PH-Physics Courses

Courses

PH 100. Preparatory Physics. 3 Hours.
Designed primarily for students in need of preparation for PH 201 or PH 221. Vectors, kinematics, and dynamics, including conservation laws. Emphasis placed on methods of analyzing physics problems, setting up equations for physics problems, and interpreting information in physics problems.
Prerequisites: MA 106 [Min Grade: C] or MA 107 [Min Grade: C] or MA 125 [Min Grade: C] or MA 225 [Min Grade: C]

PH 103. Understanding the World Through Data. 3 Hours.
This course is designed to provide students of all disciplines with an introduction to using data and models to understand systems. This course features a carefully guided and curated selection of introductory-level topics related to modeling and simulation. Emphasis is placed on developing the inductive and deductive reasoning skills specific to the use of models in the physical sciences. Students will make and explore conjectures about data in a variety of disciplines, including physics, data science, biology, the social sciences, business, and finance. Students will be introduced to the use of simple models to visualize and qualitatively understand quantitative information via the Python programming language. No prior programming experience is necessary. This course meets Blazer Core Quantitative Literacy with a Flag in High Impact Practices/Collaborative Assignments.

PH 104. Community Data Research. 3 Hours.
Working with a team of other undergraduate students, students will engage in team-based/project-based learning opportunities to find answers to real-world data analysis questions relevant to Birmingham. This course is designed to provide students of all disciplines with a local experiential learning opportunity in data analysis and data communication by using the department of Physics expertise in Computational and Data-Driven Materials Physics Research. Students learn to solve problems by using data analysis and deliver data projects with relevance to our local community interests, local quality of life, and local economic development. This course features a carefully guided and curated selection of introductory-level topics related to data analytics and data modeling. Data analysis tools used within the context of the course are of relevance for the local and national STEM and data workforce. Emphasis is placed on developing inductive and deductive reasoning skills specific to the analysis of data and on using computational tools for model development and testing. Students will make and explore conjectures about data in a variety of disciplines, by using techniques developed in the fields of computational and data science and data-driven materials physics to understand social science, business, and finance data. Students will be introduced to the use of simple models to visualize and qualitatively understand quantitative information. Students will work as part of a team to design and develop data analysis. This course meets Blazer Core City as a Classroom with flags in Civic Engagement & Collaborative Assignments and Projects.

PH 110. Topics in Contemporary Physics. 1 Hour.
The objective of this course is to introduce incoming freshmen to the different areas of physics and to topics that physicists are working on today. Through lectures and seminars by members of the UAB physics faculty, students are introduced to the UAB Department of Physics community, their research activities, and career opportunities for graduates in the various tracks of the Physics Undergraduate Program. Course required for physics majors in the first fall semester of residency.

PH 191. Co-operative Work Program. 2-3 Hours.
Co-Op Work Program.

PH 201. College Physics I. 4 Hours.
First term of non-calculus based physics. Linear and planar motion, Newton's laws, work and energy, gravitation, momentum, rigid body motion, elasticity, oscillations, waves, sound, fluids, ideal gases, heat and thermodynamics. Lecture and laboratory. Quantitative Literacy is a significant component of this course. This course meets Blazer Core Scientific Inquiry with a Flag in High Impact Practices/Collaborative Assignments and Projects.
Prerequisites: (MA 106 [Min Grade: C] or MA 106 [Min Grade: P]) or (MA 107 [Min Grade: C] or MA 107 [Min Grade: P]) or (MA 125 [Min Grade: C] or MA 125 [Min Grade: P]) or PH 100 [Min Grade: C] or MA 225 [Min Grade: C] or (MA 126 [Min Grade: C] or MA 126 [Min Grade: P]) or MA 226 [Min Grade: C] or (A02 25 and HSCG 3.5) or (A02 26 and HSCG 3.0) or A02 27 or (SAT2 580 and HSCG 3.5) or (SAT2 600 and HSCG 3.0) or SAT2 620 or MAC2 16 or MTH5 80 or (S02 600 and HSCG 3.5) or (S02 620 and HSCG 3.0) or S02 640 or MTH5 75 or MPL 76

PH 201L. College Physics Laboratory I. 0 Hours.
Laboratory for PH 201. Lecture, laboratory, and recitation must be taken concurrently.

PH 201R. College Physics I Recitation. 0 Hours.
First term of non-calculus based physics. Linear and planar motion, Newton s Law, work and energy, gravitation, momentum, rigid body motion, statics, elasticity, oscillations, waves, sound, fluids, ideal gases, heat,and thermodynamics. Lecture, laboratory, and recitation must be taken concurrently.

PH 202. College Physics II. 4 Hours.
Second term of non-calculus based physics. Electricity and magnetism, optics, and modern physics. Lecture, laboratory, and recitation must be taken concurrently. This course meets Blazer Core Scientific Inquiry with Flags in High Impact Practices/Collaborative Assignments and Projects and High Impact Practices/Undergraduate Research.
Prerequisites: PH 201 [Min Grade: C] or PH 221 [Min Grade: C]

PH 202L. College Physics Laboratory II. 0 Hours.
Laboratory for PH 202. Lecture, laboratory, and recitation must be taken concurrently.

PH 202R. College Physics II - Recitation. 0 Hours.
Second term of non-calculus based physics sequence covering electricity and magnetism, optics, and modern physics. Lecture, laboratory, and recitation must be taken concurrently.

PH 211. College Physics I Laboratory. 0-1 Hours.
College Physics I Laboratory.

PH 212. College Physics II Lab. 1 Hour.

PH 221. General Physics I. 4 Hours.
First term of introductory, calculus-based general physics sequence covering classical mechanics: measurements, kinematics, vectors, translational and rotational dynamics, work, energy, momentum, statics, oscillatory motion, wave motion, and sound. Lecture and laboratory. Quantitative Literacy is a significant component of this course. PH 221 General Physics I – Honors: This section of PH 221 is designed for students with strong interests and preparation in science, mathematics, and/or engineering. Topics are covered with more mathematical rigor and in greater depth than in regular sections. Second term of non-calculus based physics. Electricity and magnetism, optics, and modern physics. Lecture, laboratory, and recitation must be taken concurrently. This course meets Blazer Core Scientific Inquiry with a Flag in High Impact Practices/Collaborative Assignments and Projects.
Prerequisites: MA 125 [Min Grade: C] or MA 225 [Min Grade: C]

PH 221L. General Physics Laboratory I. 0 Hours.
Laboratory for PH 221. Lecture, laboratory, and recitation must be taken concurrently.

PH 221R. General Physics I Recitation. 0 Hours.
First term of introductory, calculus-based general physics sequence covering classical mechanics: measurements, kinematics, vectors, translational and rotational dynamics, work, energy, momentum, statics, oscillatory motion, wave motion, and sound. Lecture, laboratory, and recitation must be taken concurrently.

PH 222. General Physics II. 4 Hours.
Second term of introductory, calculus-based general physics sequence covering electricity and magnetism: Coulomb's Law, electric fields, Gauss' Law, potential, capacitors and dielectrics, Ohm's Law, DC circuits, magnetic fields, Ampere's Law, Biot-Savart Law, Faraday's Law, inductance, AC circuits, geometrical and physical optics. Lecture, Laboratory, and Recitation must be taken concurrently. PH 222 General Physics II Honors: This section of PH 222 is designed for students with strong interests and preparation in science, mathematics, and/or engineering. Topics are covered with more mathematical rigor and in greater depth than in regular sections. This course meets Blazer Core Scientific Inquiry with Flags in High Impact Practices/Collaborative Assignments and Projects and High Impact Practices/Undergraduate Research.
Prerequisites: PH 221 [Min Grade: C] and (MA 126 [Min Grade: C] or MA 226 [Min Grade: C])

PH 222L. General Physics Laboratory II. 0 Hours.
Laboratory for PH 222. Lecture, Laboratory, and Recitation must be taken concurrently.

PH 222R. General Physics II - Recitation. 0 Hours.
Second term of introductory, calculus-based general physics sequence covering electricity and magnetism, Coulomb's Law, electric fields, Gauss' Law, potential, capacitors, and dielectrics, Ohm's Law, DC circuits, magnetic fields, Ampere's Law, Biot-Savart Law, Faraday's Law, inductance, AC circuits, geometrical and physical optics. Lecture, laboratory, and recitation must be taken concurrently.

PH 223. General Physics III: Thermodynamics & Quantum Physics. 4 Hours.
Study of topics in thermodynamics (including the kinetic theory of gases, as well as first and second laws of thermodynamics) and modern physics (including atomic structure, quantum mechanics, and applications to condensed matter, nuclear and particle physics). Specific applications in medical physics will also be discussed. Emphasis on the use of quantitative reasoning to solve thermodynamics and quantum physics problems. Writing and scientific ethics assignments based on laboratory experiences. Lecture and laboratory. Writing, Quantitative Literacy and Ethics and Civic Responsibility are significant components of this course.
Prerequisites: PH 222 [Min Grade: C]

PH 223L. General Physics Laboratory III. 0 Hours.
Laboratory for PH 223. Experimental work in the topics associated with PH 223, including atomic structure, quantum physics, and solid state physics. Successful students will develop their ability to collect and analyze experimental data, interpret the results, and present their findings in a clear, concise, and convincing way. Writing, Quantitative Literacy and Ethics and Civic Responsibility are significant components of this course.

PH 231. General Physics I Laboratory. 0-1 Hours.
General Physics I Laboratory.

PH 232. General Physics II Laboratory. 1 Hour.
General Physics II Laboratory.

PH 291. Physics Research Experiences. 3 Hours.
Physics Research Experiences (PH 291) is a 3 semester-hour course that provides students with the opportunity to participate in the design/discovery efforts of research teams under the supervision of an approved UAB faculty mentor, and to assist faculty and graduate students with research and development issues in their areas of expertise.

PH 299. Reasoning through Modeling and Simulation of Data. 3 Hours.
This course provides in-depth coverage of modeling and simulation topics with a focus on the use of acquired knowledge for project-based cooperative learning. Students will learn to reason in terms of models and will learn how well-validated models are used to understand data and make sense of complex systems in the physical sciences. Students will work with a team of peers and the course instructor to develop modeling and computational knowledge and skills, and apply them to the analysis of real-world data sets. Students will engage in modeling and simulation in areas including physics, data science, biology, the social sciences, and business and finance. This course introduces students to a variety of powerful modeling methods used in physics, which are ubiquitous across many fields of study. Students will be introduced to simulation via the Python programming language. No prior programming experience is necessary. This course meets Blazer Core Quantitative Literacy with Flags in High Impact Practices/Collaborative Assignments and Projects and High Impact Practices/Undergraduate Research.

PH 301. Instructional Astronomy I. 4 Hours.
Survey of selected topics in astronomy of the universe, stellar systems and solar systems with a focus on preparing to teach. Lecture and Laboratory must be taken concurrently.

PH 301L. Instructional Astronomy Laboratory. 0 Hours.
Laboratory for PH 301. Lecture and Laboratory must be taken concurrently.

PH 302. Instructional Physical Science. 4 Hours.
Lecture and discussion in areas of the physical sciences importance to basic scientific literacy and to current technology, with a focus on preparing to teach. Must be taken concurrently with PH 302L.

PH 302L. Instructional Physical Science Laboratory. 0 Hours.
Laboratory for PH 302.

PH 304. Intermediate Mechanics. 3 Hours.
Intermediate treatment of the kinematics and dynamics of classical systems.Presentation of problem solving techniques is emphasized.
Prerequisites: PH 222 [Min Grade: C]

PH 305. Intermediate Electricity and Magnetism. 3 Hours.
Intermediate treatment of electricity and magnetism including fields, potential, induction, Maxwell's equations, circuits. Presentation of problem solving techniques is emphasized.
Prerequisites: PH 222 [Min Grade: C]

PH 310. Introduction to Quantum Computing. 3 Hours.
This course introduces students to the world of quantum computation and quantum information. Students will engage in learning key algorithms and their implementations using quantum circuits. Students will develop an understanding of the major differences between traditional (classical) and modern quantum computing. Through coding and quantum simulations using Python programming language, students will develop an understanding of quantum computing models and basic algorithms — e.g., Deutch-Jozsa, Simon, Quantum Fourier transform, Shor, and Grover's search algorithm. No prior programming experience is necessary. By discussing interdisciplinary topics in materials and device physics, students will also develop an appreciation for the quantum hardware necessary to run these algorithms.
Prerequisites: PH 221 [Min Grade: C]

PH 331. Classical Thermodynamics. 3 Hours.
Introduction to thermal phenomena on a macroscopic and statistical basic, principles and laws governing them.
Prerequisites: PH 222 [Min Grade: C] and MA 227 [Min Grade: C]

PH 336. Physics of Current and Emerging Energy Technologies. 3 Hours.
The technologies involved in energy conversion, storage, and transmission, represent one of the cornerstones of modern civilization. In this course, the principles of mechanics, electromagnetism, thermodynamics, and quantum physics are applied to the understanding of current and emerging energy technologies. Topics include electrical power generation from conventional and renewable resources, electrochemical and thermal energy storage, as well as power transmission via electrical, optical, and superconducting systems.
Prerequisites: PH 222 [Min Grade: C]

PH 350. Computation, Theory, and Measurement in Quantum Physics and Relativity. 4 Hours.
An emphasis on the principles of experimental physics at an advanced level, including computational modeling/analysis via introduction to Python coding. Lectures focused on the theoretical basis of modern physics topics with applications in special relativity, quantum mechanics, atomic and nuclear structure, solid-state physics, semiconductors, lasers and nanotechnology.
Prerequisites: PH 223 [Min Grade: C] or PH 351 [Min Grade: C]

PH 350L. Computation, Theory, and Measurement in Quantum Physics and Relativity Laboratory. 0 Hours.
Laboratory for PH 350. Experimental work in the topics associated with PH 350 at a level of investigation to more strongly develop the connections between theory and experiment. Experiments are designed to verify fundamental concepts in modern physics and will integrate computer codes to analyze and visualize the data collected in the laboratory. Students will organize and maintain a rigorous laboratory notebook and will prepare/present scientific reports for these experiments as a major component of the course. Successful students will refine their data collection, analysis, and interpretation and scientific presentation skills. Writing, Quantitative Literacy and Ethics and Civic Responsibility are significant components of this course.

PH 397. Directed Reading in Physics I. 2-3 Hours.
Tutorial studies in physics offered by special arrangement. Permission of instructor.

PH 398. Directed Reading in Physics II. 2-3 Hours.
Tutorial studies in physics offered by special arrangement. Permission of instructor.

PH 410. Physics of Fluids and Polymer Solutions. 3 Hours.
This course provides an introduction to fluid mechanics and polymer physics appropriate for physics, engineering, chemistry, and biology majors. Topics include the concept of a fluid, the fluid as a continuum, properties of the velocity field, thermodynamic properties of a fluid, viscosity, pressure distribution in a fluid, basic physical laws of fluid mechanics, the Reynolds transport theorem, differential relations for a fluid particle, viscous flow, polymer solutions and thermodynamics, Brownian motion, diffusion equation, Fick's law, Stokes-Einstein equation and hydrodynamic radius of a polymer chain, and viscosity of polymer solutions.
Prerequisites: PH 221 [Min Grade: C] and MA 252 [Min Grade: C]

PH 418. Machine Learning Applications in Physics and Materials Science. 3 Hours.
This course covers interdisciplinary topics in data science, computer science, and materials physics, with a focus on introducing first-principles software based on density-functional theory and data-driven machine-learning discoveries for applications in materials science and other physics domains.
Prerequisites: PH 350 [Min Grade: C]

PH 420. Mathematical Methods of Physics I. 3 Hours.
Vector calculus. Curvilinear coordinate systems. Commonly encountered ordinary differential equations and special functions. Complex variables and contour integration. Partial differential equations, including solutions by Green function methods.
Prerequisites: PH 222 [Min Grade: C] and MA 252 [Min Grade: C] or EGR 265 [Min Grade: C]

PH 421. Mathematical Methods of Physics II. 3 Hours.
Vector calculus. Curvilinear coordinate systems. Commonly encountered ordinary differential equations and special functions. Complex variables and contour integration. Partial differential equations, including solutions by Green function methods.
Prerequisites: PH 420 [Min Grade: C]

PH 423. Computational Physics. 3 Hours.
Introduces symbolic and numerical computation through examples drawn from classical and modern physics, such as, classical mechanics, electromagnetism, and quantum mechanics. Emphasizes computer-based approaches to visualization, solution of ordinary differential equations, evaluation of integrals, and finding roots, eigenvalues, and eigenvectors.
Prerequisites: MA 252 [Min Grade: C] or EGR 265 [Min Grade: C] and PH 222 [Min Grade: C]

PH 424. Biomedical Optics. 3 Hours.
The objective in this class is to present an introduction to applied optics, with an emphasis on biomedical applications.
Prerequisites: PH 222 [Min Grade: C]

PH 425. Applications of Contemporary Optics I. 3 Hours.
Applied geometrical and wave optics. Paraxial ray optics, optical matrix theory, aberrations, optical imaging systems, and computer-based optical design. Optical interferometry, diffraction, holography, polarization phenomena, coherence theory, lasers, and Gaussian beam propagation.
Prerequisites: PH 222 [Min Grade: C]

PH 426. Applications of Contemporary Optics II. 3 Hours.
Applied geometrical and wave optics. Paraxial ray optics, optical matrix theory, aberrations, optical imaging systems, and computer-based optical design. Optical interferometry, diffraction, holography, polarization phenomena, coherence theory, lasers, and Gaussian beam propagation.
Prerequisites: PH 425 [Min Grade: C]

PH 427. Geometrical Optics. 4 Hours.
Properties of optical systems. Lenses, mirrors, and stops. Aberrations. Rays and wave fronts. Optical instruments. Aspheric components. Lecture and laboratory must be taken concurrently.
Prerequisites: PH 222 [Min Grade: C]

PH 427L. Geometrical Optics Laboratory. 0 Hours.
Laboratory for PH 427. Lecture and laboratory must be taken concurrently.

PH 428. Physical Optics. 4 Hours.
Interference and diffraction phenomena. Emission, propagation, and absorption of radiation. Polarization and dispersion. Stimulated emission. Lecture and laboratory must be taken concurrently.
Prerequisites: PH 222 [Min Grade: C]

PH 428L. Physical Optics Laboratory. 0 Hours.
Laboratory for PH 428. Lecture and laboratory must be taken concurrently.

PH 429. Applications of Contemporary Optics III. 3 Hours.
Optical interactions with materials, including nonlinear optical effects, such as birefringence, electro-optics, photoelasticity, crystal optics, acousto-optics, and phase conjugation. Optical spectroscopies, such as spectroscopic instrumentation, lasers as spectroscopic light sources, fluorescence and Raman laser spectroscopy, and applications of laser spectroscopy in chemistry, environmental research, materials science, biology, and medicine.
Prerequisites: PH 425 [Min Grade: C] and PH 426 [Min Grade: C]

PH 432. Statistical Thermodynamics I. 3 Hours.
Statistical basis of laws of thermodynamics. Ensembles and partition functions. Quantum statistics of ideal gases, including photons and electrons. Applications to solids, real gases, liquids, and magnetic systems. Transport theory.
Prerequisites: PH 223 [Min Grade: C]

PH 433. Statistical Thermodynamics II. 3 Hours.
Statistical basis of laws of thermodynamics. Ensembles and partition functions. Quantum statistics of ideal gases, including photons and electrons. Applications to solids, real gases, liquids, and magnetic systems. Transport theory.
Prerequisites: PH 432 [Min Grade: C] and PH 450 [Min Grade: C]

PH 435. Physics of Biomedical Processes and Technologies. 3 Hours.
Integrated study of the fundamentals and dynamical principles of mechanics, electromagnetism, and select quantum physics topics, with applications to biomechanical systems, biophysical networks, and bioimaging technologies.
Prerequisites: PH 461 [Min Grade: C] and PH 445 [Min Grade: C]

PH 436. Physics of Renewable Energy Systems. 3 Hours.
Integrated study of the fundamentals and dynamical principles of mechanics, electromagnetism, and select quantum physics topics, with applications to electrical power generation from renewable resources such as solar, wind, hydro, and ocean energy.
Prerequisites: PH 461 [Min Grade: C] and PH 445 [Min Grade: C]

PH 445. Electromagnetic Theory I. 3 Hours.
Electromagnetic theory approached from the standpoint of fields and using Maxwell's equations.
Prerequisites: PH 222 [Min Grade: C] and PH 420 [Min Grade: C]

PH 446. Electromagnetic Theory II. 3 Hours.
Electromagnetic theory approached from the standpoint of fields and using Maxwell's equations.
Prerequisites: PH 445 [Min Grade: C]

PH 447. Directed Reading in Electromagnetic Theory. 2-3 Hours.
Tutorial studies in electromagnetic theory offered by special arrangement.

PH 450. Introductory Quantum Mechanics I. 3 Hours.
Principles of quantum mechanics and their application to particle waves, angular momentum, tunneling, radiation, and selection rules. Perturbation and variational methods. Successful completion of PH 350 is recommended prior to registering for this class.
Prerequisites: PH 350 [Min Grade: C] and PH 461 [Min Grade: C]

PH 451. Introductory Quantum Mechanics II. 3 Hours.
Principles of quantum mechanics and their application to particle waves, angular momentum, tunneling, radiation, and selection rules. Perturbation and variational methods. Successful completion of PH 350 is recommended prior to registering for this class.
Prerequisites: PH 450 [Min Grade: C]

PH 452. Directed Reading in Quantum Mechanics. 2-3 Hours.
Tutorial studies in quantum mechanics offered by special arrangement.

PH 453. Introductory Solid State Physics I. 3 Hours.
Properties of crystal lattices, lattice dynamics, lattice imperfections, and bonding energies. Electronic properties of dielectrics, semiconductors, and metals. Ferroelectric, magnetic, and optical properties of solids.
Prerequisites: PH 450 [Min Grade: C](Can be taken Concurrently)

PH 454. Introductory Solid State Physics II. 3 Hours.
Properties of crystal lattices, lattice dynamics, lattice imperfections, and binding energies. Electronic properties of dielectrics, semiconductors,and metals.
Prerequisites: PH 453 [Min Grade: C]

PH 455. Molecular Spectroscopy. 3 Hours.
Molecular Spectroscopy.

PH 461. Classical Mechanics I. 3 Hours.
Kinematics and dynamics, including central forces, rotating coordinate systems, and generalized coordinates. Lagrangian, Hamiltonian, and other equivalent formulations of mechanics.
Prerequisites: PH 222 [Min Grade: C] and (MA 252 [Min Grade: C] or EGR 265 [Min Grade: C])

PH 462. Classical Mechanics II. 3 Hours.
Kinematics and dynamics, including central forces, rotating coordinate systems, and generalized coordinates. Lagrangian, Hamiltonian, and other equivalent formulations of mechanics.
Prerequisites: PH 461 [Min Grade: C]

PH 463. Directed Reading in Classical Mechanics. 2-3 Hours.
Tutorial studies in classical mechanics offered by special arrangement.

PH 467. Special Relativity. 3 Hours.
Principles and foundations of special relativity with applications to mechanics and electrodynamics.
Prerequisites: PH 446 [Min Grade: C] and PH 462 [Min Grade: C]

PH 468. General Relativity. 3 Hours.
Gravitational phenomena associated with and resulting from linear field equations. Equivalence principle, its implications of non-linear field, and physical consequences.

PH 469. Directed Reading in Physics. 2-3 Hours.
Tutorial studies in physics offered by special arrangement.

PH 471. Fundamentals of Spectroscopy. 3 Hours.
Explanation of phenomena related to rotational vibration and electronic spectroscopy of atoms and molecules; operational principles of spectroscopic tools including diffraction grating, waveguides and interferometers, basic group theory concepts and notation.

PH 475. Introduction to Biophysics I. 3 Hours.
Physics of biological systems: proteins, lipids, nucleic acids, supramolecular structures, and molecular motors; structure, function, energetics, thermodynamics, and bio-nanotechnology. Emphasis on systems that are best understood in physical and molecular detail. Systems will direct study, with modern physical methods introduced as needed.
Prerequisites: PH 223 [Min Grade: C]

PH 476. Introduction to Biophysics II. 3 Hours.
Physics of biological systems: proteins, lipids, nucleic acids, supramolecular structures, and molecular motors; structure, function, energetics, thermodynamics, and bio-nanotechnology. Emphasis on systems that are best understood in physical and molecular detail. Systems will direct study, with modern physical methods introduced as needed.
Prerequisites: PH 475 [Min Grade: C]

PH 481. Laser Physics I. 3 Hours.
Physical principles of laser operation and design. Spontaneous and stimulated emission, population inversion, light amplification, laser resonators, Q-switching, mode-locking, pulse shortening techniques, spectral narrowing, and tunable lasers. Individual types of lasers such as gas, solid state, dye, color center, and semiconductor. Practical applications of lasers as well as modern techniques and instrumentation in laser spectroscopy.
Prerequisites: PH 222 [Min Grade: C]

PH 482. Laser Physics II. 3 Hours.
Physical principles of laser operation and design. Spontaneous and stimulated emission, population inversion, light amplification, laser resonators, Q-switching, mode-locking, pulse shortening techniques, spectral narrowing, and tunablelasers. Individual types of lasers such as gas, solid state, dye, color center, and semiconductor. Practical applications of lasers as well as modern techniques and instrumentation in laser spectroscopy.
Prerequisites: PH 481 [Min Grade: C]

PH 485. Laser Spectroscopy. 3 Hours.
Fundamental principles, experimental techniques, instrumentation, and practical applications of laser spectroscopy.

PH 486. Semiconductor Materials in Modern Technology. 3 Hours.
Brief review of electronic materials with emphasis on traditional and cutting edge silicon technology. Competing and complementary semiconductors covered in standard lecture and seminar style. Materials: compound and tertiary semiconductors, organic semiconductors, and wide bandgap semiconductors. Applications: optical and chemical sensors, microwave electronics, high power electronics, and lasers. Specific applications and materials determined by student interests.
Prerequisites: PH 350 [Min Grade: C] or EE 351 [Min Grade: C] or CH 326 [Min Grade: C]

PH 487. Nanoscale Science and Applications. 3 Hours.
Physics of electronic, mechanical, and biological properties of materials at the nanoscale level approaching one billionth of a meter. The applications of nanoscale materials in electronic, mechanical, and biomedical systems will be emphasized. Special tools in synthesis and characterization of nanomaterials will be discussed.
Prerequisites: (PH 221 [Min Grade: C] and PH 222 [Min Grade: C]) or (CH 115 [Min Grade: C] and CH 117 [Min Grade: C])

PH 490. Preparations for Teaching. 1-4 Hour.
This class prepares physics majors for successful teaching experiences. The course emphasizes a foundation of practical knowledge related to expectations and duties shared by teachers in physics education, as well as an opportunity to read, reflect, and discuss current research related to physics teaching and learning in secondary and higher education.
Prerequisites: PH 350 [Min Grade: C]

PH 491. Advanced Physics Laboratory I. 1-4 Hour.
This course provides physics majors with the opportunity to integrate the physics knowledge acquired in earlier courses in a research environment under the supervision of an approved UAB faculty mentor.
Prerequisites: PH 350 [Min Grade: C]

PH 492. Advanced Physics Laboratory II. 1-4 Hour.
This course provides physics majors with the opportunity to integrate the physics knowledge acquired in earlier courses in a research environment under the supervision of an approved UAB faculty mentor.
Prerequisites: PH 491 [Min Grade: C]

PH 493. Advanced Physics Laboratory III. 1-4 Hour.
This course provides physics majors with the opportunity to integrate the physics knowledge acquired in earlier courses in a research environment under the supervision of an approved UAB faculty mentor.
Prerequisites: PH 492 [Min Grade: C]

PH 494. Research Methods in Physics. 1-3 Hour.
This course is designed to provide future physics teachers with the tools that physicists use to solve scientific problems; to give them the opportunity to use these tools in a physics laboratory setting; to make them aware of how scientists communicate with each other through peer-reviewed scientific literature; and to enable them to understand how scientists in general and physicists in particular develop new knowledge and insights, the most important of which are eventually presented in textbooks and taught in conventional science classes.
Prerequisites: EHS 126 [Min Grade: C]

PH 495. Honors Research. 1-3 Hour.
Research under the direction of a faculty sponsor and the Honors Committee. Admission to Departmental Honors in Physics required. May be repeated.
Prerequisites: PH 350 [Min Grade: C]

PH 497. Special Topics in Physics. 1-6 Hour.
Topics of current interest, such as theoretical physics, computational physics, experimental techniques. May be repeated for credit.

PH 498. Directed Research. 1-6 Hour.
Directed Research.

PH 499. Physics Capstone. 3 Hours.
Instructional sessions, conclusion of research or teaching project and career planning activities aimed at the integration of physics knowledge and competencies in scientific writing, quantitative literacy, and ethics and civic responsibility.
Prerequisites: PH 490 [Min Grade: C] or PH 491 [Min Grade: C] or PH 495 [Min Grade: C]