MATHEMATICS (MAT)

MAT 112 Contemporary Topics in Mathematics 3
Practical mathematical topics including set theory, properties and operations of number systems, algebra, geometry and consumer mathematics. Additional topics may be selected from logic, systems of numeration, and mathematical systems.

GE Core: GMT
Notes: Students may not receive credit for both MAT 112 and RCO 112.

MAT 115 College Algebra 3
Algebraic expressions, exponents, radicals, factoring, solving equations and inequalities, graphing, polynomial and rational functions.

GE Core: GMT
Notes: Credit can be earned for only one of MAT 115 or MAT 150.

MAT 120 Calculus with Business Applications 3
Introductory survey of differential calculus with emphasis on techniques and applications related to business and the social sciences.

GE Core: GMT
Prerequisites: An acceptable score on the mathematics placement test or a minimum grade of C (2.0) in at least one of: MAT 115, MAT 150, MAT 151, and/or MAT 190.
Notes: This course does not serve as a prerequisite for MAT 292 (Calculus II). This is a terminal course and not adequate preparation for MAT 292.

MAT 150 Precalculus I 3
Review of elementary algebra, equations, inequalities, relations, functions, transformations, graphing, complex numbers, polynomial and rational functions.

GE Core: GMT
Notes: Credit can be earned for only one of MAT 115 or MAT 150.

MAT 151 Precalculus II 3
Properties, graphs, and applications of exponential, logarithmic, trigonometric functions.

GE Core: GMT
Prerequisites: An acceptable score on the mathematics placement test or a grade of C or better in MAT 115 or MAT 150.

MAT 181 Experimental Course: Foundations of Calculus I 3
Foundational concepts that supplement topics covered in Calculus I.

Corequisites: MAT 191.
Notes: Grade: Pass/Not Pass (P/NP).

MAT 190 Precalculus 3
This course covers essential prerequisites for calculus. Topics include functions and graphs, equations and inequalities, polynomial and rational functions, trigonometry, functions of trigonometric, exponential, and logarithmic type.

GE Core: GMT
Prerequisites: Acceptable score on the mathematics placement test.

MAT 191 Calculus I 3
Limits and introductory differential calculus of the algebraic and transcendental functions of one variable.

GE Core: GMT
Prerequisites: An acceptable score on the mathematics placement test or a grade of C or better in MAT 151 (or MAT 190).

MAT 220 Plane and Solid Analytic Geometry 3
Study of conic sections (including rotation of axes), graphing with polar coordinates, quadric surfaces, and vectors.

Prerequisites: Grade of C or better in MAT 151 (or equivalent).
Notes: Hours do not count toward degree requirements for MATH major.

MAT 253 Discrete Mathematical Structures 3
A rigorous introduction to discrete mathematical structures, proof techniques, and programming. Topics include sets, functions, sequences, relations, induction, propositional and predicate logic, modular arithmetic, and mathematical programming.

Notes: Only one of MAT 253 or MAT 295 can count toward degree requirements for MATH major.

MAT 292 Calculus II 3
Introductory integral calculus of the algebraic and transcendental functions of one variable, techniques of integration.

GE Core: GMT
Prerequisites: Grade of C or better in MAT 191.

MAT 293 Calculus III 3
Infinite sequences and series, conic sections, polar coordinates, vectors in dimensions two and three, vector-valued functions.

Prerequisites: Grade of C or better in MAT 292.

MAT 300X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

MAT 310 Elementary Linear Algebra 3
Linear systems, matrices, determinants, eigenvalues and eigenvectors, finite-dimensional vector spaces, linear transformations.

Prerequisites: Grade of C or better in MAT 292.

MAT 311 Introduction to Abstract Algebra 3
Sets and mappings, equivalence relations, mathematical induction, introduction to theory of groups, rings, and fields.

Prerequisites: Grade of C or better in MAT 253 and MAT 310.

MAT 320 Introduction to Topology 3
Metric spaces, continuity, equivalence of various types of definitions of continuity, convergence, compactness, connectedness, topological spaces.

Prerequisites: Minimum grade of C in MAT 293 and a minimum grade of C in one of MAT 253 or MAT 310 or CSC 250.

MAT 322 Linear Programming 3
Covers simplex computational procedure, minimum feasible solutions, artificial-basis technique, slack variables, perturbation techniques, cycling, parametric objective and dual problems, sensitivity analysis, and decomposition algorithms.

Prerequisites: Grade of C or better in MAT 310.

MAT 330 Axiomatic Foundations of Geometry 3
Axiomatic systems, logic and proof, incidence geometries, absolute geometries, Euclidean geometry, and an introduction to non-Euclidean geometries and transformational geometry.

Prerequisites: Grade of C or better in MAT 292.
Notes: Required for students seeking secondary licensure in mathematics.

MAT 349 Preparation for Industrial Careers in Mathematical Sciences 3
This course prepares mathematical sciences students for industrial careers by engaging them in research problems that come directly from industry.

Prerequisites: Permission of instructor.

MAT 353 Introduction to Discrete Mathematics 3
Elementary graph theory, combinatorics, partially ordered sets.

Prerequisites: Grade of C or better in MAT 253 or CSC 250.
MAT 390 Ordinary Differential Equations 3
First order differential equations and linear equations of finite order, Laplace transforms, undetermined coefficients, variation of parameters, applications, numerical methods.
Prerequisites: Grade of C or better in MAT 292.

MAT 394 Calculus IV 3
Multivariable functions, partial differentiation, multiple integrals, vector calculus.
Prerequisites: Grade of C or better in MAT 293.

MAT 395 Introduction to Mathematical Analysis 3
Properties of real numbers, sequences, limits of sequences and functions, continuity, differentiation, Riemann integral.
Prerequisites: Grade of C or better in MAT 253, MAT 293, and MAT 310.

MAT 400X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

MAT 405 Foundations of Mathematics for Teaching I 3
Capstone survey of real and complex numbers; polynomial, rational, exponential, logarithmic, and trigonometric functions; calculus concepts. Special teaching problems and procedures for secondary topics in relation to their mathematical foundations.
Prerequisites: Grade of C (2.0) or better in MAT 310.

MAT 406 Foundations of Mathematics for Teaching II 4
Capstone survey of geometry, probability, data analysis, and discrete mathematics. Special teaching problems and procedures for secondary topics related to their mathematical foundations, including 50-hour internship in secondary math classroom.
Prerequisites: Minimum grade of C (2.0) in MAT 405 and minimum grade of C (2.0) in one of either MAT 311 or MAT 395. Admission to the Teacher Education Program.

MAT 413 Historical Development of Mathematics 3
Study of the historical development of mathematics, not a history of persons involved in development.
Prerequisites: Grade of C or better in MAT 292.
Notes: Hours do not count toward degree requirements for MATH major nor for the M.A. degree in Mathematics.

MAT 414 Theory of Numbers 3
An introductory course to both multiplicative and additive number theory. Divisibility, prime numbers, congruencies, linear and nonlinear Diophantine equations (including Pell's equation), quadratic residues, number-theoretic functions, and other topics.
Prerequisites: Grade of C or better in either MAT 311 or MAT 395.

MAT 415 Mathematical Logic 3
Prerequisites: Grade of C or better in MAT 311 (or MAT 353).

MAT 416 Intermediate Abstract Algebra 3
Rings, integral domains, fields, division algorithm, factorization theorems, zeros of polynomials, greatest common divisor, formal derivatives, prime polynomials, Euclidean domains, the fundamental theorem of algebra.
Prerequisites: Grade of C or better in MAT 311.

MAT 417 Theory of Groups 3
Elementary properties of groups and homomorphisms, quotients and products of groups, the Sylow theorems, structure theory for finitely generated abelian groups.

MAT 419 Intuitive Concepts in Topology 3
Basic concepts, vector fields, the Jordan curve theorem, surfaces, homology of complexes, continuity.
Prerequisites: Grade of C or better in MAT 311 (or MAT 395).

MAT 420 Non-Euclidean Geometry 3
Fifth postulate, hyperbolic geometries, elliptic geometries, consistency of non-Euclidean geometries, models for geometries, elements of inversion.
Prerequisites: Grade of C or better in MAT 311 (or MAT 395).

MAT 421 Projective Geometry 3
Transformation groups and projective, affine and metric geometries of the line, plane, and space. Homogeneous coordinates, principles of duality, involutions, cross-ratio, collineations, fixed points, conics, models, and Euclidean specializations.
Prerequisites: Permission of instructor.

MAT 422 Introductory Functional Analysis 3
Basic concepts in Banach spaces, Hilbert spaces, linear operators, and their applications.
Prerequisites: Grade of C or better in MAT 395.

MAT 423 Numerical Methods 3
Number systems and errors, solutions of non-linear and linear systems, interpolation, numerical differentiation and integration, solution of differential equations. Implementation of numerical methods using a high-level programming language.
Prerequisites: A grade of at least C in MAT 293.

MAT 425 Intermediate Mathematical Analysis 3
Integration, infinite series, sequences and series of functions.
Prerequisites: Grade of C or better in MAT 395.

MAT 427 Numerical Methods 3
Number systems and errors, solutions of non-linear and linear systems, interpolation, numerical differentiation and integration, solution of differential equations. Implementation of numerical methods using a high-level programming language.
Prerequisites: A grade of at least C in MAT 293.

MAT 431 Combinatorial Analysis 3
The pigeon-hole principle, permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, recurrence relations.
Prerequisites: Grade of C or better in MAT 253 (or MAT 295 or MAT 311 or MAT 395). or permission of instructor.

MAT 432 Introductory Graph Theory 3
Basic concepts, graph coloring, trees, planar graphs, networks.
Prerequisites: Grade of C or better in MAT 310 and any one of the courses MAT 253, MAT 295, MAT 311, MAT 395, MAT 431.

MAT 435 Differential Equations and Orthogonal Systems 3
An introduction to Fourier series and orthogonal sets of functions, with applications to boundary value problems.
Prerequisites: Grade of C or better in MAT 293 and MAT 390. or permission of instructor.

MAT 436 Partial Differential Equations with Applications 3
Fourier integrals, Bessel functions, Legendre polynomials and their applications. Existence and uniqueness of solutions to boundary value problems.
Prerequisites: Grade of C or better in MAT 435.
MAT 439 Topics in Applied Mathematics 3
Selected topics of current interest in applied mathematics.
Prerequisites: Grade of C or better in MAT 293 and MAT 390, or permission of instructor;
Notes: May be repeated for credit with approval of the Department Head.

MAT 440 Introductory Complex Analysis 3
The complex number system, holomorphic functions, power series, complex integration, representation theorems, the calculus of residues.
Prerequisites: Grade of C or better in MAT 394.

MAT 441 Stochastic Processes 3
Prerequisites: Grade of C or better in MAT 394 and MAT 353, or equivalents.

MAT 442 Stochastic Processes 3
Prerequisites: Grade of C or better in MAT 394 and MAT 353, or equivalents.

MAT 465 Student Teaching and Seminar-Secondary Mathematics 12
Supervised student teaching in senior high school under direction of university supervisor. Observation, participation, and appropriate classroom teaching experience on full-time teaching assignment for full semester with weekly seminar.
Prerequisites: MAT 406. Admission to the Teacher Education Program.

MAT 486 Financial Mathematics for Actuaries 3
Measurement of interest, present and accumulated value, amortization, sinking funds, bonds, duration, immunization, and an introductory analysis of financial derivatives. Intended to help prepare for the FM/2 actuarial exam.
Prerequisites: Minimum grade of C (2.0) in MAT 394 or permission of instructor. Graduate students in MA in Mathematics, Ph.D. students in Computational Mathematics, or undergraduate students in the accelerated BS to MA in Mathematics.

MAT 488 Directed Study in Mathematics 1-3
MAT 490 Senior Seminar in Mathematics 3
Oral presentations on topics in mathematics, including current mathematics literature.
Prerequisites: Senior standing and mathematics major, or permission of instructor.

MAT 493 Honors Work 3-6
Prerequisite: Permission of instructor; 3.30 GPA in the major; 12 s.h. in the major;
Notes: May be repeated for credit if the topic of study changes.

MAT 494 Directed Study in Mathematics 1-3

MAT 503 Problem Solving in Mathematics 3
Investigates the nature of problem solving, covers procedures involved in problem solving, develops individual problem solving skills, and collects a set of appropriate problems. Required for middle grades mathematics concentration.
Prerequisites: Grade of at least C in MAT 191 and MAT 303 or permission of instructor.
Notes: Hours do not count toward degree requirements for Mathematics majors. This course cannot be applied toward the requirements for the M.A. degree in Mathematics.

MAT 505 Foundations of Mathematics for Teachers 3
Primarily for students seeking teacher certification. Includes properties and algebra of real numbers; analytic geometry; polynomial, rational, exponential, logarithmic, and trigonometric functions; complex numbers; concept of limits of functions.
Prerequisites: Grade of C or better in MAT 292 (or MAT 303), or permission of instructor;
Notes: Hours do not count toward degree requirements for MATH major nor for the M.A. degree in Mathematics.

MAT 513 Historical Development of Mathematics 3
Study of the historical development of mathematics, not a history of persons involved in development.
Prerequisites: Grade of C or better in MAT 292.
Notes: Hours do not count toward degree requirements for MATH major nor for the M.A. degree in Mathematics.

MAT 591 Advanced Abstract Algebra 3
Groups: homomorphisms, quotient groups, Sylow theorems, finitely generated abelian groups. Rings: homomorphisms, ideals, quotient rings, integral domains, Euclidean domains, factorization. Fields: algebraic extensions of fields, Galois theory.
Prerequisites: Grade of C or better in MAT 516.

MAT 593 Directed Study in Mathematics 1-3
MAT 594 Directed Study in Mathematics 1-3
MAT 600X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

MAT 601 Seminar in the Teaching of Mathematics I 1
Seminar on practices and principles of undergraduate teaching in mathematics and statistics.
Notes: Required for all teaching assistants. Grade: Satisfactory/Unsatisfactory (S/U).

MAT 602 Seminar in Mathematical Software 3
Variety of issues in the design of mathematical software, i.e., type systems, user interfaces, and memory management. Each student investigates one computer algebra system more closely.
Prerequisites: Knowledge of a programming language.

MAT 603 Practicum in the Teaching of Mathematics 2
Practicum in teaching mathematics at the college/university level.
Topics include course design, class materials, exams, grading, syllabus, choosing textbooks, dealing with difficult matters, and mathematical typesetting.
Corequisites: MAT 601.

MAT 614 Theory of Numbers 3
An introductory course to both multiplicative and additive number theory. Divisibility, prime numbers, congruencies, linear and nonlinear Diophantine equations (including Pell’s equation), quadratic residues, number-theoretic functions, and other topics.
Prerequisites: Grade of C or better in either MAT 311 or MAT 395.

MAT 617 Theory of Groups 3
Elementary properties of groups and homomorphisms, quotients and products of groups, the Sylow theorems, structure theory for finitely generated abelian groups.

MAT 619 Intuitive Concepts in Topology 3
Basic concepts, vector fields, the Jordan curve theorem, surfaces, homology of complexes, continuity.
Prerequisites: Grade of C or better in MAT 311 (or MAT 395).
MAT 620 Non-Euclidean Geometry 3
Fifth postulate, hyperbolic geometries, elliptic geometries, consistency of non-Euclidean geometries, models for geometries, elements of inversion.
Prerequisites: Grade of C or better in MAT 311 (or MAT 395).

MAT 621 Projective Geometry 3
Transformation groups and projective, affine and metric geometries of the line, plane, and space. Homogeneous coordinates, principles of duality, involutions, cross-ratio, collineations, fixed points, conics, models, and Euclidean specializations.
Prerequisites: Permission of instructor.

MAT 622 Introductory Functional Analysis 3
Basic concepts in Banach spaces, Hilbert spaces, linear operators, and their applications.
Prerequisites: Grade of C or better in MAT 395.

MAT 623 Numerical Methods 3
Number systems and errors, solutions of non-linear and linear systems, interpolation, numerical differentiation and integration, solution of differential equations. Implementation of numerical methods using a high-level programming language.
Prerequisites: A grade of at least C in MAT 293.

MAT 625 Intermediate Mathematical Analysis 3
Integration, infinite series, sequences and series of functions.
Prerequisites: Grade of C or better in MAT 395.

MAT 627 Numerical Methods 3
Number systems and errors, solutions of non-linear and linear systems, interpolation, numerical differentiation and integration, solution of differential equations. Implementation of numerical methods using a high-level programming language.
Prerequisites: A grade of at least C in MAT 293.

MAT 631 Combinatorial Analysis 3
The pigeon-hole principle, permutations, combinations, generating functions, principle of inclusion and exclusion, distributions, partitions, recurrence relations.
Prerequisites: Grade of C or better in MAT 253 (or MAT 295 or MAT 311 or MAT 395) or permission of instructor.

MAT 632 Introductory Graph Theory 3
Basic concepts, graph coloring, trees, planar graphs, networks.
Prerequisites: Grade of C or better in MAT 310 and any one of the courses MAT 253, MAT 295, MAT 311, MAT 395, MAT 531.

MAT 635 Differential Equations and Orthogonal Systems 3
An introduction to Fourier series and orthogonal sets of functions, with applications to boundary value problems.
Prerequisites: Grade of C or better in MAT 293 and MAT 390 or permission of instructor.

MAT 636 Partial Differential Equations with Applications 3
Fourier integrals, Bessel functions, Legendre polynomials and their applications. Existence and uniqueness of solutions to boundary value problems.
Prerequisites: Grade of C or better in MAT 545.

MAT 639 Topics in Applied Mathematics 3
Selected topics of current interest in applied mathematics.
Prerequisites: Grade of C or better in MAT 293 and MAT 390 or permission of instructor;
Notes: May be repeated for credit with approval of the Department Head.

MAT 640 Introductory Complex Analysis 3
The complex number system, holomorphic functions, power series, complex integration, representation theorems, the calculus of residues.
Prerequisites: Grade of C or better in MAT 394.

MAT 641 Stochastic Processes 3
Markov processes, Markov reward processes, queuing, decision making, graphs, and networks. Applications to performance, reliability, and availability modeling.
Prerequisites: Grade of C or better in MAT 394 and MAT 353 or equivalents.

MAT 642 Stochastic Processes 3
Markov processes, Markov reward processes, queuing, decision making, graphs, and networks. Applications to performance, reliability, and availability modeling.
Prerequisites: Grade of C or better in MAT 394 and MAT 353 or equivalents.

MAT 659 Advanced Topics in Mathematics 3
Topics vary according to interest and demand, and include algebra, applied mathematics, combinatorics, dynamics, mathematical logic, topology, and other topics.
Prerequisites: Permission of instructor.
Notes: May be repeated for credit when topic varies.

MAT 686 Financial Mathematics for Actuaries 3
Measurement of interest, present and accumulated value, amortization, sinking funds, bonds, duration, immunization, and an introductory analysis of financial derivatives. Intended to help prepare for the FM/2 actuarial exam.
Prerequisites: Minimum grade of C (2.0) in MAT 394 or permission of instructor. Graduate students in MA in Mathematics, Ph.D. students in Computational Mathematics, or undergraduate students in the accelerated BS to MA in Mathematics.

MAT 687 Project in Mathematics 3
Directed research project in Mathematics.
Prerequisites: Admission to the MA in Mathematics and Permission of Instructor.

MAT 691 Advanced Abstract Algebra 3
Groups: homomorphisms, quotient groups, Sylow theorems, finitely generated abelian groups. Rings: homomorphisms, ideals, quotient rings, integral domains, Euclidean domains, factorization. Fields: algebraic extensions of fields, Galois theory.
Prerequisites: Grade of C or better in MAT 516.

MAT 692 Advanced Abstract Algebra 3
Groups: homomorphisms, quotient groups, Sylow theorems, finitely generated abelian groups. Rings: homomorphisms, ideals, quotient rings, integral domains, Euclidean domains, factorization. Fields: algebraic extensions of fields, Galois theory.
Prerequisites: Grade of C or better in MAT 516.

MAT 695 Mathematical Analysis 3
Real number axioms, metric spaces, sequences, series, continuity, differentiation, the Riemann-Stieltjes integral.
Prerequisites: MAT 395 or permission of instructor.

MAT 696 Mathematical Analysis 3
Real number axioms, metric spaces, sequences, series, continuity, differentiation, the Riemann-Stieltjes integral.
Prerequisites: MAT 395 or permission of instructor.
MAT 699 Thesis 1-6
MAT 701 Graduate Seminar in Computational Mathematics 3
Readings from the literature of computational mathematics.
Prerequisites: MAT 748 or permission of instructor.
Notes: May be repeated for credit when topic varies.

MAT 709 Topics in Computational Mathematics 3
Advanced study in special topics in computational mathematics.
Prerequisites: MAT 748 or permission of instructor.
Notes: May be repeated for credit when topic varies.

MAT 721 Mathematical Cryptography 3
Mathematics of cryptography with emphasis on public key systems.
Applications of elliptic and hyperelliptic curves and lattice theory in
attacking and evaluating the security of cryptographic systems.
Prerequisites: MAT 748 or permission of instructor.

MAT 723 Numerical Mathematics 3
Functional analytic treatment of computation, approximation,
optimization, interpolation, smoothing equations, linear systems,
differential equations. Emphasis on the mathematical development and
analysis of numerical techniques.
Prerequisites: MAT 390, MAT 595, MAT 596, or equivalents.

MAT 726 Finite Element Methods 3
Introduce the fundamental concepts of the finite element method for
approximating solutions to boundary and initial boundary value problems.
Topics include modeling, mathematical formulations, convergence
analysis, and computer implementation.
Prerequisites: A grade of B or better in MAT 727.

MAT 727 Linear Algebra and Matrix Theory 3
Vector spaces. Linear operators and similarity. The eigenvalue problem
and a special decomposition theorem. Normal forms: Smith form for
matrices, rational and Jordan forms. Spectral resolution of matrix
functions. Special topics.
Prerequisites: MAT 310, MAT 311 or permission of instructor.

MAT 728 Linear Algebra and Matrix Theory 3
Vector spaces. Linear operators and similarity. The eigenvalue problem
and a special decomposition theorem. Normal forms: Smith form for
matrices, rational and Jordan forms. Spectral resolution of matrix
functions. Special topics.
Prerequisites: MAT 310, MAT 311 or permission of instructor.

MAT 735 Ordinary Differential Equations 3
Existence and uniqueness theorems for initial value problems, theory of
linear equations, nonlinear equations, stability theory, boundary value
problems.
Prerequisites: MAT 390 and MAT 595 or permission of instructor.

MAT 736 Partial Differential Equations 3
Derivation of partial differential equations (PDE) models and applications,
linear first order PDE’s, elliptic equations and Green’s function, PDE’s of
parabolic and hyperbolic type.
Prerequisites: MAT 735 or permission of instructor.

MAT 737 General Topology 3
Topological spaces, point set topology, product and quotient spaces,
embedding and metrization, uniform spaces, function spaces, homotopy
theory, simplicial complexes and homology, more algebraic topology,
general homotopy theories.
Prerequisites: Bachelor’s degree with a major in mathematics. Credits
equivalent to credits for mathematics MAT 310, MAT 311, MAT 595, and
MAT 596, or permission of instructor and department head.

MAT 740 Modern Abstract Algebra 3
Real and complex number fields; rings, integral domains and fields;
polynomial rings; extensions of rings and fields; elementary factorization
theory; ideals; topics in linear algebra.

MAT 741 Modern Abstract Algebra 3
Real and complex number fields; rings, integral domains and fields;
polynomial rings; extensions of rings and fields; elementary factorization
theory; ideals; topics in linear algebra.
Prerequisites: Bachelor’s degree with a major in mathematics. Credits
equivalent to credits for mathematics MAT 310, MAT 311, MAT 595, and
MAT 596, or permission of instructor and department head.

MAT 742 Computational Number Theory 3
Main algorithms used to compute basic information about algebraic
number fields, including integral bases, ideal factorization, system of
fundamental units, and class group structure.
Prerequisites: MAT 748 or permission of instructor.

MAT 743 Complex Analysis 3
The complex number system, holomorphic functions, power series,
complex integration, representation theorems, the calculus of residues.

MAT 744 Complex Analysis 3
Lebesgue measure; the Lebesgue integral; differentiation and integration,
the classical Banach spaces; metric spaces, topological spaces, compact
spaces; Banach spaces, measure and integration, measure and outer
measure; the Daniell integral; mappings of measure spaces.
Prerequisites: Bachelor’s degree with a major in mathematics. Credits
equivalent to credits for mathematics MAT 310, MAT 311, MAT 595, and
MAT 596, or permission of instructor and department head.

MAT 745 Real Analysis 3
Lebesgue measure; the Lebesque integral; differentiation and integration,
the classical Banach spaces; metric spaces, topological spaces, compact
spaces; Banach spaces, measure and integration, measure and outer
measure; the Daniell integral; mappings of measure spaces.
Prerequisites: Bachelor’s degree with a major in mathematics. Credits
equivalent to credits for mathematics MAT 310, MAT 311, MAT 595, and
MAT 596, or permission of instructor and department head.

MAT 747 Computational Topology 3
Triangulations and WRAP. Computing homology algorithmically. Morse
theory and persistent homology. Computations on knots, braids, and
links.
Prerequisites: MAT 748 or permission of instructor.

MAT 748 Computational Algebra 3
Variety of basic subjects in computational algebra: fast arithmetic,
 algorithms for finite fields, matrix normal forms over rings, polynomial
factorization, and Groebner bases.
Prerequisites: MAT 591, MAT 592, and knowledge of a programming
language. Or permission of instructor.

MAT 749 Topological Algebra 3
Topological groups, Lie groups, algebraic groups, linear groups,
representation theory, algebraic K-Theory, and applications.
Prerequisites: MAT 745 or equivalent knowledge.
MAT 799 Dissertation 1-12
MAT 801 Thesis Extension 1-3
Thesis Extension.
MAT 802 Dissertation Extension 1-3
Dissertation Extension.