MAJOR IN PHYSICS, APPLIED PHYSICS CONCENTRATION

Requirements
Effective Fall 2023

Each course used to meet requirements of the concentration need a minimum grade of C-, including courses to satisfy AUCC Categories 1, 2, and 3A.

Freshman

		AUCC	Credits
CO 150	College Composition (GT-CO2)	1A	3
Select one of the following groups:			5
CS 150B	Culture and Coding: Python (GT-AH3)	3B	
Electives			
or			
CS 152	Python for STEM		
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
MATH 160	Calculus for Physical Scientists I (GT-MA1)	1B	4
MATH 161	Calculus for Physical Scientists II (GT-MA1)	1B	4
PH 141	Physics for Scientists and Engineers I (GT-SC1)	3A	5
PH 142	Physics for Scientists and Engineers II (GT-SC1)	3A	5
PH 193	Introductory Seminar in Physics		1
Diversity, Equity, and Inclusion (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#diversity-equity-inclusion)		1C	3
	Total Credits		**30**

Sophomore

MATH 261	Calculus for Physical Scientists III		4
Select one from the following:			4
MATH 340	Intro to Ordinary Differential Equations		
MATH 345	Differential Equations		
PH 210	Introduction to Computing in Physics		3
PH 245[1]	Introduction to Electronics		3
PH 293	Selected Topics in Physics		1
PH 314	Introduction to Modern Physics		4
PH 315	Modern Physics Laboratory		2
Arts and Humanities (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Social and Behavioral Sciences (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-sciences)		3C	3
Historical Perspectives (http://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
	Total Credits		**30**

Junior

Select one from the following:[2]			3
CHEM 301	Advanced Scientific Writing--Chemistry (GT-CO3)	2	
CO 300	Writing Arguments (GT-CO3)	2	

CO 301B	Writing in the Disciplines: Sciences (GT-CO3)	2	
JTC 300	Strategic Writing and Communication (GT-CO3)	2	
LB 300	Specialized Professional Writing	2	
MATH 369	Linear Algebra I		3
PH 341	Mechanics		4
PH 351[1]	Electricity and Magnetism		4
PH 353	Optics and Waves		4
PH 361	Physical Thermodynamics		3
Technical Elective (see list below)			3
Electives			6
	Total Credits		**30**
Senior			
PH 425	Advanced Physics Laboratory	4C	2
PH 451	Introductory Quantum Mechanics I	4A,4B	3
PH 492	Seminar	4C	1
Select one Field from the lists below (Select a minimum of 12 credits from a minimum of four courses)[3]			12
Electives[4]			12
	Total Credits		**30**
	Program Total Credits:		**120**

Technical Electives (select a minimum of 3 credits not taken elsewhere in the program)

Code	Title	Credits
ATS 550	Atmospheric Radiation and Remote Sensing	3
CHEM 111	General Chemistry I (GT-SC2)	4
CHEM 120	Foundations of Modern Chemistry (GT-SC2)	4
CIVE 300	Fluid Mechanics	3
ECE 441	Optical Electronics	3
ERHS 450	Introduction to Radiation Biology	3
MATH 332	Partial Differential Equations	3
MATH 366	Introduction to Abstract Algebra	3
MATH 419	Introduction to Complex Variables	3
MATH 430/ECE 430	Fourier and Wavelet Analysis with Apps	3
MATH 450	Introduction to Numerical Analysis I	3
MATH 451	Introduction to Numerical Analysis II	3
MATH 472	Introduction to Topology	3
MATH 474	Introduction to Differential Geometry	3
MECH 518	Orbital Mechanics	3
PH 498	Research	1-6
PH 517	Chaos, Fractals, and Nonlinear Dynamics	3
PH 521	Introduction to Lasers	3
PH 531	Introductory Condensed Matter Physics	3
PH 561	Elementary Particle Physics	3
PH 571	Mathematical Methods for Physics I	3
STAT 315	Intro to Theory and Practice of Statistics	3
STAT 420	Probability and Mathematical Statistics I	3

Biophysics Field

Code	Title	Credits
BC 351	Principles of Biochemistry	4
BC 411	Physical Biochemistry	4
BC 463	Molecular Genetics	3
BC 464	Molecular Genetics Recitation	1
BC 465	Molecular Regulation of Cell Function	3
BC 467	Biochemistry of Disease	3
BIOM 421	Transport Phenomena in Biomedical Engineering	3
BIOM 422	Quantitative Systems and Synthetic Biology	3
BIOM 441	Biomechanics and Biomaterials	3
BIOM 526/ECE 526	Biological Physics	3
BZ 310	Cell Biology	4
CHEM 433	Clinical Chemistry	3
ERHS 450	Introduction to Radiation Biology	3
ERHS 530	Radiological Physics and Dosimetry I	3
ERHS 531	Nuclear Instruments and Measurements	2
ERHS 550	Principles of Radiation Biology	5
MIP 300	General Microbiology	3
MIP 450	Microbial Genetics	3

Chemistry Field

Code	Title	Credits
CHEM 231	Foundations of Analytical Chemistry	3
CHEM 232	Foundations of Analytical Chemistry Lab	2
CHEM 241	Foundations of Organic Chemistry	4
CHEM 242	Foundations of Organic Chemistry Laboratory	1
CHEM 245	Fundamentals of Organic Chemistry	4
CHEM 246	Fundamentals of Organic Chemistry Laboratory	1
CHEM 261	Fundamentals of Inorganic Chemistry	3
CHEM 263	Foundations of Inorganic Chemistry	4

CHEM 264	Foundations of Inorganic Chemistry Laboratory	1
CHEM 302-379		
CHEM 400-479		

Computers Field

Only 3 credits from each CS course counts towards the 12 credit requirement.

Code	Title	Credits
CS 220	Discrete Structures and their Applications	4
CS 250	Computer Systems Foundations	4
CS 314	Software Engineering	3
CS 320	Algorithms--Theory and Practice	3
CS 345	Machine Learning Foundations and Practice	3
CS 356	Systems Security	3
CS 370	Operating Systems	3
CS 414	Object-Oriented Design	4
CS 415	Software Testing	4
CS 420	Introduction to Analysis of Algorithms	4
CS 430	Database Systems	4
CS 435	Introduction to Big Data	4
CS 440	Introduction to Artificial Intelligence	4
CS 445	Introduction to Machine Learning	4
CS 453	Introduction to Compiler Construction	4
CS 454	Principles of Programming Languages	4
CS 455	Introduction to Distributed Systems	4
CS 456	Modern CyberSecurity	4
CS 457	Computer Networks and the Internet	4
CS 462	Engaging in Virtual Worlds	4
CS 475	Parallel Programming	4
ECE 251	Introduction to Microcontrollers and IoT	4
ECE 450	Digital System Design Laboratory	1
ECE 451	Digital System Design	3
ECE 452	Computer Organization and Architecture	3
ECE 456	Computer Networks	4
MATH 360	Mathematics of Information Security	3
MATH 460	Information and Coding Theory	3
MATH 463	Post-Quantum Cryptography	3

Custom Field

Specific courses forming a coherent program are selected by the student in consultation with their academic advisor and subject to approval of the Key Advisor.

Data Science Field

Code	Title	Credits
DSCI 235	Data Wrangling	2
DSCI 320	Optimization Methods in Data Science	3
DSCI 335	Inferential Reasoning in Data Analysis	3
DSCI 336	Data Graphics and Visualization	1
DSCI 445	Statistical Machine Learning	3
DSCI 473	Introduction to Geometric Data Analysis	2
DSCI 475	Topological Data Analysis	2
STAT 158	Introduction to R Programming	1
STAT 341	Statistical Data Analysis I	3

Electronics, Semiconductors, and Optics Field

Code	Title	Credits
ECE 311	Linear System Analysis I	3
ECE 312	Linear System Analysis II	3
ECE 331	Electronics Principles I	4
ECE 332	Electronics Principles II	4
ECE 404	Experiments in Optical Electronics	2
ECE 411	Control Systems	3
ECE 412	Digital Control and Digital Filters	3
ECE 415	Semiconductor Physics and Junctions	2
ECE 421	Telecommunications I	3
ECE 430/MATH 430	Fourier and Wavelet Analysis with Apps	3
ECE 441	Optical Electronics	3
ECE 444	Antennas and Radiation	3
ECE 457	Fourier Optics	3
ECE 546	Laser Fundamentals and Devices	3

Geophysics Field

Code	Title	Credits
CIVE 413	Environmental River Mechanics	3
GEOL 232	Mineralogy	3
GEOL 250	The Solid Earth	3
GEOL 332	Optical Mineralogy	2
GEOL 344	Stratigraphy and Sedimentology	4
GEOL 364	Igneous and Metamorphic Petrology	4
GEOL 372	Structural Geology	4
GEOL 415	Critical Zone Science	3
GEOL 440	Geodetic and Near-Surface Geophysical Methods	4
GEOL 442	Applied Geophysics	4
GEOL 446	Environmental Geology	3
GEOL 454	Geomorphology	4
GEOL 530	Advanced Petrology	3
GEOL 535	Microtectonics	3
GEOL 570	Plate Tectonics	3

Materials and Fluids Field

Code	Title	Credits
CBE 331	Momentum Transfer and Mechanical Separations	3
CBE 332	Heat and Mass Transfer Fundamentals	3
CIVE 300	Fluid Mechanics	3
CIVE 301	Fluid Mechanics Laboratory	1
CIVE 401	Hydraulic Engineering	3
CIVE 413	Environmental River Mechanics	3
MECH 331A	Introduction to Engineering Materials: Lecture	3
MECH 331B	Introduction to Engineering Materials : Lab	1
MECH 338	Thermal/Fluid Sciences Laboratory	1

MECH 342	Fluid Mechanics for Mechanical Engineers	3
MECH 344	Heat and Mass Transfer	3
MECH 431	Metals and Alloys	3
MECH 432	Engineering of Nanomaterials	3
MECH 450	Aerospace Propulsion	3
MECH 460	Aeronautics	3
MECH 468	Space Propulsion and Power Engineering	3
MSE 502A	Materials Science and Engineering Methods: Materials Structure and Scattering	1
MSE 502B	Materials Science and Engineering Methods: Computational Materials Methods	1
MSE 502C	Materials Science and Engineering Methods: Materials Microscopy	1
MSE 502D	Materials Science and Engineering Methods: Materials Spectroscopy	1
MSE 502E	Materials Science and Engineering Methods: Bulk Properties and Performance	1
MSE 502F	Materials Science and Engineering Methods: Experimental Methods for Materials Research	1
MSE 503	Mechanical Behavior of Materials	3
MSE 504	Thermodynamics of Materials	3
MSE 505	Kinetics of Materials	3
MSE 523	Electronic Properties of Materials	3
PH 531	Introductory Condensed Matter Physics	3

Medical Physics Field

Code	Title	Credits
BC 467	Biochemistry of Disease	3
BIOM 421	Transport Phenomena in Biomedical Engineering	3
BIOM 422	Quantitative Systems and Synthetic Biology	3
BMS 300	Principles of Human Physiology	4
BMS 325	Cellular Neurobiology	3
BMS 345	Functional Neuroanatomy	4
CHEM 433	Clinical Chemistry	3
ERHS 332	Principles of Epidemiology	3
ERHS 450	Introduction to Radiation Biology	3
ERHS 515	Non-Ionizing Radiation Safety	2
ERHS 530	Radiological Physics and Dosimetry I	3
ERHS 531	Nuclear Instruments and Measurements	2
ERHS 556	Monte Carlo Methods in Health Physics	3
ERHS 561	Radiation Public Health	2
ERHS 563	Environmental Contaminant Modeling I	2
ERHS 570	Radioecology	2
MIP 300	General Microbiology	3
MIP 342	Immunology	4
MIP 351	Medical Bacteriology	3
MIP 420	Medical and Molecular Virology	4

1 For students who change majors from Electrical Engineering or are double-majoring in Electrical Engineering, please see an advisor for possible substitutions.

2 Other courses in AUCC Category 2 may be accepted if they are taken prior to declaring the Physics major or are taken to meet requirements of another major.

3 A minimum of 6 credits must be 300-, 400-, or 500-level.

4 Select enough elective credits to bring the program total to a minimum of 120 credits, of which at least 42 must be upper-division (300- , 400-level, or 500-level).