Physics

Physics Major

Students who complete a major in Physics are prepared for careers in industrial and governmental research and development and for graduate study in physics, astronomy, engineering, medicine, materials science, and environmental science. In-depth preparation is also provided for teaching in secondary schools.

Students interested in Physics Education are encouraged to declare a double major in their discipline and in education (i.e., Physics Education (http://bulletin.ndsu.edu/past-bulletin-archive/2014-15/undergraduate/colleges/human-development-education/education/teaching-specialty-physics) and Physics). Such double majors may be earned by the successful completion of a few additional credits. Students should contact their adviser, the School of Education (http://www.ndsu.edu/education) , or the Office of Registration and Records (http://www.ndsu.edu/bulletin/offices/registrar) for details and are encouraged to declare their primary and secondary majors with the Office of Registration and Records, Ceres Hall 110.

Optical Science and Engineering Option

This option includes an interdisciplinary optics/photonics sequence of courses taught by the Departments of Physics (http://www.ndsu.edu/physics) and the Department of Electrical and Computer Engineering (http://www.ndsu.edu/ece) using a state-of-the-art optics teaching laboratory. This is the only regional program of its type. Optics and lasers are enabling technologies and are applied in most high-tech experiments, communications, devices, medical diagnostics, media, etc. There are more than 5,000 optics-related companies in the United States alone, but even more important, photonics provides the technical foundation for many more. Optical science and engineering has exploded to encompass nearly all fields of science and technology with a consequent shortage of individuals trained in the field. The optical science and engineering option will enhance any job search.

Physics Minor

A Physics minor consists of 19 credits, of which at least eight credits must be completed at NDSU.

Major Requirements

Major: Physics (Standard)

Degree Type: B.A. or B.S.
Required Degree Credits to Graduate: 122

General Education Requirements

First Year Experience (F):		
UNIV 189	Skills For Academic Success (Students transferring in 24 or more credits do not need to take UNIV 189.)	1
Communication (C):		
ENGL 110	College Composition I	3
ENGL 120	College Composition II	3
One Course in Upper Level Writing: Select from current general education list		3
COMM 110	Fundamentals of Public Speaking	3
Quantitative Reasoning (R):		
MATH 165	Calculus I	4
Science & Technology (S):		
PHYS 251 & 251L	University Physics I and University Physics I Laboratory	5
PHYS 252 & 252L	University Physics II and University Physics II Laboratory	5
Humanities & Fine Arts (A): Select from current general education list		6
Social & Behavioral Sciences (B): Select from current general education list		6
Wellness (W): Select from current general education list		2
Cultural Diversity (D): Select from current general education list		
Global Perspectives (G): Select from current general education list		
Total Credits		41

College Requirements

Bachelor of Science (BS) Degree – An additional 6 credits in Humanities or Social Sciences*

Bachelor of Arts (BA) Degree – An additional 12 credits Humanities and Social Sciences* and proficiency at the second year level in a modern foreign language.

* Humanities and Social Sciences may be fulfilled by any course having the following prefix: ADHM, ANTH, ARCH, ART, CJ, CLAS, COMM, ECON, ENGL, FREN, GEOG, GERM, HDFS, HIST, LA, LANG, MUSC, PHIL, POLS, PSYC, RELS, SOC, SPAN, THEA, WGS, or any course from the approved list of general education courses in humanities and social sciences (general education categories A and B). These credits must come from outside the department of the student's major.

Major Requirements - Standard Option

A grade of 'C' or better is required for all PHYS and AST prefix courses.

General Education Requirements		40
College of Science and Mathematics Requirements		6-12
Physics Major Requirements (Standard Option)		
PHYS 171	Introductory Projects in Physics	1
PHYS 251R	University Physics I Recitation	1
PHYS 252R	University Physics II Recitation	1
PHYS 350	Modern Physics	3
PHYS 360	Modern Physics II	3
PHYS 361	Electromagnetic Theory (or PHYS 370:Electromagnetic Theory - MSUM)	3-4
PHYS 370	Introduction to Computational Physics	3
PHYS 411 & 411L	Optics for Scientists & Engineers and Optics for Scientists and Engineers Lab	4
Select one of the following:		3-4
PHYS 455	Classical Mechanics	
PHYS 330	Intermediate Mechanics (MSUM)	
PHYS 462	Heat & Thermodynamics	3
PHYS 485	Quantum Mechanics I	3
PHYS 486	Quantum Mechanics II	3

PHYS 489	Physics Projects	3
Physics Electives: Select two of the following:		6
PHYS 215	Research For Undergraduates	
PHYS 413	Lasers for Scientists and Engineers	
PHYS 415	Elements of Photonics	
PHYS 463	Statistical Mechanics	
PHYS 481	Introduction to Solid State Physics	
MSUM AST	Astronomy courses (300/400-level) with departmental permission	
Related Required Courses		
Mathematics:		
MATH 129	Basic Linear Algebra	2-3
or MATH 429	Linear Algebra	
MATH 166	Calculus II	4
MATH 265	Calculus III	4
MATH 266	Introduction to Differential Equations	3
MATH Electives	400-level (MATH 488 & MATH 489 are recommended)	6
Chemistry: Select one of the following (150/160 recommended):		4
CHEM 150 & CHEM 160	Principles of Chemistry I and Principles of Chemistry Laboratory I	
CHEM 121 & 121L	General Chemistry I and General Chemistry I Laboratory	
Select one of the following (151/161 recommended):		4
CHEM 151 & CHEM 161	Principles of Chemistry II and Principles of Chemistry Laboratory II	
CHEM 122 & 122L	General Chemistry II and General Chemistry II Laboratory	
Computer Science:		
CSCI 160	Computer Science I	3-4
or ECE 173	Introduction to Computing	
CSCI 161	Computer Science II	4
Degree Requirements: Potential of one credit to reach 122.		1
Total Credits		122-132

Program Notes

- Except for courses offered only as pass/fail grading, no course may be taken Pass/Fail.

Major Requirements

Major: Physics with Optical Science and Engineering Option

Degree Type: B.A. or B.S.
Required Degree Credits to Graduate: 122

General Education Requirements

First Year Experience (F):		
UNIV 189	Skills For Academic Success (Students transferring in 24 or more credits do not need to take UNIV 189.)	1
Communication (C):		
ENGL 110	College Composition I	3
ENGL 120	College Composition II	3
One Course in Upper Level Writing: Select from current general education list		3
COMM 110	Fundamentals of Public Speaking	3
Quantitative Reasoning (R):		
MATH 165	Calculus I	4
Science & Technology (S):		
PHYS 251 & 251L	University Physics I and University Physics I Laboratory	5
PHYS 252 & 252L	University Physics II and University Physics II Laboratory	5
Humanities & Fine Arts (A): Select from current general education list		6
Social & Behavioral Sciences (B): Select from current general education list		6
Wellness (W): Select from current general education list		2
Cultural Diversity (D): Select from current general education list		
Global Perspectives (G): Select from current general education list		
Total Credits		41

College Requirements

Bachelor of Science (BS) Degree – An additional 6 credits in Humanities or Social Sciences*

Bachelor of Arts (BA) Degree – An additional 12 credits Humanities and Social Sciences* and proficiency at the second year level in a modern foreign language.

* Humanities and Social Sciences may be fulfilled by any course having the following prefix: ADHM, ANTH, ARCH, ART, CJ, CLAS, COMM, ECON, ENGL, FREN, GEOG, GERM, HDFS, HIST, LA, LANG, MUSC, PHIL, POLS, PSYC, RELS, SOC, SPAN, THEA, WGS, or any course from the approved list of general education courses in humanities and social sciences (general education categories A and B). These credits must come from outside the department of the student's major.

Major Requirements - Optical Science and Engineering Option

A grade of 'C' or better is required for all PHYS prefix courses.

General Education Requirements		40
College of Science and Mathematics Requirements		6-12
Physics Major Requirements (Optical Science and Engineering Option)		
PHYS 171	Introductory Projects in Physics	1
PHYS 251R	University Physics I Recitation	1
PHYS 252R	University Physics II Recitation	1
PHYS 350	Modern Physics	3
PHYS 360	Modern Physics II	3
PHYS 361	Electromagnetic Theory (or PHYS 370: Electromagnetic Theory - MSUM)	3-4
PHYS 370	Introduction to Computational Physics	3
PHYS 411 & 411L	Optics for Scientists & Engineers and Optics for Scientists and Engineers Lab	4
PHYS 413	Lasers for Scientists and Engineers	3

PHYS 415	Elements of Photonics	3
Select one of the following:		3-4
PHYS 455	Classical Mechanics	
PHYS 330	Intermediate Mechanics (MSUM)	
PHYS 462	Heat & Thermodynamics	3
PHYS 485	Quantum Mechanics I	3
PHYS 486	Quantum Mechanics II	3
PHYS 489	Physics Projects	3
CSCI 160	Computer Science I	3-4
or ECE 173	Introduction to Computing	
EE 206	Circuit Analysis I	4
Related Required Courses		
Mathematics:		
MATH 129	Basic Linear Algebra	2-3
or MATH 429	Linear Algebra	
MATH 166	Calculus II	4
MATH 265	Calculus III	4
MATH 266	Introduction to Differential Equations	3
MATH Electives	(400-level (MATH 452, MATH 481, and/or MATH 488 are recommended)	6
Chemistry: Select one of the following (150/160 recommended):		4
CHEM 150 & CHEM 160	Principles of Chemistry I and Principles of Chemistry Laboratory I	
CHEM 121 & 121L	General Chemistry I and General Chemistry I Laboratory	
Select one of the following (151/161 recommended):		4
CHEM 151 & CHEM 161	Principles of Chemistry II and Principles of Chemistry Laboratory II	
CHEM 122 & 122L	General Chemistry II and General Chemistry II Laboratory	
Degree Requirements: Potential of one credit to reach 122		1
Total Credits		122-132

Recommended Electives for Optical and Engineering Option

ECE 311	Circuit Analysis II	4
ECE 321	Electronics for Electrical Engineers	5
ECE 417	Optical Signal Transmission	3
ECE 483	Instrumentation for Engineers	3

Program Notes

- Except for courses offered only as pass/fail grading, no course may be taken Pass/Fail.

Minor Requirements

Physics Minor

Minor Requirements

Required Credits: 19

Required Courses

PHYS 252	University Physics II	4
PHYS 252L	University Physics II Laboratory	1
PHYS 350	Modern Physics	3
Electives: Select 11 credits from the following:		11
PHYS 251	University Physics I	
PHYS 251L	University Physics I Laboratory	
PHYS 251R	University Physics I Recitation	
PHYS 252R	University Physics II Recitation	
PHYS Elective	Any 300-400 level	
Total Credits		19

Minor Requirements and Notes

- A minimum of 8 credits must be taken at NDSU.