

## PHYSICS

Physics is the most fundamental and exact of the physical sciences. Its laws are basic to deep understanding in all of technology, and in fields of learning such as astronomy, chemistry, engineering, photonics, biology, medicine, geology, environmental science and oceanography.

### Background Information

The Department of Physics offers a wide range of curricula which prepares students for industrial, governmental, academic or graduate work in these fields. The physics education program prepares students for teaching in secondary schools. Graduate program activities, such as research projects and colloquia, offer undergraduate students many opportunities for learning experiences outside the classroom. Finally, the Tri-College University physics program offers a variety of courses in basic and applied physics usually found only at very large universities. This program involves neighboring Concordia College and Minnesota State University Moorhead.

### High School Preparation

A prospective physics major is generally expected to have taken chemistry, physics and mathematics courses in high school. Courses in computer programming also are quite helpful. Deficiencies in any of these subjects, however, may be remedied in the freshman or later years at the University.

### Curriculum Options

The Department of Physics offers a major in physics with options in computational physics, and optical sciences and engineering.

In the physics option, students take basic courses in mechanics, electricity and magnetism, thermodynamics, quantum mechanics and modern physics specialty areas such as optics, photonics, and condensed-matter physics. The physics option prepares students for graduate work in physics and eventual employment as college teachers, or as research physicists in government or industry. Students taking this option are in demand at many institutions for graduate studies in condensed matter, chemical physics, biophysics, mathematical physics, engineering, environmental science, meteorology, medicine, nuclear studies, oceanography and radiological physics.

The computational physics option involves a higher concentration of computer-related courses, which prepares students for careers in both basic research and industry. This option responds to a growing demand for scientists with expertise in the application of computers to physical problems.

In the optical science and engineering option, students substitute basic electrical engineering courses in the optics-physics curriculum to prepare them to pursue an industrial career or graduate school in photonics. There is a national shortage of scientists and engineers with the multidisciplinary background in optical engineering necessary to meet the fast growing needs of the photonics industry. Students choosing this option will be particularly attractive to high-tech employers.

Students may also elect to take applied physics courses such as acoustics, celestial mechanics and astrophysics that are offered on a cooperative basis within the Tri-College University.

### Career Opportunities

A great variety of employment opportunities exist for physics majors who wish to pursue careers after obtaining the B.S. degree. Some find positions in industry or government. Many technical industries seek physics graduates for work in software development, engineering, science and lab technician positions, management and sales. Nationwide median 12-month salaries for an entry-level (median age 32) physicist with a Ph.D., according to a 2003 survey performed by the American Institute of Physics, are: industry, \$68,000-\$90,000; government, \$75,000-\$98,000; and academia, \$41,000-\$57,000. For B.S. and M.S. degree recipients, median starting salaries in industry range from to \$23,000-\$71,000.

An education in physics is so fundamental that it provides an excellent preparation for graduate education in nearly every technical field, including engineering. Additionally, NDSU graduates in physics have entered medical schools and have studied law. One past graduate received a Ph.D. in biophysics, and now works at the University of Minnesota Medical School; another is at the Mayo Clinic in Rochester, Minn. Some of our recent graduates worked on advance degrees in biomedical engineering, chemical physics, electrical engineering, solid-state physics, meteorology and radiological science. A number of recent graduates are pursuing graduate studies at schools such as Michigan State University, the University of Minnesota, Carnegie Mellon University and SUNY Stony Brook. A 2004 physics Ph.D is now an associate professor at State University of New York Canton.

As technology continues to develop, there will be a need for skilled people to make new discoveries in the basic sciences. Because of this, talented physics majors are encouraged to pursue the Ph.D. degree. Outstanding Ph.D. graduates in physics find research and teaching positions in universities, or employment in government laboratories and research-oriented industries.

If you have a technical career objective, examine it closely. You will find that a major in physics, with one of the options at NDSU, will give you the preparation you need to achieve your goals.

### Financial Aid

Financial aid at NDSU is available in the form of loans, grants, scholarships and work study. Students who qualify for federal college work-study may be paid for work on department research projects. Highly qualified students may be hired as undergraduate research assistants at the campus Center for Nanoscale Science and Engineering.

### Internships

The Cooperative Education Program provides students the opportunity to earn money and gain valuable experience by spending one or more semesters working in industrial or government laboratories.

## For Further Information

Department of Physics  
 North Dakota State University  
 South Engineering 218  
 Dept #2755  
 PO Box 6050  
 Fargo, ND 58108-6050

Tel. (701) 231-8974  
 Fax: (701) 231-7088  
 Web: <http://www.physics.ndsu.nodak.edu/>

**This sample curriculum is not intended to serve as a curriculum guide for current students, but rather an example of course offerings for prospective students. For the curriculum requirements in effect at the time of entrance into a program, consult with an academic adviser or with the Office of Registration and Records.**

### Sample Curriculum

General Education Requirements	Credits
First Year Experience	
Univ. 189 - Skills for Academic Success.....	1
Communication	
Comm. 110 - Fund of Public Speaking.....	3
Engl. 110, 120 - College Composition I, II.....	3, 3
English Upper Level Writing Course .....	3
Quantitative Reasoning	
Math. 165 - Calculus I .....	3
Science & Technology	
Phys. 251, 251L - University Physics I and Lab.....	4, 1
Phys. 252, 252L - University Physics II and Lab .....	4, 1
Humanities & Fine Arts.....	6
Social & Behavioral Sciences .....	6
Wellness .....	2
Cultural Diversity.....	-
Global Perspective.....	-
<b>Total.....</b>	<b>40</b>

College and Department Requirements	Credits
Hum/Soc. Science Electives (B.S. Degree).....	6
Hum/Soc. Science Electives (B.A. Degree).....	12
Second Year Language Proficiency .....	-
<b>Totals .....</b>	<b>6-12</b>

Major Requirements	Credits
Math. 166 - Calculus II .....	4
Math. 265 - Calculus III .....	4
Math. 266 - Introduction to Differential Equations .....	3
Phys. 251R - University Physics I Recitation .....	1
Phys. 252R - University Physics II Recitation .....	3
Phys. 330 (MSUM) - Intermediate Mechanics <i>or</i>	
Phys. 455 - Classical Mechanics .....	4 or 3
Phys. 350, 360 - Modern Physics.....	6
Phys. 361 - Electromagnetic Theory <i>or</i>	
Phys. 370 (MSUM) - Electromagnetic Theory.....	3 or 4
Phys. 370 - Introduction to Computational Physics .....	3
Phys. 411, 411L - Optics for Science and	
Engineering and Lab.....	3, 1
Phys. 462 - Heat and Thermodynamics.....	3
Phys. 471 -Advanced Physics Lab .....	2
Phys. 485 -Quantum Mechanics I .....	3
Phys. 486 -Quantum Mechanics II.....	3
Phys. 489 -Senior Project.....	3
400 Level Math Electives.....	6
Chemistry Electives .....	6
<b>Totals .....</b>	<b>58-61</b>

General Physics Option	Credits
Option Electives.....	13-28
Physics Electives.....	4-6
<b>Totals .....</b>	<b>17-34</b>
<b>CURRICULUM TOTAL .....</b>	<b>122</b>

MSUM=Minnesota State University Moorhead