MATHEMATICS (MATH)

MATH 0235 - Intro Elementary Algebra
Credit(s): 3 Credits
Prerequisite: Math Assessment.
Attributes: Prof. Studies Students Only

MATH 0240 - Intro Elementary Algebra I
Credit(s): 3 Credits
Review of the real number system; linear equations, and inequalities in one and two variables; functions; systems of linear equations. Fall.
MATH 0240 and MATH 0250 together cover the same material as MATH 0260, but in two semesters.

MATH 0250 - Intro to Elementary Algebra II
Credit(s): 3 Credits
Exponents, polynomials and polynomial functions; factoring; rational expressions and functions; roots, radicals and root functions; quadratic equations, inequalities and functions. Spring. MATH 0240 and MATH 0250 together cover the same material as MATH 0260, but in two semesters.
Prerequisite(s): MATH 0240 with a grade of C- or higher

MATH 0260 - Intermediate Algebra
Credit(s): 0-3 Credits
Review of the real number system; linear equations, and inequalities in one and two variables; functions; systems of linear equations; exponents, polynomials and polynomial functions; factoring; rational expressions and functions; roots, radicals and root functions; quadratic equations, inequalities and functions. Fall and spring.

MATH 0261 - Intermediate Algebra Support Lab
Credit(s): 2 Credits
Intermediate Algebra Support Lab MATH 0261 is required for all students retaking Intermediate Algebra MATH 0260. MATH 0260 and MATH 0261 must be taken concurrently. This course fills gaps in mathematical knowledge and builds the necessary study skills to succeed with further mathematics and its applications.
Corequisite(s): MATH 0260

MATH 0265 - Intermediate Algebra
Credit(s): 3 Credits
Review of the real number system; linear equations, and inequalities in one and two variables; functions; systems of linear equations; exponents, polynomials and polynomial functions; factoring; rational expressions and functions; roots, radicals and root functions; quadratic equations, inequalities and functions. Fall and spring. Credit not given for both MATH 0260 and any of the following: MATH 0240, MATH 0250.
Prerequisite(s): MATH 0230
Attributes: Prof. Studies Students Only

MATH 0930 - Special Topics
Credit(s): 1 or 2 Credits

MATH 1200 - College Algebra
Credit(s): 0 or 3 Credits
Brief review of algebraic essentials, graphs, functions and their graphs, linear and quadratic functions, polynomial and rational functions, exponential and logarthmic functions, systems of linear equations. Intended for students needing more preparation before taking MATH 1320 or MATH 1400. (Offered every Fall, Spring and Summer)
Prerequisite(s): MATH 0250 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 0250, MATH 0260 with a grade of C- or higher, or SLU Math Placement with a minimum score of 1200
Attributes: Mathematics BA Req (A&S)

MATH 1220 - Finite Mathematics
Credit(s): 3 Credits
Linear equations and straight lines, matrices, sets and counting, probability and statistics, the mathematics of finance, and logic.
Prerequisite(s): (MATH 0250 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 0250, MATH 0260 with a grade of C- or higher, or SLU Math Placement with a minimum score of 0260)
Attributes: Mathematics BA Req (A&S), UUC:Quantitative Reasoning

MATH 1240 - Mathematics and the Art of M.C. Escher
Credit(s): 3 Credits
An inquiry course open to all undergraduates. The art of M.C. Escher is used to explore topics in geometry such as symmetry, tessellations, wallpaper patterns, the geometry of the sphere and hyperbolic geometry. Taught in a computer classroom.
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1400)
Attributes: Mathematics BA Req (A&S), UUC:Quantitative Reasoning

MATH 1250 - Math Thinking in Real World
Credit(s): 3 Credits
An inquiry course open to all undergraduates. In this course, aimed at students in the humanities and social sciences, we study some of the greatest ideas of mathematics that are often hidden from view in lower division courses. Topics selected from number theory, the infinite, geometry, topology, chaos and fractals, and probability. Taught in a computer classroom.
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1400)
Attributes: Mathematics BA Req (A&S), UUC:Quantitative Reasoning

MATH 1260 - Statistics Including Sports and Politics
Credit(s): 3 Credits
An inquiry course open to all undergraduates. Producing data through the use of samples and experiments; organizing data through graphs and numbers that describe the distribution of the data of one variable or the relationship between two variables; probability, statistical inference including confidence intervals and tests of significance.
Attributes: Mathematics BA Req (A&S)

MATH 1270 - Math Media: Reading News with Mathematical Eyes
Credit(s): 3 Credits
An inquiry course open to all undergraduates. Reading the news, through the lens of mathematical concepts. The course explores topics in probability, trigonometry, pattern recognition, math modeling, graph theory, geometry, descriptive statistics, and logic. The course emphasizes applications of mathematics to law, health, society, politics, analyzing meaning from data, and current events.
Attributes: UUC:Quantitative Reasoning

MATH 1300 - Elementary Statistics with Computers
Credit(s): 3 Credits
Data production and analysis; probability basics, distributions; sampling, estimation with confidence intervals, hypothesis testing, t-test; correlation and regression; crosstabulations and chi-square. Students learn to use a statistical package such as R.
Prerequisite(s): (1 Course from MATH 1200-4999, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1200)
Attributes: Bio-Chemical Biology Elective, Mathematics BA Req (A&S), UUC:Quantitative Reasoning
MATH 1300X - Elementary Statistics with Computers
Credit(s): 3 Credits
Data production and analysis; probability basics, distributions; sampling, estimation with confidence intervals, hypothesis testing, t-test; correlation and regression; Cross tabulations and chi-square. Students learn to use a statistical package such as SPSS. Credit not given for STAT 1300 and any of the following: MATH 1300 or OPM 2070.
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1200)
Attributes: Bio-Chemical Biology Elective, Mathematics BA Req (A&S), UUC:Quantitative Reasoning

MATH 1320 - Survey of Calculus
Credit(s): 3 Credits
Linear equations and graphs; functions and graphs; limits; the derivative; rules of differentiation; curve sketching and optimization; antiderivatives; the definite integral; multivariable calculus and partial derivatives. (Offered every Fall, Spring and Summer)
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1400)
Attributes: Mathematics BA Req (A&S), UUC:Quantitative Reasoning

MATH 1325 - Survey of Calculus
Credit(s): 3 Credits
Linear equations and graphs; functions and graphs; limits; the derivative; rules of differentiation; curve sketching and optimization; antiderivatives; the definite integral; multivariable calculus and partial derivatives. (Offered every Fall, Spring and Summer)
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1400)
Attributes: Prof. Studies Students Only

MATH 1400 - Pre-Calculus
Credit(s): 0 or 3 Credits
Functions, graphs and models; modeling with linear and quadratic functions; polynomial and rational functions; modeling with exponential and logarithmic functions; trigonometric functions; trigonometric identities and conditional equations; additional topics in trigonometry; additional topics in analytic geometry; parametric equations. (Offered every Fall, Spring and Summer)
Prerequisite(s): (MATH Waiver per Advisor with a minimum score of 1200, MATH 1200 with a grade of C- or higher, or SLU Math Placement with a minimum score of 1400)
Attributes: Mathematics BA Req (A&S), UUC:Quantitative Reasoning

MATH 1410 - Calculus I
Credit(s): 0 or 4 Credits
Functions; continuity; limits; the derivative; differentiation from graphical, numerical and analytical viewpoints; optimization and modeling; rates and related rates; the definite integral; antiderivatives from graphical, numerical and analytical viewpoints. (Offered every Fall, Spring and Summer)
Prerequisite(s): (Math Waiver per Advisor with a minimum score of 1400, MATH 1400 with a grade of C- or higher, or SLU Math Placement with a minimum score of 1510)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S), UUC:Quantitative Reasoning

MATH 1510 - Calculus II
Credit(s): 0 or 4 Credits
Symbolic and numerical techniques of integration, improper integrals, applications using the definite integral, sequences and series, power series, Taylor series, differential equations. (Offered every Fall, Spring and Summer)
Prerequisite(s): (Math Waiver per Advisor with a minimum score of 1510, MATH 1510 with a grade of C- or higher, AP Calculus AB with a minimum score of 4, or SLU Math Placement with a minimum score of 1520)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S), UUC:Quantitative Reasoning

MATH 1660 - Discrete Mathematics
Credit(s): 3 Credits
Concepts of discrete mathematics used in computer science; sets, sequences, strings, symbolic logic, proofs, mathematical induction, sums and products, number systems, algorithms, complexity, graph theory, finite state machines.
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1400)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)

MATH 1930 - Special Topics
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)

MATH 1980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)

MATH 2530 - Calculus III
Credit(s): 4 Credits
Three-dimensional analytic geometry, vector-valued functions, partial differentiation, multiple integration, and line integrals. (Offered every Fall and Spring)
Prerequisite(s): (MATH 1520 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1520, or SLU Math Placement with a minimum score of 2530)
Attributes: Geospatial Elective, Mathematics BA Req (A&S), Mathematics BS Req (A&S), UUC:Quantitative Reasoning

MATH 2660 - Discrete Mathematics
Credit(s): 3 Credits
Concepts of discrete mathematics used in computer science; sets, sequences, strings, symbolic logic, proofs, mathematical induction, sums and products, number systems, algorithms, complexity, graph theory, finite state machines.
Prerequisite(s): (MATH 1200 with a grade of C- or higher, Math Waiver per Advisor with a minimum score of 1200, or SLU Math Placement with a minimum score of 1400)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)

MATH 2930 - Special Topics
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)

MATH 2980 - Independent Study
Credit(s): 1-3 Credits (Repeatable for credit)
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)
MATH 2980 - Independent Study
Credit(s): 0-3 Credits (Repeatable for credit)
Prior approval of sponsoring professor and chair required.
Attributes: Mathematics BA Req (A&S), Mathematics BS Req (A&S)

MATH 3110 - Linear Algebra for Engineers
Credit(s): 3 Credits
Scheduling, bin-packing: algorithmic analysis and NP completeness.
first and breadth-first searches; combinational algorithms: resource
minimum-cost spanning trees, shortest path, network flows; depth
generating functions; algorithms: graphs and digraphs, graph algorithms:
advanced counting methods: permutations and combinations, recurrence
relations, generating functions; algorithms: graphs and digraphs, graph algorithms:
minimum-cost spanning trees, shortest path, network flows; depth
first and breadth-first searches; combinational algorithms: resource
scheduling, bin-packing: algorithmic analysis and NP completeness.

MATH 3120 - Introduction to Linear Algebra
Credit(s): 3 Credits
Matrices, row operations with matrices, determinants, systems of
linear equations, vector spaces, linear transformations, inner products,
eigenvalues and eigenvectors. Credit not given for both MATH 3110 and
MATH 3120. (Offered every Fall and Spring)

MATH 3240 - Numerical Analysis
Credit(s): 3 Credits
Review of calculus; root finding, nonlinear systems, interpolation and
approximation; numerical differentiation and integration.

MATH 3270 - Advanced Mathematics for Engineers
Credit(s): 3 Credits
Introduction to algebraic number theory. Topics will include primes,
Chinese remainder theorem, Diophantine equations, algebraic numbers
and quadratic residues. Additional topics will vary from year to year.

MATH 4110 - Introduction to Abstract Algebra
Credit(s): 3 Credits
Elementary properties of the integers, sets and mappings, groups, rings,
integral domains, division rings and fields. (Offered every Fall)

MATH 4120 - Linear Algebra
Credit(s): 3 Credits
Advanced linear algebra, including linear transformations and duality,
elementary canonical forms, rational and Jordan forms, inner product
spaces, unitary operators, normal operators and spectral theory. (Offered
every Spring)

MATH 4150 - Number Theory
Credit(s): 3 Credits
Introduction to algebraic number theory. Topics will include primes,
Chinese remainder theorem, Diophantine equations, algebraic numbers
and quadratic residues. Additional topics will vary from year to year.
(Offered periodically)

MATH 3550 - Differential Equations
Credit(s): 3 Credits
Solution of ordinary differential equations, higher order linear equations,
constant coefficient equations, systems of first order equations, linear
systems, equilibrium of nonlinear systems, Laplace transformations.

MATH 3800 - Elementary Theory of Probability
Credit(s): 3 Credits
Counting theory; axiomatic probability, random variables, expectation,
limit theorems. Applications of the theory of probability to a variety of
practical problems. Credit not given toward the math major or minors for
both MATH 3800 and either MATH 3810 or MATH 4800. (Offered every
Fall)

MATH 3850 - Foundation of Statistics
Credit(s): 3 Credits
Descriptive statistics, probability distributions, random variables,
expectation, independence, hypothesis testing, confidence intervals,
regression and ANOVA. Applications and theory. Taught using statistical
software. Credit not given toward the math major or minors for both
MATH 3810 and MATH 3850 / STAT 3850.

MATH 3760 - Financial Mathematics
Credit(s): 3 Credits
This course covers the theory of interest material for the Financial
Mathematics exam of the Society of Actuaries. Time permitting,
supplemental material covering financial derivatives will be discussed.

MATH 3930 - Special Topics
Credit(s): 0-3 Credits (Repeatable for credit)

MATH 3980 - Independent Study
Credit(s): 0-3 Credits (Repeatable for credit)

MATH 3990 - Independent Study
Credit(s): 0-3 Credits (Repeatable for credit)

MATH 4050 - History of Mathematics
Credit(s): 3 Credits
The development of several important branches of mathematics,
including numeration and computation, algebra, non-Euclidean geometry,
and calculus. (Offered periodically)

MATH 4100 - Introduction to Abstract Algebra
Credit(s): 3 Credits
Elementary properties of the integers, sets and mappings, groups, rings,
integral domains, division rings and fields. (Offered every Fall)

MATH 4110 - Linear Algebra
Credit(s): 3 Credits
Advanced linear algebra, including linear transformations and duality,
elementary canonical forms, rational and Jordan forms, inner product
spaces, unitary operators, normal operators and spectral theory. (Offered
every Spring)

MATH 4150 - Number Theory
Credit(s): 3 Credits
Introduction to algebraic number theory. Topics will include primes,
Chinese remainder theorem, Diophantine equations, algebraic numbers
and quadratic residues. Additional topics will vary from year to year.
(Offered periodically)

* Concurrent enrollment allowed.
MATH 4210 - Introduction to Analysis  
Credit(s): 3 Credits  
Real number system, functions, sequences, limits, continuity, differentiation, integration and series. (Offered every Fall)  
Prerequisite(s): MATH 2530; MATH 3120 with a grade of C- or higher

MATH 4220 - Metric Spaces  
Credit(s): 3 Credits  
Set theory, metric spaces, completeness, compactness, connected sets, category. (Offered every Spring)  
Prerequisite(s): MATH 4210

MATH 4230 - Multivariable Analysis  
Credit(s): 3 Credits  
Introduction to analysis in multidimensional Euclidean space. Sequences and Series of functions, Differentiability, Integrability, Inverse and Implicit function theorems, Fundamental Theorems of Multivariable Calculus (Green's Theorem, Stokes' Theorem, Divergence Theorem). (Offered every Spring)  
Prerequisite(s): MATH 4210

MATH 4310 - Introduction to Complex Variables  
Credit(s): 3 Credits  
Complex number system and its operations, limits and sequences, continuous functions and their properties, derivatives, conformal representation, curvilinear and complex integration, Cauchy integral theorems, power series and singularities. (Offered every Fall)  
Prerequisite(s): MATH 2530

MATH 4320 - Complex Variables II  
Credit(s): 3 Credits  
This course is a continuation of MATH 4310. Topics covered include series, residues and poles, conformal mapping, integral formulas, analytic continuation, and Riemann surfaces.  
Prerequisite(s): MATH 4210

MATH 4410 - Foundations of Geometry  
Credit(s): 3 Credits  
Historical background of the study of Euclidean geometry; development of two-dimensional Euclidean geometry from a selected set of postulates. (Offered periodically)  
Prerequisite(s): MATH 1510 or Math Waiver per Advisor with a minimum score of 1510

MATH 4430 - Non-Euclidean Geometry  
Credit(s): 3 Credits  
The rise and development of the non-Euclidean geometries with intensive study of plane hyperbolic geometry. (Offered periodically)  
Prerequisite(s): (0 Course from MATH 1510-2530 or Math Waiver per Advisor with a minimum score of 1510)

MATH 4500 - Nonlinear Dynamics and Chaos  
Credit(s): 3 Credits  
Bifurcation in one-dimensional flows. Two-dimensional flows, fixed points and linearization, conservative systems, index theory, limit cycles. Poincar-Bendixson theory, bifurcations. Chaos, the Lorenz equation, discrete maps, fractals, and strange attractors.  
Prerequisite(s): MATH 3550

MATH 4570 - Partial Differential Equations  
Credit(s): 3 Credits  
Fourier series, Fourier Integrals, the heat equation, Sturm-Liouville problems, the wave equation, the potential equation, problems in several dimensions, Laplace transforms numerical methods.  
Prerequisite(s): MATH 3550  
Attributes: Geospatial Elective

MATH 4630 - Graph Theory  
Credit(s): 3 Credits  
Basic definitions and concepts, undirected graphs (trees and graphs with cycles), directed graphs, and operation on graphs, Euler's formula, and surfaces. (Offered periodically)  
Prerequisite(s): (MATH 2530 or Math Waiver per Advisor with a minimum score of 2530)

MATH 4800 - Probability Theory  
Credit(s): 3 Credits  
Axioms of probability, conditional probability. Discrete and continuous random variables, expectation, jointly defined random variables. Transformations of random variables and limit theorems. Theory and applications, taught using statistical software. Credit not given toward the math major or minors for any two of MATH 3800, MATH 4800 and MATH 4810.  
Prerequisite(s): (MATH 3850 or STAT 3850); MATH 2530; (MATH 1660 or MATH 2660)

MATH 4840 - Time Series  
Credit(s): 3 Credits  
Applied time series. Topics include exploratory data analysis, regression, ARIMA. Spectral analysis, state-space models. Theory and applications, taught using statistical software.  
Prerequisite(s): (MATH 3850 or STAT 3850)

MATH 4850 - Mathematical Statistics  
Credit(s): 3 Credits  
Theory of estimators, sampling distributions, hypothesis testing, confidence intervals, regression, bootstrapping, and resampling. Theory and applications, taught using statistical software.  
Prerequisite(s): (MATH 4800 or STAT 4800)

MATH 4870 - Applied Regression  
Credit(s): 3 Credits  
Linear regression, model selection, nonparametric regression, classification and graphical models. Theory and applications using statistical software.  
Prerequisite(s): (MATH 3850 or STAT 3850); (MATH 3110 or MATH 3120)

MATH 4910 - Internship  
Credit(s): 1-6 Credits (Repeatable for credit)  
Attributes: UUC:Reflection-in-Action

MATH 4930 - Special Topics  
Credit(s): 3 Credits (Repeatable for credit)

MATH 4980 - Advanced Independent Study  
Credit(s): 3 Credits  
(Repeatable for credit)

MATH 5011 - Introduction to Abstract Algebra  
Credit(s): 3 Credits  
Elementary properties of the integers, sets and mappings, groups, rings, integral domains, division rings and fields.

MATH 5012 - Linear Algebra  
Credit(s): 3 Credits  
Advanced linear algebra including linear transformations and duality, elementary canonical forms, rational and Jordan forms, inner product spaces, unitary operators, normal operators, and spectral theory. (Offered every other spring semester)
MATH 5015 - Number Theory  
Credit(s): 3 Credits  
Introduction to algebraic number theory. Topics will include primes, Chinese remainder theorem, Diophantine equations, algebraic numbers and quadratic residues. Additional topics will vary from year to year. (Offered every other spring semester)  
Prerequisite(s): MATH 5011

MATH 5021 - Introduction to Analysis  
Credit(s): 3 Credits  
Real number system, functions, sequences, limits, continuity, differentiation, integration and series.  
Attributes: Bioinformatics & Comp Bio Elec

MATH 5022 - Metric Spaces  
Credit(s): 3 Credits  
Set theory, real line, separation properties, compactness, metric spaces, metrization. (Offered every other spring semester)  
Prerequisite(s): MATH 5021

MATH 5023 - Multivariable Analysis  
Credit(s): 3 Credits  
Sequences and Series of functions, Differentiability, Integrability, Inverse and Implicit function theorems, Fundamental Theorems of Multi-variable Calculus (Green's Theorem, Stokes Theorem, Divergence Theorem). (Offered every other spring semester)  
Prerequisite(s): MATH 5021

MATH 5080 - Probability Theory  
Credit(s): 3 Credits  
Axioms of probability, conditional probability. Discrete and continuous random variables, expectation, jointly defined random variables. Transformations of random variables and limit theorems. Theory and applications, taught using statistical software.  
Attributes: Bioinformatics & Comp Bio Elec

MATH 5110 - Algebraic Structures I  
Credit(s): 3 Credits  
This course is intended as a graduate-level introduction to groups, rings, and fields. These algebraic objects are of fundamental importance to numerous branches of mathematics, including algebraic number theory, algebraic geometry, representation theory, analysis, topology, differential geometry, and partial differential equations. This course will provide the algebraic foundations for further study in more specialized topics.

MATH 5120 - Algebra II  
Credit(s): 3 Credits  
Rings, fields, bases and degrees of extension fields, transcendent elements, normal fields and their structures. Galois theory, finite fields; solutions of equations by radicals, general equations of degree \( n \). (Offered every Spring)  
Prerequisite(s): MATH 5110

MATH 5130 - Computational Algebra  
Credit(s): 3 Credits  
This course is an introduction to computational methods in algebra. The course will cover a selection of computer algebra topics such as factorization and greatest common divisors, fast multiplication (FFT), solving polynomial equations, lattice reduction, linear difference equations, Groebner bases, and elimination theory. Additional topics may be introduced at the instructors discretion. The course will include a general introduction to the topics as well as a discussion of algorithms and applications.

MATH 5210 - Measure Theory  
Credit(s): 3 Credits  
The topology of the reals, Lebesgue and Borel measurable functions, properties of the Lebesgue integral, differential of the integral.

MATH 5220 - Complex Analysis  
Credit(s): 3 Credits  
Holomorphic and Harmonic functions and power series expansions. Complex integration. Cauchy's theorem and applications. Laurent series, singularities, Runge's theorem, and the calculus of residues. Additional topics may include Analytic continuation, Riemann surfaces, and conformal mapping.  
Prerequisite(s): MATH 5210; MATH 5310

MATH 5240 - Harmonic Analysis  
Credit(s): 3 Credits  
Fourier Series on the circle, Convergence of Fourier series, Conjugate and maximal functions, Interpolation of Linear Operators, Lacunary Sequences, Fourier Transform on the line, Fourier transform on locally compact Abelian groups. MATH 5310 is recommended. (Offered periodically)  
Prerequisite(s): MATH 5210

MATH 5310 - Point Set Topology  
Credit(s): 3 Credits  
Topological spaces, convergence, nets, product spaces, metrization, compact spaces, connected spaces.

MATH 5320 - General Topology II  
Credit(s): 3 Credits  
Compact surfaces, fundamental groups, force groups and free products, Seifert-van Kampen theorem, covering spaces. Offered every Spring semester.  
Prerequisite(s): MATH 5310

MATH 5350 - Differential Topology  
Credit(s): 3 Credits  
This course will be an introduction to elementary differential topology. Topics covered include manifolds and smooth maps, morse functions, manifolds with boundary, transversality, intersection numbers, orientation, vector fields, the Euler Characteristic, and vector bundles.

MATH 5360 - Applied Topology and the Shape of Data  
Credit(s): 3 Credits  
This graduate course will involve a brief introduction to elementary algebraic topology and some of its applications, including topological data analysis. The course will be a mixture of proofs and computations which help illuminate the theory.

MATH 5910 - Internship  
Credit(s): 1-3 Credits

MATH 5930 - Special Topics in Mathematics  
Credit(s): 1-3 Credits (Repeatable for credit)

MATH 5980 - Graduate Reading Course  
Credit(s): 1-3 Credits (Repeatable for credit)  
Prior permission of instructor and chairperson required.

MATH 5990 - Thesis Research  
Credit(s): 0-6 Credits (Repeatable for credit)

MATH 6180 - Topics in Algebra  
Credit(s): 3 Credits  
Various topics are discussed to bring graduate students to the forefront of a research area in algebra. Times of offering in accordance with research interests of faculty. (Offered occasionally)
MATH 6230 - Functional Analysis  
Credit(s): 3 Credits  

MATH 6280 - Topics in Analysis  
Credit(s): 3 Credits (Repeatable for credit)  
Various topics are offered to bring graduate students to the forefront of a research area in analysis. Times of offering in accordance with research interests of faculty. Offered occasionally.

MATH 6310 - Algebraic Topology  
Credit(s): 3 Credits  
Homotopy theory, homology theory, exact sequences, Mayer-Vietoris sequences, degrees of maps, cohomology, Künneth formula, cup and cap products, applications to manifolds including Poincaré-Lefshetz duality. Offered every other year.  
Prerequisite(s): MATH 5320

MATH 6380 - Topics in Topology  
Credit(s): 3 Credits (Repeatable for credit)  
Various topics are offered to bring graduate students to the forefront of a research area in topology. Times of offering in accordance with research interests of faculty. Offered occasionally.

MATH 6410 - Differential Geometry  
Credit(s): 3 Credits  
This course is an introduction to Riemannian manifolds, including much on the behavior of geodesics. A key highlight is the Hopf-Rinow Theorem on completeness.  
Prerequisite(s): MATH 5320

MATH 6420 - Differential Geometry II  
Credit(s): 3 Credits  
Continuation of MATH-6410. (Offered every Spring)  
Prerequisite(s): MATH 6410

MATH 6930 - Special Topics  
Credit(s): 3 Credits (Repeatable for credit)

MATH 6980 - Graduate Reading Course  
Credit(s): 1-3 Credits (Repeatable for credit)  
Prior permission of instructor and chairperson required.

MATH 6990 - Dissertation Research  
Credit(s): 0-6 Credits (Repeatable for credit)