

# Physics (PHYS)

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## Courses

### PHYS A101 Physics of Sports 3 Credits

Introduces liberal arts students to the theory, methods and techniques of physics, the most basic of the sciences, using the theme of sports.

Provides broad exposure to many aspects of physics, including mechanics, friction and fluid flow, and how they apply to hockey, basketball, soccer, skiing, track and field, football, and other sports.

**Attributes:** UAA Natural Sciences GER.

### PHYS A115 Physical Science 3 Credits

Exposes students to basic concepts in physics. Presents general knowledge of science rather than an in-depth study of any one field.

**Registration Restrictions:** Placement into MATH A105 or higher.

### PHYS A115L Physical Science Lab 1 Credit

Exposes students to basic concepts in physics labs. Presents general knowledge of science rather than an in-depth study of any one field.

**Prerequisites:** PHYS A115 with a minimum grade of D or concurrent enrollment.

### PHYS A123 College Physics I 3 Credits

Algebra-based introduction to classical physics, including: kinematics, Newton's Laws, momentum, work, energy, gravity, rotational motion, fluids, heat, temperature, and laws of thermodynamics.

**Special Note:** PHYS A123L is a separate laboratory course.

**Prerequisites:** MATH A105 with a minimum grade of C or MATH A151 with a minimum grade of C or MATH A152 with a minimum grade of C or MATH A251 with a minimum grade of C or MATH A251F with a minimum grade of C or ALEKS Overall Test 1 with a score of 055 or ALEKS Overall Test 2 with a score of 055 or ALEKS Overall Test 3 with a score of 055 or ALEKS Overall Test 4 with a score of 055 or ALEKS Overall Test 5 with a score of 055.

**Attributes:** UAA Natural Sciences GER.

### PHYS A123L College Physics I Laboratory 1 Credit

Introductory physics laboratory with experiments in mechanics, fluids and thermodynamics.

**Prerequisites:** PHYS A123 with a minimum grade of C or concurrent enrollment.

**Attributes:** UAA Natural Sci Lab Only GER.

### PHYS A123R College Physics I Problem Solving 1 Credit

Techniques of problem solving for material covered in PHYS A123. Includes student discussion and presentation of solutions.

**Corequisites:** PHYS A123.

### PHYS A124 College Physics II 3 Credits

Algebra-based introduction to classical physics, including: Coulomb's law, electrical potential, electric circuits, capacitance, Kirchhoff's laws, magnetic fields, Faraday's law, electromagnetic waves, physical and geometric optics, waves, and particles. Additional topics include: oscillations.

**Special Note:** PHYS A124L is a separate laboratory course.

**Prerequisites:** PHYS A123 with a minimum grade of C.

**Attributes:** UAA Natural Sciences GER.

### PHYS A124L College Physics II Laboratory 1 Credit

Introductory physics laboratory with experiments in electricity and magnetism, waves, and optics.

**Prerequisites:** (PHYS A123 with a minimum grade of C and PHYS A123L with a minimum grade of C) and PHYS A124 with a minimum grade of C or concurrent enrollment.

**Attributes:** UAA Natural Sci Lab Only GER.

### PHYS A124R College Physics II Problem Solving 1 Credit

Techniques of problem solving for material covered in PHYS A124. Includes student discussion and presentation of solutions.

**Corequisites:** PHYS A124.

### PHYS A130 Survey of College Physics 3 Credits

Introduction to core principles of physics in classical mechanics, waves, electricity and magnetism, and optics. Specifically designed to prepare students for entry into calculus based physics.

**Prerequisites:** MATH A105 with a minimum grade of C or MATH A151 with a minimum grade of C or MATH A152 with a minimum grade of C or MATH A251 with a minimum grade of C or MATH A251F with a minimum grade of C or ALEKS Overall Test 1 with a score of 055 or ALEKS Overall Test 2 with a score of 055 or ALEKS Overall Test 3 with a score of 055 or ALEKS Overall Test 4 with a score of 055 or ALEKS Overall Test 5 with a score of 055.

### PHYS A211 General Physics I 3 Credits

Calculus-based introduction to classical mechanics, including: kinematics, Newton's Laws, momentum, work, energy, gravity, rotational motion, oscillations and fluids.

**Special Note:** PHYS A211L is a separate laboratory course.

**Registration Restrictions:** Advanced Placement (AP) Physics 1 score of 3 or higher can fulfill the PHYS A130 prerequisite with instructor approval

**Prerequisites:** (PHYS A130 with a minimum grade of C or UAA PHYS A211 Placement Exam with a score of 18) and (MATH A251 with a minimum grade of C or MATH A251F with a minimum grade of C) and (MATH A252 with a minimum grade of C or concurrent enrollment or MATH A252F with a minimum grade of C or concurrent enrollment).

**Attributes:** UAA Natural Sciences GER.

### PHYS A211L General Physics I Laboratory 1 Credit

Calculus-based introductory physics laboratory with experiments in computerized data collection and analysis, mechanics, waves, elasticity and wave motion.

**Prerequisites:** PHYS A211 with a minimum grade of C or concurrent enrollment.

**Attributes:** UAA Natural Sci Lab Only GER.

### PHYS A211R General Physics I Problem Solving 1 Credit

Techniques of problem solving for material covered in PHYS A211. Includes student discussion and presentation of solutions in a small-group setting.

**Corequisites:** PHYS A211.

**PHYS A212 General Physics II 3 Credits**

Calculus-based introduction to classical physics, including: Coulomb's Law, electrical potential, electric circuits, capacitance, Kirchoff's Laws, Biot-Savart Law, Faraday's Law and electromagnetic waves.

**Special Note:** Additional topics include waves and sound.

PHYS A212L is a separate laboratory course.

**Prerequisites:** (MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C) and MATH A253 with a minimum grade of C or concurrent enrollment and PHYS A211 with a minimum grade of C.

**Attributes:** UAA Natural Sciences GER.

**PHYS A212L General Physics II Laboratory 1 Credit**

Calculus-based introductory physics laboratory with experiments in electric and magnetic fields, geometric and physical optics, and light.

**Prerequisites:** PHYS A211 with a minimum grade of C and PHYS A211L with a minimum grade of C and PHYS A212 with a minimum grade of C or concurrent enrollment.

**Attributes:** UAA Natural Sci Lab Only GER.

**PHYS A212R General Physics II Problem Solving 1 Credit**

Techniques of problem solving for material covered in PHYS A212. Includes student discussion and presentation of solutions.

**Special Note:** This course does not meet General Education Requirements.

**Corequisites:** PHYS A212.

**PHYS A214 Waves, Thermodynamics and Electricity 3 Credits**

Calculus-based study of waves and sound, thermodynamics, and electricity, including electrical circuits.

**Prerequisites:** (MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C) and MATH A253 with a minimum grade of C or concurrent enrollment and PHYS A211 with a minimum grade of C.

**PHYS A214L Waves, Thermodynamics and Electricity Laboratory 1 Credit**

Calculus-based introductory physics laboratory with experiments in waves and sound, electric fields, circuits, and thermodynamics.

**Registration Restrictions:** If the equivalent of PHYS A214 is taken from another institution, it must be completed prior to taking PHYS A214L.

**Prerequisites:** PHYS A211 with a minimum grade of C and PHYS A211L with a minimum grade of C and PHYS A214 with a minimum grade of C or concurrent enrollment.

**PHYS A303 Modern Physics 3 Credits**

Introduces modern physics, primarily special relativity and quantum mechanics. Applies these topics to the quantum structure of atoms, molecules, and solids; lasers; nuclear/particle physics and cosmology.

**Prerequisites:** MATH A302 with a minimum grade of C and PHYS A212 with a minimum grade of C.

**PHYS A311 Intermediate Classical Mechanics 3 Credits**

Newtonian, Lagrangian, and Hamiltonian mechanics, dynamics of systems of particles and rigid bodies.

**Prerequisites:** MATH A302 with a minimum grade of C and PHYS A212 with a minimum grade of C.

**PHYS A314 Electromagnetics 3 Credits**

Electromagnetic theory and applications. Static electric fields in free space and material media; steady current systems and associated magnetic effects. Includes electrostatics, magnetostatics, Maxwell's equations, electromagnetic wave propagation and transmission lines. Application of Maxwell's equations to engineering systems.

**Crosslisted With:** EE A314.

**Prerequisites:** PHYS A212 with a minimum grade of C and PHYS A212L with a minimum grade of C and MATH A302 with a minimum grade of C.

**PHYS A320 Simulation of Physical Systems 3 Credits**

Introduces methods of computer simulation with diverse applications in physics such as numerical integration of Newton's equation, cellular automata, random walks, Monte Carlo methods, percolation and the dynamics of many body systems. No prior programming experience is required.

**Prerequisites:** (MATH A252 with a minimum grade of C or MATH A252F with a minimum grade of C) and (PHYS A124 with a minimum grade of C or PHYS A212 with a minimum grade of C).

**PHYS A324 Electromagnetics II 3 Credits**

Use of Maxwell's equations in analysis of plane wave propagation, wave reflection, radiation and antennas, waveguides, cavity resonators, transmission lines, and radio propagation.

**Crosslisted With:** EE A324.

**Prerequisites:** EE A314 with a minimum grade of C or PHYS A314 with a minimum grade of C.

**PHYS A362 Optics 4 Credits**

Interaction of light with matter: theory of geometric and nonlinear optics, Fourier optics, coherence theory, lasers, and additional topics of interest. Practical experience with relevant theories through laboratory projects including investigation of diffraction, interference and polarization. Design and construction of a telescope, a microscope and an interferometer.

**Prerequisites:** PHYS A212 with a minimum grade of C and PHYS A212L with a minimum grade of C.

**PHYS A381 Advanced Physics Laboratory 3 Credits**

Theory and practical application of topics in upper-division physics, using advanced laboratory experiments and techniques with statistical and error analysis of data.

**Prerequisites:** PHYS A303 with a minimum grade of C or concurrent enrollment.

**PHYS A403 Quantum Mechanics 4 Credits**

Fundamentals of quantum mechanics including applications to the hydrogen atom, particle spin and perturbation theory.

**Special Note:** Not available for credit to students who have completed PHYS A603.

**May Be Stacked With:** PHYS A603

**Prerequisites:** PHYS A303 with a minimum grade of C and MATH A314 with a minimum grade of C.

**PHYS A413 Statistical and Thermal Physics 4 Credits**

Principles of applications of statistical mechanics and thermodynamics.

**Special Note:** Not available for credit to students who have completed PHYS A613.

**May Be Stacked With:** PHYS A613

**Prerequisites:** PHYS A212 with a minimum grade of C.

**PHYS A456 Nonlinear Dynamics and Chaos 3 Credits**

An introduction to nonlinear dynamics and chaos. Concrete examples from physics, biology, chemistry, and engineering are used to develop analytical methods and geometric intuition. Topics covered include phase plane analysis, iterated maps, fractals, and strange attractors.

**Registration Restrictions:** Completion of GER Tier 1 (basic college-level skills) courses and junior standing.

**Prerequisites:** MATH A253 with a minimum grade of C and (PHYS A124 with a minimum grade of C or PHYS A212 with a minimum grade of C).

**Attributes:** UAA Integrative Capstone GER.

**PHYS A490 Special Topics in Physics 1-4 Credits**

Detailed study of a selected topic in physics.

**Special Note:** May be repeated for credit with a change of topic for a maximum of 12 credits. Not available for credit to students who have completed PHYS A690 with the same topic.

**May Be Stacked With:** PHYS A690

**Prerequisites:** PHYS A303 with a minimum grade of C.

**PHYS A498 Individual Research 1-6 Credits**

Research projects to be arranged with individual faculty members who will direct the research program.

**Special Note:** May be repeated for a maximum of 6 credits.

**Registration Restrictions:** Department permission.

**PHYS A603 Advanced Quantum Mechanics 4 Credits**

Mathematical foundations of quantum mechanics and advanced applications to the hydrogen atom, particle spin and perturbation theory. Includes review of current literature and/or independent research on the topic.

**Special Note:** Not available for credit to students who have completed PHYS A403.

**Registration Restrictions:** Graduate standing and approval of faculty advisor.

**May Be Stacked With:** PHYS A403

**PHYS A613 Advanced Statistical and Thermal Physics 4 Credits**

Principles and advanced applications of statistical mechanics and thermodynamics. Include review of current literature and/or independent research on the topic.

**Special Note:** Not available for credit to students who have completed PHYS A413.

**Registration Restrictions:** Graduate standing and approval of faculty advisor.

**May Be Stacked With:** PHYS A413

**PHYS A690 Advanced Special Topics in Physics 1-4 Credits**

Detailed study of a selected topic in physics at the graduate level.

Includes review of current literature and/or independent research on the topic.

**Special Note:** May be repeated with change of topic for a maximum of 12 credits. Not available for credit to students who have completed PHYS A490 with the same topic.

**Registration Restrictions:** Graduate standing and approval of faculty advisor.

**May Be Stacked With:** PHYS A490

**PHYS A698 Graduate Individual Research 1-6 Credits**

Research projects to be arranged with individual faculty members who will direct the research program.

**Special Note:** May be repeated for a maximum of 12 credits.

**Registration Restrictions:** Graduate standing and approval of faculty advisor

**PHYS A699 Thesis 1-6 Credits**

Involves planning, preparation and completion of a graduate level thesis.

**Special Note:** May be repeated for a maximum of 12 credits.

**Registration Restrictions:** Graduate standing and instructor approval