

# MATHEMATICS AND PHYSICS

## Degrees Majors

- Bachelor of Arts with a Double Major (BA) (<https://catalog.tamui.edu/undergraduate-information/arts-sciences/bachelor-arts-double-major-ba/>)
- Bachelor of Arts with a Major in Mathematics (BA) (<https://catalog.tamui.edu/undergraduate-information/arts-sciences/mathematics-physics/bachelor-arts-major-mathematics-ba/>)
- Bachelor of Arts with a Major in Mathematics with Grades 7-12 Certification (BA) (<https://catalog.tamui.edu/undergraduate-information/arts-sciences/mathematics-physics/bachelor-arts-major-mathematics-grades-7-12-certification-ba/>)
- Bachelor of Science with a Major in Mathematics (BS) (<https://catalog.tamui.edu/undergraduate-information/arts-sciences/mathematics-physics/bachelor-science-major-mathematics-bs/>)

## Minors

- Applied Physics (<https://catalog.tamui.edu/undergraduate-information/arts-sciences/mathematics-physics/applied-physics-minor/>)
- Mathematics (<https://catalog.tamui.edu/undergraduate-information/arts-sciences/mathematics-physics/mathematics-minor/>)

## Courses

### ASTR 1110 Principles of Astronomy Lab

Laboratory course to accompany ASTR 1310. Practical exercises reinforce ASTR 1310 lecture material. Topics include astronomical measurements, Kepler's laws of planetary motion, Newton's law of universal gravitation, stellar spectra, parallax, and the Hertzsprung-Russell diagram. Must be taken concurrently with ASTR 1310.

TCCN: ASTR 1103

### ASTR 1111 Planetary Astronomy Lab

Laboratory course to accompany ASTR 1311. Practical exercises reinforce ASTR 1311 lecture material. Topics will include unaided-eye observation, telescopic observation, telescope manipulation and experiments/exercises. Must be taken concurrently with ASTR 1311. Carries no credit towards a major or minor in Physics. Laboratory fee applicable.

### ASTR 1112 Stellar Astronomy Lab

Laboratory course to accompany ASTR 1312. Practical exercises reinforce ASTR 1312 lecture material. Topics will include unaided-eye observation, telescopic observation, telescope manipulation and experiments/exercises. Must be taken concurrently with ASTR 1312. Carries no credit towards a major or minor in Physics. Laboratory fee applicable.

### ASTR 1310 Principles of Astronomy

A one semester introductory survey course of astronomy. Topics include discovery in solar system of planets and moons, spectra, our sun and other stars, black holes and neutron stars, star clusters, nebula, galaxies and the structure of the universe. Designed to fulfill laboratory science core curriculum requirements. Must be taken concurrently with ASTR 1110.

TCCN: ASTR 1303

### ASTR 1311 Planetary Astronomy

An introductory survey of the solar system to include astronomical history and instrumentation, the sun, planets and their moons, comets, asteroids and meteoroids and meteorites. Designed to fulfill laboratory science core curriculum requirements. Must be taken concurrently with ASTR 1111. Carries no credit toward a major or minor in Physics.

### ASTR 1312 Stellar Astronomy

An introductory survey of stellar properties and life cycles, H-R Diagrams, as well as galaxies and Hubble's Law. Instrumentation techniques used to collect astronomical data is discussed in addition to topics from cosmology including General Relativity theory and the Big Bang theory. May be taken independently from ASTR 1311. Designed to fulfill laboratory science core curriculum requirements. Must be taken concurrently with ASTR 1112. Carries no credit towards a major or minor in Physics.

### MATH 1314 College Algebra

The fundamentals of algebra; polynomials and graphs; conic sections; systems of linear equations, matrices; sequences and series; mathematical induction and the binomial theorem.

Prerequisites: Completion of Texas Success Initiative (TSI) mathematics requirements, appropriate level developmental course sequence, a minimum ACT Mathematics score of 19 with an ACT Composite score of 23 or above, a minimum SAT Mathematics score of 500 with a SAT Total score of 1,070 or above, or a Redesigned SAT Mathematics score of 530 or above.

TCCN: MATH 1314

### MATH 1316 Plane Trigonometry

In-depth study and applications of trigonometry including definitions, identities, inverse functions, solutions of equations, graphing, and solving triangles. Additional topics such as vectors, polar coordinates and parametric equations may be included. Students completing both MATH 1314 and MATH 1316 may satisfy MATH 2412 requirement at TAMIU.

Prerequisites: ACT Mathematics score of 27 or above, an SAT Mathematics score of 630 or above, a Redesigned SAT Mathematics score of 650 or above, or MATH 1314.

TCCN: MATH 1316

### MATH 1324 Business Math I

The application of common algebraic functions, including polynomial, exponential, logarithmic, and rational, to problems in business, economics, and the social sciences are addressed. The applications include mathematics of finance, including simple and compound interest and annuities; systems of linear equations; matrices; and linear programming.

Prerequisites: Completion of Texas Success Initiative (TSI) Mathematics requirements or appropriate level developmental course sequence.

TCCN: MATH 1324

### MATH 1325 Business Math II

This course is the basic study of limits and continuity, differentiation, optimization and graphing, and integration of elementary functions, with emphasis on applications in business, economics, and social sciences. This course is not a substitute for MATH 2413.

Prerequisites: MATH 1324.

TCCN: MATH 1325

### **MATH 1332 Mathematics for Liberal Arts I**

This course is intended for Non STEM (Science, Technology, Engineering, and Mathematics) majors. Topics include introductory treatments of sets and logic, financial mathematics, probability and statistics with appropriate applications. Number sense, proportional reasoning, estimation, technology, and communication should be embedded throughout the course. Additional topics may be covered.

Prerequisites: Completion of Texas Success Initiative (TSI) Mathematics requirements or appropriate level developmental course sequence.

TCCN: MATH 1332

### **MATH 1342 Introductory Statistics**

Topics include collection, analysis, presentation and interpretation of data, and probability. Analysis includes descriptive statistics, correlation and regression, confidence intervals and hypothesis testing. Use of appropriate technology is recommended.

Prerequisites: Completion of Texas Success Initiative (TSI) Mathematics requirements or appropriate level developmental course sequence.

TCCN: MATH 1342

### **MATH 1348 Analytic Geometry**

Lines, circles, and other conic sections; transformation of coordinates; polar coordinates; and parametric equations.

Prerequisites: MATH 1316 or MATH 2412.

### **MATH 1350 Fundamentals of Mathematics I**

This course is intended to build or reinforce a foundation in fundamental mathematics concepts and skills. It includes the conceptual development of the following: sets, functions, numeration systems, number theory, and properties of the various number systems with an emphasis on problem solving and critical thinking. This course is primarily intended for students enrolled in the degree programs with various levels of certification.

Prerequisites: MATH 1314, MATH 1324, MATH 1332, or MATH 1342.

TCCN: MATH 1350

### **MATH 1351 Fundamentals of Mathematics II**

Probability, statistics, and geometry. This course cannot be used to fulfill Core Curriculum requirement.

Prerequisites: MATH 1350.

TCCN: MATH 1351

### **MATH 2330 Elementary Geometry**

Introduction to classical Euclidean Geometry. Postulates, congruency, similarity and classical construction. Introduction to solid geometry and transformations in the plane. (Formerly MATH 3320)

### **MATH 2412 Pre-Calculus**

In-depth combined study of algebra, trigonometry, and other topics for calculus readiness. Topics include: Analytic geometry, complex numbers, and systems of algebraic equations; algebraic, exponential, logarithmic and trigonometric functions and applications; sequences and applications. Students will receive credits for at most two courses from MATH 1314, 1316 and 2412.

Prerequisites: ACT Mathematics score of 25 or above, an SAT Mathematics score of 600 or above, a Redesigned SAT Mathematics score of 620 or above, MATH 1314, or successful completion of Pre-Calculus Placement Exam.

TCCN: MATH 2412

### **MATH 2413 Calculus I**

Limits and continuity; the Fundamental Theorem of Calculus; definition of the derivative of a function and techniques of differentiation; applications of the derivative to maximizing or minimizing a function; the chain rule, mean value theorem, and rate of change problems; curve sketching; definite and indefinite integration of algebraic, trigonometric, and transcendental functions, with an application to calculation of areas. Course credits may be received for an AP score of 3 or more for Mathematics Calculus AB.

Prerequisites: ACT Mathematics score of 29 or above, an SAT Mathematics score of 660 or above, a Redesigned SAT Mathematics score of 690 or above, MATH 1316, or MATH 2412.

TCCN: MATH 2413

### **MATH 2414 Calculus II**

Techniques and applications of integration of differentiation and integration of transcendental functions; parametric equations and polar coordinates; techniques of integration; sequences and series; improper integrals. Course credits may be received for an AP score of 3 or more for Mathematics Calculus BC.

Prerequisites: MATH 2413.

TCCN: MATH 2414

### **MATH 2415 Calculus III**

Advanced topics in calculus, including vectors and vector-valued functions, partial differentiation, Lagrange multipliers, multiple integrals, and Jacobians; application of the line integral, including Green's Theorem, the Divergence Theorem, and Stokes' Theorem.

Prerequisites: MATH 2414.

TCCN: MATH 2415

### **MATH 3195 Seminar**

Seminar on various topics in mathematics. May be repeated for credit with departmental approval.

### **MATH 3295 Seminar**

Seminar on various topics in mathematics. May be repeated for credit with departmental approval.

### **MATH 3310 Introduction to Linear Algebra**

Introduction to linear transformations and matrices; vector spaces, vector operations.

Prerequisites: MATH 2415.

### **MATH 3318 Advanced Linear Algebra**

A continuation of MATH 3310. Focuses on more abstract aspects as well as computational aspects. Topics include inner product spaces, spectral theorems, diagonalization, Hermitian matrices, quadratic forms, numerical linear and Jordan canonical.

Prerequisites: MATH 3310.

### **MATH 3320 Modern Geometry**

Modern development of Euclidean geometry (Hilbert axioms) with historical and philosophical context; independence of the parallel postulate; models of hyperbolic non-Euclidean geometry, as well as transformational geometry, with techniques from linear algebra. Intended primarily for students seeking secondary certification.

Prerequisites: MATH 3310.

### **MATH 3325 Geometry**

Selected topics from the foundations of Euclidean and non-Euclidean geometries. Includes the study of spherical and hyperbolic geometries, as well as transformational geometry, with techniques from linear algebra. Intended primarily for students seeking secondary certification.

Prerequisites: MATH 3310.

### **MATH 3328 Advanced Geometry**

Study of Neutral, Euclidean and Hyperbolic geometrics from an axiomatic perspective.

Prerequisites: MATH 3365.

### **MATH 3330 Ordinary Diff Equations**

Solution of first order differential equations. Study of second and higher order equations with constant coefficients. Power series solutions. Laplace Transform and Linear Systems. A brief introduction to numerical methods.

Prerequisites: MATH 2414.

### **MATH 3360 Statistical Analysis**

Fundamentals of probability, distribution theory, random variables, law of large numbers, central limit theorems, statistical inequalities.

Prerequisites: MATH 2414.

### **MATH 3365 Discrete Mathematics**

This course is a study of elements of discrete mathematics. Topics covered: logic; counting techniques; mathematical induction; the binomial theorem; number theory; sets, relations and functions.

Prerequisites: MATH 2413.

### **MATH 3371 Communications in Mathematics**

This course is designated to enhance students' communication skills in mathematics. Emphasis will be placed in writing proofs. Topics include set theory, logic and properties of numbers at an elementary level. Substantial writing in mathematics using LaTeX is required.

Prerequisites: ENGL 1302 and MATH 3365.

### **MATH 3390 Principles of Math for Elem Ed**

An in-depth study of the mathematical principles and concepts underlying the traditionally computational techniques for the teaching of mathematics at early childhood and elementary school levels. The course content includes problem solving; arithmetic, algebra, geometry, probability, logic, counting, numeration and number systems (including natural, integer, rational, and real number systems), and their historical development; content based teaching; integrating various areas of mathematics; and examining connections of college-level mathematics course contents with the mathematics content of and its effective teaching at the early childhood and elementary school levels. In addition, TExES Mathematics Standards V-IX covering Mathematical Processes, Mathematical Perspectives, Mathematical Learning and Instruction, Mathematical Assessment and Professional Development will be emphasized. Students must earn a "C" or better to successfully complete the course. The course may not be counted toward a major or minor in Mathematics or for certification in secondary mathematics. Open only to early childhood/elementary education majors. It is strongly recommended to take this course concurrently with Block II.

Prerequisites: Completion of Block I and a grade of at least "C" in MATH 1350 and 1351.

### **MATH 3395 Seminar**

Seminar on various topics in mathematics. May be repeated for credit with departmental approval.

### **MATH 4152 Internship In Mathematics**

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

### **MATH 4252 Internship in Mathematics**

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

### **MATH 4305 Number Theory**

Divisibility, congruence, power residues, quadratic reciprocity, Diophantine equations, Euler's function, Fermat's theorem, primitive roots, Legendre and Jacobi symbols.

Prerequisites: MATH 3365 and MATH 3310.

### **MATH 4310 Abstract Algebra I**

Introduction to abstract algebra. Topics include Introduction to Ring theory: arithmetic in integers, modular arithmetic, fields, arithmetic in the Ring of polynomials. Unique factorization in integers and polynomials. Introduction to Group theory: definition and examples, subgroups, quotient groups, symmetry groups and permutation groups.

Prerequisites: MATH 3365.

### **MATH 4315 Abstract Algebra II**

Continuation of MATH 4310. Topics in group theory: group actions, Sylow theorems, fundamental theorem of Abelian groups, and finite simple groups. Topics in Ring theory: ideals and quotient rings, Euclidean domain, principal ideal domain and unique factorization domain. Topics in Field theory: vector spaces, field extensions, finite field, and Galois Theory.

Prerequisites: MATH 4310.

### **MATH 4330 Numerical Linear Algebra**

Numerical methods for problems of linear algebra, including the solution of large systems, eigenvalues and eigenvectors.

Prerequisites: MATH 3310

### **MATH 4335 Advanced Calculus**

A course in real analysis. It will include topology, continuity, differentiation, integration, sequences, series and power series.

Prerequisites: MATH 2414 and MATH 3365.

### **MATH 4340 Numerical Analysis I**

Error analysis, solutions of non-linear functions, systems of linear equations, eigenvalue problems, interpolation theory, numerical differentiation and integration, numerical methods for ordinary differential equations.

Prerequisites: MATH 3330 and MATH 3310.

### **MATH 4341 Numerical Analysis II**

Finite difference methods and finite element methods for elliptic, parabolic and hyperbolic equations.

Prerequisites: MATH 4340 and MATH 4350.

### **MATH 4345 Complex Variables**

This is a course in complex variables which will include analytic functions, power series, the theory of residues and conformal mappings.

Prerequisites: MATH 4335 or permission of instructor.

**MATH 4350 Partial Differential Equations**

Theory of partial differential equations and boundary value problems with applications to the physical sciences and engineering. Detailed analysis of the wave equation, the heat equation, and the potential equation. Numerical methods to solving partial differential equations will also be discussed.

Prerequisites: MATH 3330.

**MATH 4352 Internship in Mathematics**

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

**MATH 4355 Selected Topics in Math**

Topics selected from the fields of pure or applied mathematics. May be repeated when topic changes.

Prerequisites: Senior standing and permission of instructor.

**MATH 4360 Introduction to Topology**

Basic concepts of point-set topology including connectedness, compactness, etc. and metric spaces.

Prerequisites: MATH 3365 and 4335.

**MATH 4365 Geometry of Curves&Surfaces**

This course will present geometry of curves and surfaces in three dimensional Euclidean space. Topics include 1) From Curve Theory: Parametrized Curves, Arc Length, Frenet-Serret Frame, Singularities, Theory of Contact, Curvature, Torsion, Intrinsic Equation of Curves, Global Properties of Curves; 2) From Surface Theory: Parametrized Surfaces, Tangent Plane and Normal Line, First and Second Fundamental Forms, Curvature of Surfaces.

Prerequisites: MATH 2415, 3310.

**MATH 4380 Undergraduate Research in Math**

Students work on a theoretical or applied research project. The plan of study is negotiated by the faculty member and the student. Course may be repeated under different topic for credit. Evaluation of performance in this course is on a Pass/Fail basis.

Prerequisites: Consent of the instructor and the department.

**MATH 4385 History of Mathematics**

Topics from arithmetic and computation, algebra, geometry, trigonometry, calculus, number theory, linear algebra, etc. from ancient recorded history to modern times intertwined with historical perspectives, biographies of several mathematicians from different cultures and times, their contributions, and that of their cultures, to mathematics and society.

Prerequisites: Nine semester hours of advanced mathematics.

**MATH 4390 Math in Middle & High School**

Explore contemporary issues, connections among various mathematics topics, and specialized pedagogical content knowledge for teaching mathematics at the secondary school level. Content topics may include: using sequences and series to solve problems in the mathematics of finance, relate geometry and algebra by representing transformations as matrices, apply probability concepts to make inferences in statistics, and essential understandings of functions in both higher-level mathematics and in real-world contexts, among others. Concurrent enrollment in Block II is strongly recommended.

Prerequisites: Completion of Block I and at least twelve upper-level mathematics SCH.

**MATH 4395 Senior Mathematics Project**

A study project under the direction of a member of the mathematics faculty. Required will be a written report, oral presentation and approval by both the advisor and one additional mathematics faculty member.

Prerequisites: Senior standing and permission of instructor.

**MATH 4452 Internship in Mathematics**

A directed internship in a public/private organization that is appropriate to the student's career objective or desire in a mathematical science setting. Students will apply mathematical knowledge in a real world setting and receive on-the-job training experience. Seminar and training will be held to discuss field experience from theoretical and applied perspectives.

Prerequisites: Permission of the instructor and advisor.

**PHYS 1101 General Physics I Lab**

Laboratory-based course to accompany PHYS 1301. Laboratory experiments reinforce PHYS 1301 principle of physics, and place importance on scientific communication and collaboration, as well as measurement methods, data collection, basic error analysis, and preparation of laboratory report. Carries no credit towards a major or minor in physics.

Corequisites: PHYS 1301.

TCCN: PHYS 1101

**PHYS 1102 General Physics II Lab**

Laboratory-based course to accompany PHYS 1302. Laboratory experiments reinforce PHYS 1302 principle of physics, and place importance on scientific communication & collaboration, as well as measurement methods, data collection, basic error analysis, and preparation of laboratory report. Carries no credit toward a major or minor in physics. Must be taken concurrently with PHYS 1302.

Prerequisites: PHYS 1301 and PHYS 1101.

TCCN: PHYS 1102

**PHYS 1170 Survey of Physical Science Lab**

Laboratory course to accompany PHYS 1370. Laboratory exercises reinforce PHYS 1370 lecture material and place importance on scientific communication and collaboration as well as measurement methods. Some mention is made of uncertainty and basic error analysis. Must be taken concurrently with PHYS 1370. Carries no credit towards a major or minor in physics.

TCCN: PHYS 1115

**PHYS 1301 General Physics I**

Fundamental principles of physics, is the first of a two semester sequence in General Physics, using algebra and trigonometry; the principles and applications of classical mechanics and thermodynamics. Topics include: kinematics, dynamics, gravitation, energy, momentum, simple harmonic motion, fluid and heat; with emphasis on problem solving. Carries no credit toward a major or minor in physics. Must be taken concurrently with PHYS 1101.

Prerequisites: MATH 1316 or MATH 2412.

**PHYS 1302 General Physics II**

Fundamental principles of physics, is the continuation of PHYS 1301, using algebra and trigonometry; the principles and applications of electricity and magnetism. Topics include: electrostatics, circuits, electromagnetism, waves, optics, and modern physics; with emphasis on problem solving. Carries no credit toward a major or minor in physics. Must be taken concurrently with PHYS 1102. Prerequisites: PHYS 1301 and PHYS 1101.

Prerequisites: PHYS 1301 and PHYS 1101.

TCCN: PHYS 1302

### PHYS 1370 Survey of Physical Science

An introductory survey of physical science. Topics include physics (motion, forces, waves and thermodynamics), chemistry (periodic table, reactions), earth science (geology, weather, biosphere and environment) and astronomy (astronomical history, planetary astronomy, stellar astronomy and cosmology). Designed to fulfill laboratory science core curriculum requirements. Must be taken concurrently with PHYS 1170. Carries no credit towards a major or minor in physics.

TCCN: PHYS 1315

### PHYS 2125 University Physics I Lab

Laboratory course to accompany PHYS 2325. Laboratory experiments reinforce theoretical principles from PHYS 2325 and place importance on scientific communication and collaboration, as well as measurement methods, data collection, uncertainty and error analysis, and preparation of laboratory reports. Must be taken concurrently with PHYS 2325.

TCCN: PHYS 2125

### PHYS 2126 University Physics II Lab

Laboratory course to accompany PHYS 2326. Laboratory experiments reinforce theoretical principles from PHYS 2326 and place importance on scientific communication and collaboration, as well as measurement methods, data collection, uncertainty and error analysis, and preparation of laboratory reports. Must be taken concurrently with PHYS 2326.

TCCN: PHYS 2126

### PHYS 2325 University Physics I

A calculus-based treatment of the fundamental principles and applications of classical mechanics and thermodynamics for science and engineering majors. This course is the first of a two-semester sequence in University Physics. Topics include one-, two-, and three-dimensional motion, forces and Newton's laws, momentum conservation, energy conservation, gravitation, rotational dynamics, angular momentum, fluid mechanics, waves, simple harmonic motion, and thermodynamics. Must be taken concurrently with PHYS 2125.

Prerequisites: MATH 2413 or equivalent.

TCCN: PHYS 2325

### PHYS 2326 University Physics II

A calculus-based treatment of the fundamental principles and applications of electricity and magnetism for science and engineering majors. This course is a continuation of PHYS 2325. Topics include electrostatics, circuits, electromagnetism, electromagnetic waves, optics, and modern physics. Must be taken concurrently with PHYS 2126.

Prerequisites: MATH 2414 or equivalent (or concurrent enrollment therein) and PHYS 2325 and PHYS 2125.

TCCN: PHYS 2326

### PHYS 3305 Optics and Wave Theory

A detailed study of optics. Topics include thin and thick lenses, the lensmaker's equation, apertures, optical machines, interference, Fresnel and Fraunhofer diffraction and polarization, the Cornu Spiral. Electromagnetic waves, geometric optics, physical optics, optical instruments, lasers and holography.

Prerequisites: PHYS 2326/PHYS 2126, MATH 2415.

### PHYS 3310 Modern Physics

An introduction to the foundations of modern physics. Topics include special and general relativity, kinetic theory of matter, electromagnetic quantization, light and energy, wave-matter duality of light, the Schrodinger Equation, nuclear physics and elementary particle theory.

Prerequisites: PHYS 2326/PHYS 2126;

Corequisites: MATH 2415.

### PHYS 3315 Classical Mechanics

Topics include kinematics of particles and particle systems in one to three dimensions, rigid body rotation, gravitation, Lagrangian and Hamiltonian dynamics, periodic motion, and small oscillations.

Prerequisites: PHYS 2326/PHYS 2126 and MATH 3330.

### PHYS 3320 Electromagnetic Field Theory

A mathematical treatment of the fundamentals of classical electromagnetic theory. Topics include electrodynamics, vector calculus, theory of dielectrics, magnetostatic fields, electromagnetic induction, magnetic fields of currents, and Maxwell's equations.

Prerequisites: PHYS 2326/2126 and MATH 3330.

### PHYS 3325 Thermodynamics

A mathematical treatment of the fundamentals of thermal physics. Topics include the concepts of temperature, equation of state, first and second laws of thermodynamics, entropy, change of phase, and thermodynamic functions.

Prerequisites: PHYS 2326/2126 and MATH 2415.

### PHYS 4199 Special Topics in Physics

Selected topics in physics are covered, depending on student interest. Credit will be given more than once if the topic varies.

Prerequisites: Permission of instructor.

### PHYS 4299 Special Topics in Physics

Selected topics in physics are covered, depending on student interest. Credit will be given more than once if the topic varies.

Prerequisites: Permission of instructor.

### PHYS 4305 Quantum Mechanics

A mathematical treatment of quantized physical phenomena. Topics include the wave theory of matter, the principles of superposition, probability, expectation values, coordinate representation, momentum representation, indeterminacy, Hermitian operators, angular momentum, and spin. Quantum solutions for simple barriers, potential wells, harmonic oscillator, and the hydrogen atom are presented.

Prerequisites: PHYS 3310 and MATH 3330.

### PHYS 4310 Advanced Modern Physics

Continuation of PHYS 3310. Topics include atomic, molecular, nuclear, statistical, solid state, laser and elementary particle physics.

Prerequisites: PHYS 3310 and MATH 3330.

### PHYS 4315 Mathematical Methods of Physic

A course presenting mathematical techniques used in physics and engineering. The course will survey, at a brief introductory level and from a physics perspective, numerous mathematical techniques from areas such as infinite series, integral transformation, applications of complex variables, matrices and tensors, special functions, partial differential equations, Green's functions, perturbation theory, integral equations, calculus of variations, and groups and group representations.

Prerequisites: PHYS 2326/2126 and MATH 3330.

### PHYS 4399 Special Topics in Physics

Selected topics in physics are covered, depending on student interest. Credit will be given more than once if the topic varies.

Prerequisites: Permission of instructor.