

Physics

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Physics is a mathematical science and as such is rigorous and demanding. It presents a challenge found in few other disciplines. At Norwich University, the Bachelor of Science in Physics is offered to students desiring an excellent schooling in the fundamentals of physics. The program encompasses a complete curriculum comprised of classical and quantum physics ranging from the properties of particles to the dynamics of the universe. All disciplines in science and engineering turn to physics to address the foundation of their fields.

Hallmarks of a Norwich education include experiential learning and leadership development. The Department of Physics therefore not only accentuates laboratory work but also insists upon peer collaboration throughout the curriculum. Physics majors, having the advantage of a 3-to-1 student-to-faculty ratio, develop close working relationships with their faculty mentors culminating in original research conducted in a faculty laboratory. Physics majors regularly present the results of their research at regional and national conferences. Currently, the research interests of the faculty include particle physics, material science, astrophysics and geophysical fluid dynamics.

Goals:

- The Department is committed to developing the maximum potential of every individual majoring in physics. It is devoted to the proposition that physics majors will, upon graduation, have a well-founded

understanding of the physics that underlies all aspects of the physical universe. Such an education will insure that Norwich graduates have open to them and are successful in a full range of satisfying career opportunities.

Outcomes:

- Because of its importance to so many fields, physics serves as an ideal springboard for a rich diversity of careers in the sciences, mathematics and engineering. The training necessary to become a physicist develops analytical skills that allow graduates to branch out into a wide variety of technological professions that value the interdisciplinary talent that physicists have in understanding fundamental physical processes through experimentation.

Because it is one of the most challenging programs at any school, including Norwich, the personal reward of a degree in physics is great. The intellectual growth that is realized opens many doors including: pursuit of the Masters and Doctorate degrees leading to an academic position; a career as a research scientist in a laboratory of industry or government; the profession of education in high school; employment as a scientific consultant to lawyers and politicians; or service in technical branches of the military.

Careers for this Major:

- Industry
- Government
- Graduate work in physics and other physical sciences
- Military

B. S. in Physics - Curriculum Map

Freshman			
Fall	Credits	Spring	Credits
EN 101 Composition and Literature I	3	EN 102 Composition and Literature II	3
MA 121 Calculus I (General Education Math)	4	MA 122 Calculus II (General Education Math)	4
CH 103 General Chemistry I (General Education Lab Science)	4	CH 104 General Chemistry II (General Education Lab Science)	4
PS 107 Introductory Solar System Astronomy (or Free Elective)	4-3	PS 110 Physics of Continuous Media	3
	15-14		14
Sophomore			
Fall	Credits	Spring	Credits
EN 201 World Literature I (General Education Literature)	3	EN 202 World Literature II	3
MA 223 Calculus III	4	MA 224 Differential Equations	4
PS 211 University Physics I	4	PS 212 University Physics II	4
PS 205 Basic Instrumentation in the Natural Sciences (or Free Elective) ¹	4 -3	General Education History	3
PH 303 Survey of Ethics or 323 Environmental Ethics (General Education Ethics)	3	General Education Social Science	3
	18-17		17
Junior			
Fall	Credits	Spring	Credits
Mathematics Elective	3	Mathematics Elective	3
PS 331 Mechanics or 354 Thermodynamics ¹	4	PS 332 Mechanics II or 363 Optics ¹	4
PS 441 Modern Physics I or 423 Electricity and Magnetism I ¹	4	PS 442 Modern Physics II or 424 Electricity and Magnetism II ¹	4
PS 205 Basic Instrumentation in the Natural Sciences (or Free Elective)	4-3	General Education Arts & Humanities	3
Free Elective	3	Free Elective	3
	18-17		17
Senior			
Fall	Credits	Spring	Credits
PS 354 Thermodynamics or 331 Mechanics ¹	4	PS 363 Optics or 332 Mechanics II ¹	4
PS 423 Electricity and Magnetism I or 441 Modern Physics I ¹	4	PS 424 Electricity and Magnetism II or 442 Modern Physics II ¹	4
PS 461 Senior Project I	1	PS 462 Senior Project II	1
PS 451 Seminar I	1	PS 452 Seminar II	1
Free Elective	3	Free Elective	3
Free Elective	3	Free Elective	3
	16		16
Total Credits: 131-128			

¹ This course is offered in alternate years. Both courses listed are required. For the years these courses are offered, see Course Descriptions.

PS Elective	3
PS Elective (300 level or higher)	3
PS Elective (300 level or higher)	3
Total Credits	20

Physics Minor

PS 211	University Physics I	4
PS 212	University Physics II	4
PS Elective		3

Courses

PS 100 Elementary Physics 4 Credits

A selection of topics from kinematics, dynamics, fluids, energy, acoustics, electricity, optics, and modern physics required of an informed citizenry. Classroom: 3 hours; laboratory: 2 hours. Note: Credit cannot be received for PS100 if credit has been earned in PS 201 or PS 211.

PS 107 Introductory Solar System Astronomy 4 Credits

A descriptive study of the solar system, including the sun, planets, asteroids, comets and interplanetary space. The role of observation in the evolution of astronomy is emphasized. Classroom: 3 hours; laboratory: 2 hours. Does not count as a lab science if taken for 3 credits.

PS 108 Stellar and Galactic Astronomy 4 Credits

A descriptive introduction to the universe, including stars, galaxies, and recent deep space discoveries. Discussions survey the techniques used by astronomers to interpret the wide variety of observed phenomena in the cosmos. Classroom: 3 hours; laboratory: 2 hours. Does not count as a lab science if taken for 3 credits.

PS 110 Physics of Continuous Media 3 Credits

An introduction to fluid mechanics, sound and thermal physics. Open only to first year students or by permission of department. Classroom: 3 hours. Pre- or Co-Requisite: MA 108 or MA 121. Offered spring semesters only.

PS 201 General Physics I 4 Credits

An algebra-based study of mechanics, sound and heat, with correlated laboratory experiments. Classroom 3 hours, laboratory 2 hours. Prerequisite: MA107. Note: No student will receive credit for both PS201 and PS211, or for both PS202 and PS212.

PS 202 General Physics II 4 Credits

An algebra-based study of magnetism, electricity, light, and atomic physics, with correlated laboratory experiments. Classroom: 3 hours; laboratory: 2 hours. Prerequisite: PS 201. Note: Credit cannot be received for both PS 202 and PS 212. Offered spring semesters only.

PS 205 Basic Instrumentation in the Natural Sciences 4 Credits

An introduction to instrumentation theory and measurement technique. Emphasis on identification of and models for the behavior of measuring system components, the combinations of components in typical research equipment and the statistical analysis necessary for interpretation of measurements. Classroom: 3 hours; laboratory: 3 hours. Prerequisite: permission of instructor. Offered fall semester of odd-numbered years only.

PS 207 Meteorology and Climatology 3,4 Credits

A first study of atmospheric processes, elementary forecasting, and the major climatic classes. Particular emphasis is placed on the effects of these phenomena on human activities. Laboratory practice includes elementary forecasting techniques, observations, calculations, and theoretical analysis of weather and climate patterns. Classroom: 3 hours; laboratory: 2 hours. Prerequisite: PS 201 or PS 202 or permission of the instructor. Does not count as a lab science if taken for 3 credits.

PS 211 University Physics I 4 Credits

A calculus-based study of vectors; Newton's laws; uniform, accelerated, rotational and harmonic motion; conservation laws; fluid mechanics; elasticity. Classroom: 3 hours; laboratory: 2 hours. Prerequisite: MA 121. Note: Credit cannot be received for both PS 201 and PS 211. Offered fall semesters only.

PS 212 University Physics II 4 Credits

A calculus-based study of topics in electricity, magnetism, waves and optics. Classroom: 3 hours; laboratory: 2 hours. Prerequisite: PS 211; Pre- or Co-requisite: MA 122. Note: Credit cannot be received for both PS 202 and PS 212. Offered spring semesters only.

PS 232 University Physics III 3 Credits

A study of topics from quantum phenomena, spectroscopy, relativity, nuclear and solid state physics. Classroom 3 hours. Prerequisite: PS212 or permission of instructor.

PS 299 Topics in Physics 4 Credits

PS 331 Mechanics 4 Credits

Newtonian Mechanics applied to a particle including rectilinear and general motion, linear oscillations, non-inertial reference frames, gravitation, and central forces. Non-linear oscillators and chaos. Classroom: 3 hours; laboratory: 3 hours. Prerequisites: PS 212 and MA 224 or permission of instructor. Offered fall semester of odd-numbered years only.

PS 332 Mechanics II 4 Credits

Newtonian Mechanics applied to a system of particles including planar and general motion of rigid bodies, and oscillating systems. Lagrangian and Hamiltonian dynamical formulations. Introduction to relativistic dynamics. Classroom: 3 hours; laboratory: 3 hours. Prerequisite: PS 331. Offered spring semester of even-numbered years only.

PS 354 Thermodynamics 4 Credits

A study of first and second laws of thermodynamics with applications; thermodynamic potentials and applications to systems in equilibrium; introduction to statistical mechanics including Boltzmann statistics, quantum statistics, and statistical interpretation of entropy. Classroom: 3 hours; laboratory: 3 hours. Prerequisites: PS 110, PS 212 and MA 224 or permission of instructor. Offered fall semester of even-numbered years only.

PS 363 Optics 4 Credits

A study of the nature and propagation of light; reflection and refraction, thick lenses, lens aberrations, and optical instruments. Interference, dispersion, diffraction, polarization, and color phenomena. Classroom: 3 hours; laboratory: 3 hours. Prerequisites: PS 212 or permission of instructor. Offered spring semester of odd-numbered years only.

PS 421 Advanced Laboratory I 1-4 Credit

A laboratory investigation in a specific area of experimental physics designed in consultation with physics faculty. Prerequisite: Permission of the instructor. Offered fall semesters only.

PS 422 Advanced Laboratory II 1-4 Credit

A laboratory investigation in a specific area of experimental physics designed in consultation with physics faculty. Prerequisite: Permission of the instructor. Offered spring semesters only.

PS 423 Electricity and Magnetism I 4 Credits

A study of electrical circuits, electrostatic fields, application of Gauss' Law and Laplace's equation; dielectric theory; magnetic fields, induced electric fields and currents; theory of magnetic materials; Maxwell's equations and electromagnetic waves. Classroom 3 hours, laboratory 3 hours. Prerequisites: PS212 and MA224; Pre- or Co-requisite: MA223; or permission of instructor. Offered even numbered fall semesters.

PS 424 Electricity and Magnetism II 4 Credits

A continuation of PS 423, studying electrical circuits, electrostatic fields, application of Gauss' Law and Laplace's equation; dielectric theory; magnetic fields, induced electric fields and currents; theory of magnetic materials; Maxwell's equations and electromagnetic waves. Classroom: 3 hours; laboratory: 3 hours. Prerequisites: PS 423. Offered spring semester of odd-numbered years only.

PS 441 Modern Physics I 4 Credits

An introduction to special relativity, quantum mechanics, structure and spectra of atoms and molecules, nuclear models, and nuclear interactions. Classroom: 3 hours; laboratory: 3 hours. Prerequisites: PS 212 and MA 224 or permission of instructor. Offered fall semester of odd-numbered years only.

PS 442 Modern Physics II 4 Credits

A continuation of PS 441, introducing special relativity, quantum mechanics, structure and spectra of atoms and molecules, nuclear models, and nuclear interactions. Classroom: 3 hours; laboratory: 3 hours. Prerequisite: PS 441. Offered spring semester of even-numbered years only.

PS 451 Seminar I 1 Credit

A study of special topics of current interest. This capstone course integrates reading, writing, speaking and critical thinking skills.

Classroom: 1 hour. Prerequisite: permission of the instructor. Offered fall semesters only.

PS 452 Seminar II 1 Credit

A continuation of PS 451, investigating special topics of current interest.

This capstone course integrates reading, writing, speaking, and critical thinking skills. Classroom: 1 hour. Prerequisite: permission of the instructor. Offered spring semesters only.

PS 461 Senior Project I 1 Credit

A project-oriented capstone experience that integrates reading, writing, speaking and critical thinking. The senior student chooses a project with faculty advice and takes charge of its execution to a satisfying conclusion. The course requires oral and written presentations of the project results. Prerequisites: senior class standing and permission of the instructor. Offered fall semesters only.

PS 462 Senior Project II 1 Credit

A project-oriented capstone experience that integrates reading, writing, speaking and critical thinking. The senior student chooses a project with faculty advice and takes charge of its execution to a satisfying conclusion. The course requires an oral and written presentation of the completed project. Prerequisites: senior class standing and permission of the instructor. Offered spring semesters only.