

# Department of Applied Mathematics and Physics

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*TBA, Interim Head*  
*Room 2072, Nevins Hall*

The Department of Applied Mathematics and Physics offers a variety of major and minor degree programs in Mathematics, Statistics, Physics and Astronomy. The major program is in Data Science. We also offer a certificate in Data Science which can be added to any major or done by non-degree-seeking students. You may explore the details of what we have to offer by clicking on Majors, Minors, Certificates and Courses above.

The programs in the department are designed to give the student the knowledge, skills, and values that build upon the foundation provided by the University Core Curriculum and that are required for professional careers in a STEM discipline like math or physics. The requirements of all the programs have been designed in keeping with national norms of excellence. Applied Mathematics is the use of powerful mathematical theory to solve complex real-world problems. Physics is the foundation science which deals with space, time, matter, energy, gravitation, electromagnetism, light, atoms, nuclei, and the fundamental forces of the universe. Astronomy is the science that deals with the origin, evolution, position, motion, and nature of all the bodies in the observable universe, including the Sun, planets, moons, stars, nebulae, and galaxies.

Students majoring in various disciplines may be able to gain work experience related to their major through the VSU Co-op Program. Such experience can prove valuable in terms of career exploration, acquisition of new skills, and career development. Students seeking more information should contact their academic advisors or the Office of Career Opportunities.

Bachelor of Science in Data Science (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/data-science/>)

- Minor in Applied Statistics (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/minor-applied-statistics/>)
- Minor in Astronomy (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/minor-astronomy/>)
- Minor in Mathematics (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/minor-mathematics/>)
- Minor in Online Data Science (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/minor-online-data-science/>)
- Minor in Physics (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/minor-physics/>)
- Online Data Science Certificate (<http://catalog.valdosta.edu/undergraduate/academic-programs/sciences-mathematics/applied-mathematics-physics/certificate-online-data-science/>)

## Astronomy

### **ASTR 1000. Introduction to the Universe. 3 Hours.**

A survey of the universe, examining the historical origins of astronomy; the motions and physical properties of the Sun, Moon, and planets; the formation, evolution, and death of stars; and the structure of galaxies and the expansion of the Universe.

### **ASTR 1010K. Astronomy of the Solar System. 4 Hours.**

Astronomy from early ideas of the cosmos to modern observational techniques. The solar system planets, satellites, and minor bodies. The origin and evolution of the solar system. Three lectures and one night laboratory session per week.

### **ASTR 1020K. Stellar and Galactic Astronomy. 4 Hours.**

The study of the Sun and stars, their physical properties and evolution, interstellar matter, star clusters, our Galaxy and other galaxies, the origin and evolution of the Universe. Three lectures and one night laboratory session per week.

### **ASTR 2010. Tools of Astronomy. 1 Hour.**

An introduction to observational techniques for the beginning astronomy major. Completion of this course will enable the student to use the campus observatory without direct supervision. The student will be given instruction in the use of the observatory and its associated equipment. Includes laboratory safety, research methods, exploration of resources (library and Internet), and an outline of the discipline.

### **ASTR 2020. The Planetarium. 1 Hour.**

Prerequisites: ASTR 1000, ASTR 1010K, ASTR 1020K, or permission of instructor. Instruction in the operation of the campus planetarium and delivery of planetarium programs. Completion of this course will qualify the student to prepare and give planetarium programs to visiting groups.

### **ASTR 2950. Directed Study. 0-3 Hours.**

Prerequisite: Consent of the instructor required. Supervised research on a specific astronomy project or topic as agreed upon by the instructor. A maximum of 6 credit hours may be taken, and they can only be applied toward the general elective requirements for the astronomy major.

**ASTR 3220. Cosmology. 3 Hours.**

Prerequisites: ASTR 1020K. A scientific and philosophical study of our perception of the universe, including the world views of Ptolemy, Copernicus, and Einstein.

**ASTR 3400. Planetary Geology. 3 Hours.**

Also offered as GEOL 3400. Prerequisites: ASTR 1010 or GEOL 1121 or GEOG 1113. Prerequisite or corequisite: PHSC 1100 or PHYS 1111 or PHYS 2211. A study of the geology of the terrestrial planets and solid-surface moons, asteroids, comets, and meteorites. The course will focus on comparative planetary geology, with emphasis on geologic processes on the surface, planetary interiors, and data collection methods such as remote sensing and image analysis.

**ASTR 3800. Astrobiology. 3 Hours.**

Prerequisites: Any one of the following: ASTR 1000, ASTR 1010K, ASTR 1020K, BIOL 1010, BIOL 1030, BIOL 2010, CHEM 1151K, CHEM 1211, PHYS 1111K, PHYS 2211K; and either MATH 1113 or MATH 2261. A multidisciplinary science course examining the possibility of extraterrestrial life in the solar system and the universe. Emphasis is on the definition of life from the perspectives of biology, chemistry, and physics, and the requirements for lifeforms. Extreme habitats where lifeforms might evolve will be explored in context with NASA's on-going exploration of the solar system and the search for intelligent life in the galaxy.

**ASTR 4101. Observational Techniques I. 4 Hours.**

Prerequisites: PHYS 2212K, ASTR 1010K, ASTR 1020K. Aspects of observational astronomy. Topics include spectroscopy, photometry, imaging, astrometry, and operation of the observatory.

**ASTR 4102. Observational Techniques II. 3 Hours.**

Prerequisite: ASTR 4101. Aspects of observational astronomy. Topics include radio astronomy, ultraviolet and x-ray astronomy, and data reduction techniques.

**ASTR 4400. Physics of the Solar System. 3 Hours.**

Celestial mechanics; physical features of the sun, planets, moons, and other material in the solar system.

**ASTR 4410. Astrophysics. 3 Hours.**

Prerequisite or corequisite: PHYS 4411. Radiative transfer in the stellar atmosphere, the interior structure of stars, stellar evolution, physical processes in gaseous nebulae and cosmology.

**ASTR 4800. Internship in Astronomy. 3-6 Hours.**

Active participation in research in astronomy, or in some field of science closely allied with astronomy, or work with a planetarium or museum which involves planetarium operations and programs. A daily log of activities, a report on the work done, and a research paper relating the work done to the field of astronomy are required.

**ASTR 4900. Special Topics in Astronomy. 1-6 Hours.**

Prerequisite: Consent of advisor and instructor. Topics to be assigned by instructor; may be taken more than once if topics are different; up to a total of 6 credit hours.

**ASTR 4950. Directed Study in Astronomy. 1-6 Hours.**

Prerequisites: Consent of advisor, instructor, and Department Head. Study in area or subject not normally found in established courses offered by the department; may also allow students to explore in more detail and/or depth an area or subject covered by the department in astronomy; up to a maximum of 6 credit hours.

## Mathematics

**MATH 0996. Support for Elementary Statistics. 2 Hours.**

Prerequisite: Placement into course by University guidelines. Co-requisite: MATH 1401. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1401.

**MATH 0997. Support for Quantitative Reasoning. 2 Hours.**

Prerequisite: Placement into course by University guidelines. Co-requisite: MATH 1001. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1001.

**MATH 0998. Support For Mathematical Modeling. 2 Hours.**

Prerequisite: Placement into course by University guidelines. Corequisite: MATH 1101. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1101.

**MATH 0999. Support for College Algebra. 2 Hours.**

Prerequisites: Placement into course by University guidelines. Corequisite: MATH 1111. Corequisite support to provide essential quantitative skills needed to be successful in MATH 1111.

**MATH 1001. Quantitative Reasoning. 3 Hours.**

A study of quantitative reasoning skills needed for informed citizens to understand the world around them. Topics include logic, proportional reasoning, basic probability, data analysis, and modeling from data with the appropriate use of technology. NOTE: Not intended for STEM majors.

**MATH 1101. Introduction to Mathematical Modeling. 3 Hours.**

A study of algebraic topics from a modeling perspective. Introduction to different types of models including linear, quadratic, polynomial, exponential, and logarithmic. Emphasis on gathering, presentation, and interpretation of data by using real-world examples as models.

**MATH 1111. College Algebra. 3 Hours.**

Algebraic topics including polynomials, rational expressions, equations, inequalities, graphing, exponents and radicals, relations and functions through exponential and logarithmic functions.

**MATH 1112. Trigonometry. 3 Hours.**

Prerequisite: MATH 1111, 1261, or 1113 with a grade of "C" or higher, or by mathematics placement policy. Circular, trigonometric, and inverse functions, mathematical induction, the binomial theorem, and complex numbers.

**MATH 1113. Precalculus. 3 Hours.**

Prerequisite: MATH 1112 with a grade of "C" or higher, or by mathematics placement policy. Study of polynomial, rational, and transcendental functions and applications, conic sections, polar coordinates, parametric equations, and mathematical induction.

**MATH 1113H. Honors Precalculus. 3 Hours.**

Prerequisite: MATH 1112 with a grade of "C" or higher, or by mathematics placement policy. Study of polynomial, rational, and transcendental functions and applications, conic sections, polar coordinates, parametric equations, and mathematical induction. Focus on concepts and real-world applications.

**MATH 1261. Survey of Calculus I. 3 Hours.**

Prerequisite: MATH 1101, 1111, 1112, 1113, or 1113H, with a grade of "C" or higher, or by mathematics placement policy. Topics include limits, continuity, differentiation of functions of one variable, and applications.

**MATH 1401. Elementary Statistics. 3 Hours.**

A non-calculus based introduction to statistics. Course content includes descriptive statistics, probability theory, confidence intervals, hypothesis testing, and other selected topics.

**MATH 1501. Calculus I. 4 Hours.**

Topics to include functions, limits, continuity, the derivative, antidifferentiation, the definite integral, and applications. Prerequisites: Math 1113 - Precalculus or its equivalent. For more information on this institution's eCore courses, please see <http://www.valdosta.edu/ecore/>.

**MATH 2008. Foundations of Numbers and Operations. 3 Hours.**

Prerequisite: MATH 1001, 1101, MATH 1111, MATH 1112, MATH 1113, 1401 with a grade of "C" or higher. An introductory mathematics course for early childhood education majors. This course will emphasize the understanding and use of the major concepts of number and operations. As a general theme, strategies of problem solving will be used and discussed in the context of various topics.

**MATH 2150. Introduction to Linear Algebra. 3 Hours.**

Prerequisite: MATH 2261 with a grade of "C" or higher. Systems of linear equations, matrices, determinants, and their properties; vectors and inner products; vector spaces; linear transformations; eigenvalues and eigenvectors. Special emphasis is placed on applications.

**MATH 2261. Analytic Geometry and Calculus I. 4 Hours.**

Prerequisite: MATH 1112 or MATH 1113 with a grade of "C" or higher, or by university placement policy. Introduction to limits, derivatives, integration, fundamental theorem of calculus, and applications.

**MATH 2262. Analytic Geometry and Calculus II. 4 Hours.**

Prerequisite: MATH 2261 with a grade of "C" or higher. Integrals; exponential, logarithmic, and inverse functions; applications of calculus; parametric equations; polar coordinates; sequences and series.

**MATH 2263. Analytic Geometry and Calculus III. 4 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. Three-dimensional analytic geometry; functions of several variables; partial derivatives; multiple integrals, line and surface integrals.

**MATH 2900. Mathematics Sophomore Seminar – Discrete Mathematics. 2 Hours.**

Prerequisites: MATH 2262 or MATH 2150 with a grade of "C" or better. An introduction to discrete mathematics with an emphasis on written and oral communication of the basic ideas of combinatorics and graph theory. Weekly presentation by students will be required as well as substantial final project that models standard research methods in mathematics.

**MATH 3010. History of Mathematics. 3 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. A study of the development of mathematics from primitive times to the twentieth century; including numeral systems, arithmetical methods, origins of algebra, geometry, trigonometry, analytic geometry, calculus; and selected topics from modern mathematics.

**MATH 3040. Set Theory. 3 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. Propositional and predicate logic; mathematical induction. Logic and structure of sets as related to mathematical proof. Relations and cardinality.

**MATH 3161. Mathematics for Early Childhood Teachers I. 3 Hours.**

Prerequisite: ECSE 2999 or DEAF 2999 and a grade of "C" or higher in MATH 2008. An in-depth study of the concepts and processes underlying the P-5 school mathematics curriculum, with special emphasis on numeration, number systems, estimation, algebraic thinking, and computational algorithms. Problem solving and historical context serve as unifying strands.

**MATH 3162. Mathematics for Early Childhood Teachers II. 3 Hours.**

Prerequisite: C or better in MATH 3161. An in-depth study of concepts and processes underlying the P-5 school mathematics curriculum with special emphasis on measurement, geometry, and the fundamentals of probability and statistics. Problem solving and historical context serve as unifying strands.

**MATH 3180. Mathematics for Middle School Teachers. 3 Hours.**

Prerequisite: Grade of "C" or higher in either MATH 1101, MATH 1111, MATH 1112, MATH 1113, MATH 1261, or MATH 2261. Concepts and processes that provide the foundation for the middle-grades mathematics curriculum (5-8). Includes an in-depth study of the real number system with emphasis on the rational number system and axiomatic differences among number systems. Other topics include relations and functions, geometry (including coordinate geometry and graphing), measurement, and elementary probability and statistics.

**MATH 3190. Algebra and Geometry for Teachers. 3 Hours.**

Prerequisite: Grade of "C" or higher is MATH 3180 or MATH 2261. An in-depth study of concepts and processes underlying the middle and secondary school mathematics curriculum with special emphasis placed upon the integrated development of algebra, geometry, and analytical geometry. Problem solving and historical context serve as unifying strands.

**MATH 3340. Ordinary Differential Equations. 3 Hours.**

Prerequisite: MATH 2262 with a grade of "C" or higher. Differential equations of first and second order, linear equations of higher order, and applications.

**MATH 3510. Foundations of Geometry. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. A study of the Euclidean and non-Euclidean plane geometry from both synthetic and metric approaches. Topics include concepts related to incidence, betweenness, plane separation and convexity, congruence, and parallelism, with some attention given to geometric transformations.

**MATH 3600. Probability and Statistics. 3 Hours.**

Prerequisite: Either MATH 2262 with a "C" or higher. Descriptive statistics, probability distributions for discrete and continuous random variables, statistical inference, one way analysis of variance, and regression analysis.

**MATH 3700. Statistical Computing. 3 Hours.**

Prerequisite: MATH 3600 or permission of instructor. Also offered as DATA 3700. A study of the basic tools for statistical computing. Topics include generating random variates; Monte Carlo integration; Monte Carlo methods for estimation and hypothesis tests; Bootstrap confidence interval; numerical methods for root-finding, integration, optimization; regression; and other modern topics.

**MATH 3900. Mathematical Theory of Interest. 3 Hours.**

Prerequisite: MATH 2262. A treatment of the mathematical theory and the practical applications of the various measures of interest. Included in the topics to be covered are simple and compound interest, continuous annuities, varying annuities, amortization, sinking funds, bonds, valuation of securities.

**MATH 4081. Modern Algebra I. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. Topics from groups, rings, and fields. Subgroups, cyclic groups, permutation groups, normal subgroups, homomorphisms, Cayley's and Lagrange's Theorems, factor groups, abelian groups, direct products. Introduction to rings and fields.

**MATH 4082. Modern Algebra II. 3 Hours.**

Prerequisite: MATH 4081 with a grade of "C" or higher. Continuation of MATH 4081 with emphasis on rings and fields. Rings, integral domains, and fields. Vector spaces, extension fields, finite fields.

**MATH 4085. Applied Modern Algebra. 3 Hours.**

Prerequisite: MATH 4081 with a grade of "C" or higher. Lattices, Boolean algebras, semi-groups, binary group codes, binary relations, and graphs. Special emphasis is placed on applications.

**MATH 4110. Number Theory. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. Elementary properties of integers including divisibility, unique factorization, progressions and prime numbers. Linear congruences and residue classes, complete and reduced residue systems, Chinese Remainder Theorem, quadratic residues, law of quadratic reciprocity, Theorems of Fermat and Wilson, Fibonacci and perfect numbers, sums of squares, elementary theory of continued fractions.

**MATH 4150. Linear Algebra. 3 Hours.**

Prerequisites: MATH 2150 and MATH 3040 with a grade of "C" or higher. Introduction to the theory of vector spaces, with emphasis on finite-dimensional vector spaces, linear systems, matrices, linear transformations, eigenvalues, and related subjects.

**MATH 4155. Computational Linear Algebra. 3 Hours.**

A study of mathematical and computational models for compartmental modeling in epidemiology, ecology, population genetics, and physiology.

**MATH 4161. Mathematical Reasoning. 3 Hours.**

Prerequisites: MATH 3162 or MATH 3180 with a grade of "C" or better. An in-depth study of concepts and processes underlying the P-8 school mathematics curriculum, with special emphasis on informal and formal mathematical reasoning. Problem solving and historical context serve as unifying strands. The analysis and remediation of student errors manifested in the application of conceptual and procedural mathematical knowledge will also be addressed.

**MATH 4260. Mathematical Analysis. 3 Hours.**

Prerequisites: MATH 3040 with a grade of "C" or higher. A study of the principles of mathematical analysis; point set topology in Euclidean and metric spaces, numerical sequences and series, continuity, differentiation, integration, sequences and series of functions.

**MATH 4300. Functions of a Complex Variable. 3 Hours.**

Prerequisite: MATH 2263 with a grade of "C" or higher. Introductory study of the algebraic and geometric properties of the complex number system and functions of a complex variable. Limits, continuity, and differentiation of complex functions. Analytic functions and the Cauchy-Riemann conditions. Integration of complex functions; Cauchy-Goursat theorem; Cauchy integral formula; the theorems of Morera and Liouville. Taylor and Laurent series expansions. Residues and poles with applications to integration. Conformal mappings.

**MATH 4540. Topology. 3 Hours.**

Prerequisite: MATH 3040 with a grade of "C" or higher. The study of point set topology in metric and topological spaces. Open and closed sets, compactness, connectedness, topological mappings, separation, product and functions spaces.

**MATH 4621. Mathematical Statistics I. 3 Hours.**

Prerequisites: MATH 2263 and MATH 3600 with a grade of "C" or higher in both. Distributions of random variables, conditional probability and stochastic independence, multivariate and some special distributions, and distributions of functions of random variables.

**MATH 4622. Mathematical Statistics II. 3 Hours.**

Prerequisite: MATH 4621 with a grade of "C" or higher. Introduction to statistical inference, sufficient statistic, estimation theory, theory of statistical tests, and inferences about normal models.

**MATH 4651. Numerical Analysis I. 3 Hours.**

Prerequisites: MATH 2150, 2262 and CS 1301 with a grade of "C" or higher in all three. Development and implementation of efficient numerical methods; locating roots of nonlinear equations; solving systems of linear equations; numerical differentiation and integration; interpolation; approximation of functions.

**MATH 4652. Numerical Analysis II. 3 Hours.**

Prerequisites: MATH 4651 and MATH 3340 with a grade of "C" or higher in both. Continuation of MATH 4651. Determination of eigenvalues and eigenvectors of matrices; method of least squares, and curve fitting; numerical solutions of ordinary and partial differential equations.

**MATH 4801. Mathematical Biology 1. 3 Hours.**

A study of analytical and computational tools for modeling biological processes including single species and interacting population dynamics, population genetics, and infectious and dynamic diseases.

**MATH 4802. Mathematical Biology 2. 3 Hours.**

A study of mathematical and computational models for compartmental modeling in epidemiology, ecology, population genetics, and physiology.

**MATH 4901. Operations Research I. 3 Hours.**

Prerequisite: MATH 2150 or MATH 4150 with a grade of "C" or higher, or by permission of instructor. Also offered as DATA 4901. Mathematical aspects and applications of Operations Research. Topics are selected from linear programming (mainly), integer programming, and dynamic programming.

**MATH 4902. Operations Research II. 3 Hours.**

Prerequisite: MATH 3600 or MATH 4621 with a grade of "C" or higher. (Note that MATH 4901 is not a prerequisite). An introduction to stochastic operations research. Topics are selected from stochastic modeling and optimization, probability models, queueing theory and Monte Carlo simulation.

**MATH 4905. Topics in Data Science. 3 Hours.**

Prerequisite: MATH 3700 or 4901 or permission of instructor. Also offered as DATA 4905. Capstone project class for the Basic Data Science Certificate program. Students will apply the knowledge and skills of R data analysis to complete course projects that will test essential skills in data visualization, probability, statistical inference, modeling, data organization, regression, Monte Carlo simulation and machine learning. Students will create data products that can be used to showcase their skills to potential employers. All project will come from real world problems. May repeated up to twice for credit.

**MATH 4910. Mathematical Models. 3 Hours.**

Prerequisite: MATH 2263 and 3600 each with a "C" or higher or permission of instructor. An introduction to basic principles and applications of classical mathematical models, optimization models and probabilistic models.

**MATH 4980. Senior Seminar. 3 Hours.**

Prerequisite: MATH 2263, and one of MATH 4081, 4150, 4260, or 4540. A capstone experience in pure mathematics. Topics in an area of algebra, analysis, or topology will be covered and presented in a written and/or oral form.

**MATH 4990. Special Topics in Mathematics. 1-3 Hours.**

Prerequisites: Consent of instructor and Head of the Department of Mathematics. Topics and credits to be assigned. May be taken more than once if topics are different.

**MATH 4990H. Honors Special Topics in Mathematics. 1-3 Hours.**

Prerequisites: Consent of instructor and Head of the Department of Mathematics. Topics and credits to be assigned. Student presentations will be required. May be taken more than once if topics are different.

## Mathematics Education

**MAED 2999. Entry to the Education Profession. 0 Hours.**

Graded "Satisfactory" or "Unsatisfactory". A required non-credit course for all teacher education candidates pursuing a VSU recommendation for initial certification. The course must be successfully completed prior to admission to teacher education. Candidates are required to establish an electronic portfolio and provide evidence that all teacher education admission requirements have been satisfactorily met. If an "unsatisfactory" grade is earned, the course must be repeated until a "satisfactory" grade is received.



**MAED 3500. Curriculum and Methods for Teaching Middle Grades Mathematics. 3 Hours.**

Prerequisites: MAED 2999, EDUC 2110, EDUC 2120, EDUC 2130, and MATH 2262. A study of the characteristics of the middle grades mathematics learner and the development of appropriate activities for the grade 6-8 learner. Students will assess learners and apply learning theories in order to develop appropriate activities. Activities will be inquiry-based, problem-centered, and appropriate for the learner. Appropriate technology will also be included in these activities. A field experience with a minimum of 100 hours is required and integrated into this course.

**MAED 4500. Curriculum and Methods for Teaching Secondary Mathematics. 3 Hours.**

Prerequisites: MAED 2999 and MAED 3500 with a "C" or better and Senior Standing. This is a checkpoint course, and all checkpoint requirements must be met. A study of the characteristics of the high school mathematics learner and the development, implementation, and assessment of activities for grade 9-12 learners including the use of technology. Students will assess grade 9-12 learners and develop and implement appropriate curriculum and activities. Instructional methods for individual learners and whole-class strategies will be examined. A field experience with a minimum of 100 hours is required and integrated into this course.

**MAED 4790. Student Teaching. 9 Hours.**

Prerequisite: Completion of all requirements to student teach and consent of the department. Co-requisite: MAED 4800. Graded "satisfactory" or "unsatisfactory". Supervised teaching experience in secondary classrooms, providing an opportunity for students to implement theory and instructional practice and demonstrate teaching competency.

**MAED 4800. Senior Professional Development Seminar. 3 Hours.**

Prerequisite: Completion of all requirements to student teach and consent of the department. Co-requisite: MAED 4790. Graded "satisfactory" or "unsatisfactory". Reflection on teaching experience and discuss and present issues pertaining to the teaching and learning of mathematics.

## Physics

**PHYS 1111K. Introductory Physics I. 4 Hours.**

Pre or co-requisite: MATH 1112 or MATH 1113. Part I of an introductory course in physics. Topics include mechanics, thermodynamics, and waves. Elementary algebra and trigonometry will be used. Three lecture hours, one two-hour laboratory per week, and one one-hour recitation session per week.

**PHYS 1112K. Introductory Physics II. 4 Hours.**

Prerequisite: PHYS 1111K with a grade of "C" or better. Part II of an introductory course in physics. Topics include electromagnetism, optics, and modern physics. Three lecture hours, one two-hour laboratory, and one one-hour recitation session per week.

**PHYS 2010. Tools of Physics. 1 Hour.**

An introduction to research techniques for the incoming Physics major. Includes laboratory safety, research methods, exploration of resources (library and Internet), and an outline of the discipline.

**PHYS 2211K. Principles of Physics I. 4 Hours.**

Co- or prerequisite: MATH 2261. Part I of an introductory course in calculus-based physics. Topics include mechanics, thermodynamics, and waves. Elementary differential and integral calculus will be used. Three lectures, one two-hour laboratory per week, and one one-hour recitation session per week.

**PHYS 2212K. Principles of Physics II. 4 Hours.**

Prerequisite: PHYS 2211K with a grade of C or better. Co- or prerequisite: MATH 2262. Part II of an introductory course in calculus-based physics. Topics include electromagnetism, optics, and waves. Elementary and integral calculus will be used. Three lecture hours, one two-hour laboratory per week, and one one-hour recitation session per week.

**PHYS 2700. Modern Physics. 1 Hour.**

Prerequisite: PHYS 2212K. A preparatory course for the upper-division physics curriculum, emphasizing topics not covered in PHYS 2211K and PHYS 2212K but essential for the success in upper level courses. Topics include fluids, elementary thermodynamics, and wave phenomena.

**PHYS 2950. Directed Study. 0-3 Hours.**

Supervised research on a specific physics or topic as agreed upon by the instructor. A maximum of 6 credit hours may be taken, and they can only be applied toward the general elective requirements for the physics major.

**PHYS 3040. Electronics. 4 Hours.**

Prerequisite: PHYS 2212K. A lecture-laboratory study of basic electrical circuits and techniques, including extensive use of the oscilloscope. Both continuous wave and pulse phenomena are treated.

**PHYS 3100. Optics. 4 Hours.**

Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite; MATH 2263. An intermediate level course with emphasis on physical optics. Lens matrices, interference, polarization, dispersion, absorption, resonance, and quantum effects will be covered. The electromagnetic nature of light is emphasized.

**PHYS 3800. Differential Equations in Physical Systems. 3 Hours.**

Prerequisite: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263. Ordinary differential equations of first and second order, linear equations of higher order, and a brief introduction to partial differential equations. The course will emphasize equations and methods which are important to understanding advanced topics in physics, such as fluid flow, mechanics, wave equations, Schrodinger's time-independent equation, and boundary equations.

**PHYS 3810. Mathematical Methods of Physics. 3 Hours.**

Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263. Special topics in mathematics as related to advanced study in physics. Topics include vector analysis, differential equations, orthogonal functions, eigenvalue problems, matrix methods, and complex variables.

**PHYS 3820. Computational Physics I. 4 Hours.**

Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263. Formulation of equations describing physical systems and the use of computers to solve them, computer simulations of physical systems, the use of computers to acquire and analyze data, and graphical methods of displaying data.

**PHYS 3821. Computational Physics II. 3 Hours.**

Prerequisite: PHYS 3820 with a grade of "C" or better. Application of advanced numerical and computational techniques to real world problems, and utilizes multiples computer languages to solve them. Topics include matrix algebra, boundary value problems, nonlinear systems, and partial differential equations.

**PHYS 4040. Experimental Physics. 4 Hours.**

Prerequisite: PHYS 2212K. A lecture-laboratory course devoted to techniques of research in experimental physics. Topics include treatment of data, vacuum techniques, magnetic devices, preparation and manipulation of beams of particles, and radioactivity. A number of modern physics experiments are studied and performed.

**PHYS 4111. Theoretical Mechanics I. 3 Hours.**

Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263. Topics include Newtonian mechanics, conservation laws, simple harmonic motion, and Lagrange's equations.

**PHYS 4112. Theoretical Mechanics II. 3 Hours.**

Prerequisite: PHYS 4111 with a grade of "C" or better. Topics include Newtonian mechanics, rotational motion, waves relativity, and Hamiltonian formalism.

**PHYS 4211. Electromagnetism I. 3 Hours.**

Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263. Topics include electrostatics, magnetostatics, charge distributions, and Maxwell's equations in differential form.

**PHYS 4212. Electromagnetism II. 3 Hours.**

Prerequisite: PHYS 4211 with a grade of "C" or better. Topics include electrodynamics, time-varying electric and magnetic fields, and propagation of electromagnetic waves.

**PHYS 4300. Plasma Physics. 3 Hours.**

Prerequisites: PHYS 4211 with a grade of "C" or better. An introduction to the physics of ionized gases.

**PHYS 4310. Thermodynamics. 3 Hours.**

Also offered as ENGR 4310. Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263. Basic principles of classical thermodynamics which includes open and closed systems for both steady and transient processes.

**PHYS 4411. Quantum Mechanics I. 3 Hours.**

Prerequisites: PHYS 2212K with a grade of "C" or better, Pre- or Co-requisite: MATH 2263 and PHYS 4111. Topics include the wave particle duality of light and matter, Schrodinger's equation, and time-independent solutions to Schrodinger's equation. Dirac notation and matrix formalism are introduced.

**PHYS 4412. Quantum Mechanics II. 3 Hours.**

Prerequisite: PHYS 4411. Topics include angular momentum and spin operators, time-independent perturbation theory, and the WKB approximation.

**PHYS 4501. Capstone Seminar I. 1 Hour.**

Prerequisite: Senior standing. A study of current development in the fields of physics. Oral presentations will be required of all students and will be based on recent research articles in physics and related journals.

**PHYS 4800. Internship in Physics. 3-6 Hours.**

Active participation in research in physics or in a field of science closely allied with physics, such as biophysics. A daily log of activities, a report on the work done, and a research paper relating the work done to the field of physics are required.

**PHYS 4900. Special Topics in Physics. 1-6 Hours.**

Prerequisite: Consent of advisor and instructor, and at least junior standing. Topics to be assigned by instructor; may be taken more than once if topics are different, up to a total of 6 credit hours.

**PHYS 4950. Directed Study in Physics. 1-6 Hours.**

Prerequisite: At least Junior standing; permission of advisor, instructor, and department head. Study in area or subject not normally found in established courses offered by the department; may also allow student to explore in more detail and/or depth an area or subject covered by the department in physics. Up to a maximum of 12 credit hours.