	3
Language 101		3
Cognate Course		3
		Credit Hours
		16
Spring		
MTH 211	Calculus III	3

CHM 112	Principles of Chemistry II	3
Language 102		3
Cognate Course		3
Elective		3
	Credit Hours	15
Year Three		
Fall		
PHY 360	Introduction to Modern Physics	3
MTH 311	Introduction to Ordinary Differential Equations	3
BME 265	Medical Systems Physiology	3
Language 201		3
Cognate Course		3
	Credit Hours	15
Spring		
PHY 306	Intermediate Laboratory	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
PHY Elective		3
Cognate Course		3
Elective		3
	Credit Hours	13
Year Four		
Fall		
PHY 350	Intermediate Electricity and Magnetism	3
BME 330	Foundations of Medical Imaging	3
Cognate Course		3
Elective		3
Elective		3
	Credit Hours	15
Spring		
PHY 351	Intermediate Electricity and Magnetism II	3
Cognate Course		3
Elective		4
Elective		3
Elective		3
	Credit Hours	16
	Total Credit Hours	121

Computational Physics Track

Year One		
		Credit Hours
Fall		
WRS 105	First-Year Writing I	3
MTH 161	Calculus I	4
CHM 111 or 121	Principles of Chemistry I or Principles of Chemistry	3
CHM 113	Chemistry Laboratory I	1
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
	Credit Hours	16
Spring		
WRS 106	First-Year Writing II	3
MTH 162	Calculus II	4
CHM 112	Principles of Chemistry II	3

CHM 114	Chemistry Laboratory II	1
BIL 160	Evolution and Biodiversity	4
BIL 161	Evolution and Biodiversity Laboratory	1
Credit Hours		16
Year Two		
Fall		
PHY 201	University Physics I for the Sciences	4
PHY 106	College Physics Laboratory I	1
MTH 210	Introduction to Linear Algebra	3
CHM 201 or 222	Organic Chemistry I (Lecture) or Organic Reactions and Synthesis	3-4
CHM 205	Chemical Dynamics Laboratory	1
Cognate Course		3
Credit Hours		15-16
Spring		
PHY 202	University Physics II for the Sciences	4
PHY 106	College Physics Laboratory I	1
MTH 211	Calculus III	3
BIL 255	Cellular and Molecular Biology	3
CSC 120	Computer Programming I	4
Credit Hours		15
Year Three		
Fall		
PHY 360	Introduction to Modern Physics	3
MTH 311	Introduction to Ordinary Differential Equations	3
BIL 360 or BME 265	Comparative Physiology or Medical Systems Physiology	3
Language 101		3
Cognate Course		3
Credit Hours		15
Spring		
PHY 321	Thermodynamics and Kinetic Theory	3
Language 102		3
Cognate Course		3
Cognate Course		3
Elective		3
Credit Hours		15
Year Four		
Fall		
PHY 350	Intermediate Electricity and Magnetism	3
BME 330	Foundations of Medical Imaging	3
Language 201		3
Cognate Course		3
Elective		3
Credit Hours		15
Spring		
PHY Elective		3
Cognate Course		3
Elective		4

Elective	3
Credit Hours	13
Total Credit Hours	120-121

Medical Physics Track

Year One		Credit Hours
Fall		
PHY 221	University Physics I	3
MTH 151	Calculus I for Engineers	5
WRS 105	First-Year Writing I	3
BIL 150	General Biology	4
BIL 151	General Biology Laboratory	1
Credit Hours		16
Spring		
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
MTH 162	Calculus II	4
WRS 106	First-Year Writing II	3
CSC 120	Computer Programming I	4
Credit Hours		15
Year Two		
Fall		
PHY 223	University Physics III	3
PHY 225	University Physics III Lab	1
MTH 210	Introduction to Linear Algebra	3
CHM 111	Principles of Chemistry I	3
Language 101		3
Cognate Course		3
Credit Hours		16
Spring		
MTH 211	Calculus III	3
CHM 112	Principles of Chemistry II	3
Language 102		3
Cognate Course		3
Elective		3
Credit Hours		15
Year Three		
Fall		
PHY 360	Introduction to Modern Physics	3
MTH 311	Introduction to Ordinary Differential Equations	3
BME 265	Medical Systems Physiology	3
Language 201		3
Cognate Course		3
Credit Hours		15
Spring		
PHY 306	Intermediate Laboratory	1
BME 310	Mathematical Analysis in Biomedical Engineering	3
PHY Elective		3
Cognate Course		3
Elective		3
Credit Hours		13

Year Four		
Fall		
PHY 350	Intermediate Electricity and Magnetism	3
BME 330	Foundations of Medical Imaging	3
Cognate Course		3
Elective		3
Elective		3
Credit Hours		15
Spring		
PHY 351	Intermediate Electricity and Magnetism II	3
Cognate Course		3
Elective		4
Elective		3
Elective		3
Credit Hours		16
Total Credit Hours		121

Physics for the Life Sciences Track

Year One			Credit Hours
Fall			
WRS 105	First-Year Writing I		3
MTH 161	Calculus I		4
CHM 111 or 121	Principles of Chemistry I or Principles of Chemistry		3
CHM 113	Chemistry Laboratory I		1
BIL 150	General Biology		4
BIL 151	General Biology Laboratory		1
Credit Hours			16
Spring			
WRS 106	First-Year Writing II		3
MTH 162	Calculus II		4
CHM 112	Principles of Chemistry II		3
CHM 114	Chemistry Laboratory II		1
BIL 160	Evolution and Biodiversity		4
BIL 161	Evolution and Biodiversity Laboratory		1
Credit Hours			16
Year Two			
Fall			
PHY 201	University Physics I for the Sciences		4
PHY 106	College Physics Laboratory I		1
MTH 210	Introduction to Linear Algebra		3
CHM 201 or 222	Organic Chemistry I (Lecture) or Organic Reactions and Synthesis		3-4
CHM 205	Chemical Dynamics Laboratory		1
Cognate Course			3
Credit Hours			15-16
Spring			
PHY 202	University Physics II for the Sciences		4
PHY 106	College Physics Laboratory I		1
MTH 211	Calculus III		3
BIL 255	Cellular and Molecular Biology		3

CSC 120	Computer Programming I	4
Credit Hours		15
Year Three		
Fall		
PHY 360	Introduction to Modern Physics	3
MTH 311	Introduction to Ordinary Differential Equations	3
BIL 360 or BME 265	Comparative Physiology or Medical Systems Physiology	3
Language 101		3
Cognate Course		3
Credit Hours		15
Spring		
PHY 321	Thermodynamics and Kinetic Theory	3
Language 102		3
Cognate Course		3
Cognate Course		3
Elective		3
Credit Hours		15
Year Four		
Fall		
PHY 350	Intermediate Electricity and Magnetism	3
BME 330	Foundations of Medical Imaging	3
Language 201		3
Cognate Course		3
Elective		3
Credit Hours		15
Spring		
PHY Elective		3
Cognate Course		3
Elective		4
Elective		3
Credit Hours		13
Total Credit Hours		120-121

Chemical Physics Track

Code	Title	Credit Hours
Year 1		
Fall		
MTH 161	Calculus I	4
WRS 105	First-Year Writing I	3
CHM 111 or CHM 121	Principles of Chemistry I Principles of Chemistry	3-4
CHM 113	Chemistry Laboratory I	1
Cognate		3
Spring		
MTH 162	Calculus II	4
WRS 106 or ENG 106	First-Year Writing II Writing About Literature and Culture	3
CHM 112	Principles of Chemistry II	3
CHM 114	Chemistry Laboratory II	1
Cognate		3
Year 2		

Fall		
PHY 201	University Physics I for the Sciences	4
PHY 106	College Physics Laboratory I	1
MTH 210	Introduction to Linear Algebra	3
CHM 360	Physical Chemistry I (Lecture)	3
CHM 364	Physical Chemistry (Laboratory I)	1
Cognate		3
Spring		
PHY 202	University Physics II for the Sciences	4
PHY 106	College Physics Laboratory I	1
MTH 211	Calculus III	3
CHM 365	Physical Chemistry II (Lecture)	3
CHM 464	Physical Chemistry (Laboratory II)	1
Language 101		3
Year 3		
Fall		
PHY 360	Introduction to Modern Physics	3
MTH 311	Introduction to Ordinary Differential Equations	3
CHM 553	Modern Quantum Chemistry	3
or CHM 530	Fluorescence Spectroscopy and Microscopy	
or CHM 575	Principles of Nuclear Magnetic Resonance and Multidimensional Spectroscopy	
Language 102		3
Cognate		3
Spring		
PHY 321	Thermodynamics and Kinetic Theory	3
Language 201		3
Cognate		3
Electives		6
Year 4		
Fall		
PHY 350	Intermediate Electricity and Magnetism	3
Cognate		3
Electives		10
Spring		
PHY elective		3
Electives		13
Total Credit Hours		120-121

Marine Science Track

Year One		Credit Hours
Fall		
PHY 221	University Physics I	3
MTH 151	Calculus I for Engineers	5
WRS 105	First-Year Writing I	3
CSC 120	Computer Programming I	4
	Credit Hours	15
Spring		
PHY 222	University Physics II	3
PHY 224	University Physics II Lab	1
PHY 315	Mathematical Tools for Physics	3
MTH 162	Calculus II	4

WRS 106	First-Year Writing II	3
Credit Hours		14
Year Two		
Fall		
PHY 223	University Physics III	3
PHY 225	University Physics III Lab	1
MTH 210	Introduction to Linear Algebra	3
Marine Science Course from Approved List		3
Language Course		3
Cognate Course		3
Credit Hours		16
Spring		
PHY 340 or 321	Classical Mechanics I or Thermodynamics and Kinetic Theory	3
MTH 211	Calculus III	3
Marine Science Course from Approved List		3
Language Course		3
Cognate Course		3
Credit Hours		15
Year Three		
Fall		
PHY 360	Introduction to Modern Physics	3
MTH 311	Introduction to Ordinary Differential Equations	3
Marine Science Course from Approved List		3
Language Course		3
Cognate Course		3
Credit Hours		15
Spring		
PHY 306	Intermediate Laboratory	1
PHY Elective		3
Cognate Course		3
Electives		9
Credit Hours		16
Year Four		
Fall		
PHY 350	Intermediate Electricity and Magnetism	3
Cognate Course		3
Electives		9
Credit Hours		15
Spring		
Cognate Course		3
Electives		12
Credit Hours		15
Total Credit Hours		121

Mission

The mission of the Physics B.S. program is to provide students with a rigorous grounding in classical and modern theory, experience in advanced experimental techniques, and exposure to a broad spectrum of topics in physics research.

Goals

It is expected that graduates will be capable problem solvers, proficient critical and scientific thinkers, and possess backgrounds that prepare them for success in graduate school or their desired career path. Graduates will also be able to communicate their scientific ideas in written form to both scientifically literate and general audiences.

Student Learning Outcomes

- Students will demonstrate the ability to solve problems in classical and modern physics and proficiency in theoretical and applied mathematics, making them competitive in their application at top graduate programs and/or in the job market.
- Students will be exposed to and engaged in forefront physics research. Students will learn first hand how research is performed in one of our labs, while contributing to one of our active research programs.
- Students will be able to report their work/ideas in written form to both the scientific community and a broader audience.