

PHYSICS

Program Overview

Physics students at Rider develop a rigorous understanding of the natural world and the forces that govern it through a combination of traditional classes and hands-on laboratory experience. The small classes focus on a variety of topics including classical and modern physics, as well as scientific computing techniques and astrophysics. Physics students are presented with multiple research opportunities with our faculty, who actively attend national meetings and publish in international peer-reviewed journals.

The physics minor helps students seeking entrance to graduate or medical school as well as careers in physics, law, education, and business. This minor helps students develop laboratory skills, written and oral skills, as well as understanding how the laws of physics apply and can be manipulated or utilized in the real world.

Minor Offered

- Minor in Physics

Contact

Md Liakat Ali, Ph.D.

Associate Professor

Department of Computer Science and Physics
School of Science, Technology and Mathematics
Hennessy Science and Technology Center
609-895-5434
mdali@rider.edu

Program Website: Physics (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/undergraduate/physics-minor/>)

Associated Department: Department of Computer Science and Physics (<https://www.rider.edu/academics/colleges-schools/college-arts-sciences/science-technology-math/faculty-departments/computer-science-physics/>)

Related programs:

- Computer Science (<http://catalog.rider.edu/undergraduate/colleges-schools/arts-sciences/majors-minors-certificates/computer-science/>)

Physics Minor Requirements

(20 credits)

Code	Title	Credits
PHY 200 & 200L	General Physics I and General Physics I Lab	4
PHY 201 & 201L	General Physics II and General Physics II Lab	4
PHY 203	Introduction to Modern Physics	3
PHY 300	Mechanics	3
PHY 305	Electricity and Magnetism	3
One additional 300- or 400-level physics (PHY) course		3
Total Credits		20

Courses and Descriptions

PHY 200 General Physics I 4 Credits

Introductory classical physics; Newtonian mechanics, including the conservation laws, wave motion, gravity, thermodynamics. Three hours of lecture and one three-hour lab per week. Prerequisite(s): MTH 210 or concurrent enrollment

Corequisite(s): PHY 200L.

PHY 200L General Physics I Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): PHY 200.

PHY 201 General Physics II 4 Credits

A continuation of the concepts developed in Physics 200. Electricity, electrical circuits, magnetism, Maxwell's equations. Light and optics, including lenses, interference, and diffraction. Three hours of lecture and one three-hour lab per week. Prerequisite(s): PHY 200, MTH 211 or concurrent enrollment.

Corequisite(s): PHY 201L.

PHY 201L General Physics II Lab 0 Credits

This lab is a co-requisite and must be taken with the corresponding course.

Corequisite(s): PHY 201.

PHY 203 Introduction to Modern Physics 3 Credits

Covers space-time relativity, elementary particles, and basic quantum mechanics, including solutions of the Schrodinger wave equation. Applications of quantum theory in atomic, nuclear, and solid-state physics.

Prerequisite(s): PHY 201 or permission of instructor.

PHY 300 Mechanics 3 Credits

Kinematics and dynamics of particles and systems, analysis of harmonic oscillator systems, normal modes, Lagrangian and Hamiltonian dynamics and classical waves are studied.

Prerequisite(s): PHY 201, MTH 250.

PHY 305 Electricity and Magnetism 3 Credits

Electro- and magnetostatics, fields and potentials, and boundary value problems are covered.

Prerequisite(s): PHY 201, MTH 250.

PHY 310 Advanced Electricity and Magnetism 3 Credits

Maxwell's equations; electromagnetic waves in vacuum and in material media; radiation, propagation, reflection, and refraction.

Prerequisite(s): PHY 305, MTH 308.

PHY 315 Thermodynamics and Statistical Mechanics 3 Credits

Thermodynamic systems; the first and second laws of thermodynamics; entropy and thermodynamic potentials; distribution of molecular speeds; Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac distributions.

Prerequisite(s): PHY 201.

PHY 320 Quantum Mechanics 3 Credits

Historical background; the Bohr Theory; the Schrodinger equation, its interpretation and applications; the uncertainty and exclusion principles; development of the formalism.

Prerequisite(s): PHY 300.

PHY 330 Basic Electronics 3 Credits

An experimental study of devices and circuits in analog and digital electronics. No previous experience with electronic circuits is assumed; introductory topics including signal acquisition, computer interfaces, and analog/digital signal processing will be covered. One hour of lecture plus two three-hour labs per week.

Prerequisite(s): PHY 201 or permission of instructor.

PHY 350 Advanced Laboratory 2 Credits

Experiments in atomic and nuclear physics, electricity and magnetism, and physical optics. Students have the opportunity to work intensively on a particular experiment. Minimum of five to six hours per week.

PHY 400 Atomic Physics 3 Credits

Quantum mechanics and the one-electron atom; atomic structure and optical spectra of multi-electron atoms. Quantum statistics, band theory of solids.

Prerequisite(s): PHY 320.

PHY 405 Fundamentals of Nuclear Physics 3 Credits

Nuclear mass and size; nuclear forces and some models of the nucleus; radioactivity and detection; subnuclear particles and resonances.

Prerequisite(s): PHY 320.

PHY 415 Physical Optics 3 Credits

Waves and the superposition principle; interference, Fraunhofer and Fresnel diffraction; electromagnetic nature of light; absorption and scattering; dispersion; polarization.

Prerequisite(s): PHY 201, MTH 250.

PHY 416 Modern Experimental Optics Lab 1 Credits

A laboratory course in geometrical and physical (wave) optics, designed to supplement the material presented in PHY 415. Serves as an introduction to the optical equipment and techniques that are employed in laboratory research. A series of experiments cover the topics of polarization, interference, image formation, Fourier optics and lasers, and optical spectroscopy.

Prerequisite(s): PHY 201.

PHY 450 Topics in Modern Physics 3 Credits

A selected topic of contemporary interest in physics, e.g., general relativity and gravity waves, is studied. Emphasis on current journal literature and research. May be taken more than once with departmental approval. An excellent introduction to independent research in one area of physics.

Prerequisite(s): PHY 201.

PHY 490 Independent Study: Research and Creative Expression 1-4 Credits

Immerses the student in laboratory research. The student learns to organize material, use the literature, make precise measurements, and obtain reproducible data. If possible, the student will publish the results or present them at a scientific meeting. Available to majors/minors only. Approval of the faculty sponsor, department chair, and CAS dean's office is required. Only one project may be scheduled in a semester and up to 12 semester hours of independent study may count toward graduation.

Prerequisite(s): A minimum of 45 credits and 3.0 GPA.

PHY 491 Internship in Physics 1-4 Credits

A supervised research experience in an approved organization where qualified students gain real-world knowledge and utilize their academic training in a professional environment. Placement may be in private, public, non-profit, or governmental organizations under the guidance of a mentor. The mentor and student will have regular consultations with the departmental internship coordinator to assess the student's progress. Normally, 50 hours of internship per credit is required. The grade for the course will be determined by the student's overall performance in their research work, a research paper documenting their work with their internship mentor and an oral or poster presentation at the end of the semester. Available to majors/minors only. One can be scheduled in a semester and up to 8 credits of internship may count toward graduation. Approval of the faculty sponsor, department chair, and CAS dean's office is required.

Prerequisite(s): A minimum of 45 credits and 2.5 GPA.