

Physics

Three different majors in the department provide opportunities for students to study the theoretical and applied nature of physics from within a broad liberal arts context. Students will find that the courses of study in these majors will prepare them for a variety of challenging and rewarding careers, not only in the fields of science and technology, but also in education, engineering, and architecture, as well as careers emphasizing advanced analytical skills, such as business management, law, and Christian ministry.

- The Physics major prepares a student for further study in graduate school or for a career in industry. A number of our graduates have used this route to prepare for study towards a master's degree in engineering. Others have entered doctoral studies and subsequent vocations in higher education or research. Still others have gone directly into technical jobs in business such as electronics technicians or computer specialists.
- The Physics and Mathematics major is a broad course of study in both physics and mathematics, designed especially for students interested in high school teaching. Upon completion of this program and the necessary education courses, a graduate can become certified to teach both physics and mathematics in high school.

- The Applied Physics major is designed for students interested in technical careers. Depending on their interests, students will select one of three tracks within this major. The **Engineering Physics** track is designed for students preparing for further study in engineering or completing the 3-2 engineering program with George Washington University or Virginia Tech. Students interested in combining interests in physics, electronics and computer science should complete the Physics and Technology Track. The Physical Science track will give a student a broad background in both physics and chemistry.

The department also offers students the opportunity to minor in physics, which can be a unique way of blending together an interest in traditionally non-science areas with an interest in physics. For example, students interested in careers in technical writing, patent law, philosophy, or religion can combine studies in the humanities with physics. In addition, the department offers several courses in astronomy and physics that meet the General Education needs of non-science majors.

Pre-Professional Programs

For more information on pre-professional programs visit www.bridgewater.edu



► FOR INFORMATION ON CAREERS IN PHYSICS,
VISIT THE OFFICE OF CAREER SERVICES OR GO
TO: WWW.BRIDGEWATER.EDU

PHYSICS MAJOR REQUIREMENTS

This major is selected by students planning on graduate study in physics or engineering or on a physics-related career in industry.

REQUIRED COURSES:

PHYS 221/222	General Physics I, II
PHYS 305	Electronics
PHYS 308	Modern Physics
PHYS 311	Classical Mechanics I
PHYS 331	Electricity and Magnetism I
PHYS 345	Experimental Physics
PHYS 460	Seminar

And nine additional credits from courses numbered 300 or above.

SUPPORTING COURSES:

MATH 131/132	Calculus I, II
MATH 231/232	Calculus III, IV

APPLIED PHYSICS MAJOR REQUIREMENTS

This major is designed primarily for students interested in careers in engineering or technology.

REQUIRED COURSES:

PHYS 221/222	General Physics I, II
PHYS 308	Modern Physics
PHYS 460	Seminar

SUPPORTING COURSES:

MATH 131/132	Calculus I, II
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Students must select additional courses as outlined in one of the following tracks.

A. Engineering Physics Track

This track cannot be taken as a dual major with a major in physics.

REQUIRED COURSES:

CHEM 161/162	General Chemistry I, II
PHYS 311/312	Classical Mechanics I, II

And four additional courses numbered 300 or above chosen from the Department of Physics.

SUPPORTING COURSES:

MATH 231/232 Calculus III, IV

B. Physics and Technology Track

This track cannot be taken as a dual major with a major in computer science or physics.

REQUIRED COURSES:

CSCI 200	Introduction to Programming
CSCI 205	Data Structures & Abstraction
CSCI 225	Mathematical Structures for Computer Science
PHYS 305	Electronics
PHYS 306	Digital Electronics

And three additional courses numbered 300 or above chosen from the Departments of Physics and Mathematics and Computer Science (at least one from each department).

C. Physical Science Track

This track cannot be taken as a dual major with a major in chemistry or in physics.

REQUIRED COURSES:

CHEM 161/162	General Chemistry I, II
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And 18 additional credits in courses numbered 300 or above chosen from the Departments of Physics and Chemistry (at least six from each department).

SUPPORTING COURSES:

MATH 231/232	Calculus III, IV
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PHYSICS AND MATHEMATICS MAJOR REQUIREMENTS

This major is designed primarily for students wishing to certify to teach physics and mathematics at the secondary level and may not be taken as a dual major with the major in Mathematics or Physics.

REQUIRED COURSES IN PHYSICS:

PHYS 221/222	General Physics I, II
PHYS 305	Electronics
PHYS 308	Modern Physics
PHYS 345	Experimental Physics

PHYS 460 Seminar
And three additional credits in physics from courses numbered 300 or above for a total of 24 credits.

REQUIRED COURSES IN MATHEMATICS:

MATH 131/132 Calculus I, II
MATH 216 Set Theory and Symbolic Logic
MATH 231/232 Calculus III, IV
MATH 300 Modern Geometry

And six additional credits in mathematics from courses numbered 300 or above for a total of 24 credits.

PHYSICS MINOR REQUIREMENTS

REQUIRED COURSES:

PHYS 221/222 General Physics I, II
PHYS 308 Modern Physics

And three additional physics courses numbered 300 or above.

COURSES

PHYS 110 **Introductory Astronomy**
4 Credits F, S

Designed to help students appreciate and understand their physical environment and the methods of physical science through the study of basic astronomy. Topics include the history of astronomy; motion of celestial objects; planets of the solar system; birth, life, and death of stars; galaxies; and cosmology. Three hours in class and two hours in laboratory per week.

General Education: Natural Science

PHYS 125 **Concepts of Physics**
4 Credits F, S

An introduction to the basic concepts of physics emphasizing practical applications of physical laws to common occurrences. Physical descriptions are presented on how things move, the behavior of sound and light, uses of electricity and magnetism, and the behavior of fundamental

particles. Three hours in class and two hours in laboratory per week.

Prerequisites: MATH 107 or 110 or satisfactory score on the placement exam, or permission of the instructor
General Education: Natural Science

PHYS 175 **Astrobiology: Searching for Life in the Universe**
3 Credits I

This course is a general introduction to the burgeoning field of astrobiology in which students will explore astronomy from a search for life perspective. The approach to the search for life in this course will be the search for habitable places in the universe. The course will detail cosmology and the scientific description of the physical and astronomical conditions and processes that produce life on earth. These concepts form the foundation for the current search for additional locations in the solar system that might support life and the search for extrasolar planets throughout the universe.

Prerequisite: MATH 107 or 110 or satisfactory score on the placement exam, or permission of the instructor.

PHYS 205 **Principles of Astrophysics**
3 Credits I

Basic principles of physics as applied to understanding the physical nature of the solar system; the birth, life and death of stars including black holes; and the formation of the universe.

Prerequisite: MATH 120

PHYS 218, 219 **College Physics I, II**
4 Credits each F, S

An algebra-based exploration of the concepts of motion, forces, energy, waves, heat, electricity, magnetism, optics, and modern physics. Three hours in class and three hours in laboratory per week.

Prerequisites: MATH 120. PHYS 218 is prerequisite to PHYS 219

Alternate years – offered 2008-2009

General Education: Natural Science

PHYS 221, 222 **General Physics I, II**

4 Credits each F, S

During the first term: Kinematics, Newton's Laws of Motion, conservation laws, rotational motion, periodic motion, and fluid mechanics. During the second term: Thermodynamics, electricity, magnetism, optics and modern physics. A combination of lectures and learning by inquiry are employed. Computers are used for data acquisition, data analysis, and mathematical modeling. Three hours in class and three hours in laboratory per week.

Prerequisite: MATH 130 or 132 or concurrent enrollment in MATH 131, 132 respectively. *PHYS 221 is prerequisite to PHYS 222*

General Education: Natural Science

PHYS 305 **Electronics**

4 Credits F

Analog and digital electronics including diode and transistor operation, mathematical circuit analysis, operational amplifier applications, and digital logic gates. Two hours in class and six hours in laboratory per week.

Prerequisites: PHYS 222 and MATH 132

Alternate years – offered 2007-2008

PHYS 306 **Digital Electronics**

3 Credits I

Analysis and applications of digital circuits such as flip-flops, registers, counters and analog-to-digital converters leading to interfacing real-time data collection to computers.

Prerequisites: PHYS 222 or PHYS 219

Alternate years – offered 2008-2009

PHYS 308 **Modern Physics**

3 Credits F

Relativity, wave-particle dualism, Schrodinger equation, wave functions, spectra, nuclear physics and elementary particles.

Prerequisites: PHYS 222 and MATH 132

Alternate years – offered 2007-2008

PHYS 311, 312 **Classical Mechanics I, II**

3 Credits each F, S

Kinematics and dynamics in one, two and three

dimensions including oscillating systems, central force motion, Lagrangian and Hamiltonian dynamics, motion of rigid objects, and wave motion.

Prerequisites: PHYS 222 and MATH 132. *PHYS 311 is prerequisite to PHYS 312*

Alternate years – offered 2008-2009

PHYS 331, 332 **Electricity and Magnetism I, II**

3 Credits each F, S

Electrostatics, scalar potential, electric fields and energy in conductors and dielectrics, electric currents, magnetic fields and energy, leading up to Maxwell's equations and from there to electromagnetic radiation.

Prerequisites: PHYS 222 and MATH 132 (*PHYS 331 is prerequisite to PHYS 332*)

Alternate years – offered 2008-2009

PHYS 341 **Thermal and Statistical Physics**

3 Credits I

Thermodynamics, kinetic theory, and an introduction to statistical mechanics.

Prerequisites: PHYS 222 and MATH 232

Alternate years – offered 2008-2009

PHYS 345 **Experimental Physics**

3 Credits I

Certain classical and modern experiments designed to give the student a basic understanding of experimental methods. One hour in class and six hours in laboratory per week.

Prerequisites: PHYS 222 and MATH 132

Alternate years – offered 2007-2008

PHYS 410 **Optics and Laser Physics**

4 Credits S

Topics include electromagnetic nature of light, geometrical optics, polarization, interference, diffraction, holography, and basics of lasers with applications. Three hours in class and three hours in laboratory per week.

Prerequisites: PHYS 222 and MATH 232

Alternate years – offered 2007-2008

PHYS 420**Quantum Mechanics**

3 Credits S

Schrodinger equation, square well, harmonic oscillator, hydrogen atom, matrix methods, angular momentum, spin, and approximation methods.

Prerequisites: PHYS 340 and MATH 232

Alternate years – offered 2007-2008

PHYS 450**Special Topics**

3 Credits F, S

Devoted to a subject chosen from some field of physics in which regular courses are not offered. The course may be repeated for credit provided a different topic is covered.

Prerequisite: Permission of the instructor

Offered on demand

PHYS 460**Seminar**

3 Credits F

Discussion and presentation of papers by students and faculty on problems of current interest in physics.

Prerequisite: Senior standing with a major in Physics,

Applied Physics, Physics and Mathematics or permission of the instructor

PHYS 480**Internship**

3 Credits F, I, S

PHYS 490**Independent Study**

3 Credits F, I, S

PHYS 491**Research**

3 Credits F, I, S

PHYS 500**Honors Project**

3 Credits F, I, S