MATHEMATICS (MATH)

MATH 100 Math for Business and Social Sciences (3 credits)
Topics include relations, functions (linear and quadratic), factoring, exponents, proportions, probability and development of fundamentals/ concepts for college mathematics. Active learning centered model includes small group active learning sessions and online mini-lectures. This class does not count for credit toward the degrees in the College of Science and Mathematics. Special fee.

MATH 102 New Student Experience for Mathematical Sciences (1 credit)
This course introduces students to the University, the Department of Mathematical Sciences and the culture of higher education. Students learn about campus resources and activities, the disciplines of mathematics and physics, careers in mathematical sciences, and development of good study skills. There is also emphasis on issues related to health, wellness, diversity, and prejudice. Meets Gen Ed - New Student Seminar.

MATH 104 Fractals and Infinity (3 credits)
A study of the beauty of fractals, their numerical and geometric structure, and their fascinating connection to infinity and other branches of mathematics and related fields such as science, art, philosophy, and religion. Many hands-on, visualization, and computer activities and experiences offer rich opportunities to explore, create, and illustrate the dynamics of fractals and mathematics in general by stretching the mind beyond the finite to the infinite, offering a new view of the world we live in. Satisfies Mathematics GenEd requirement; satisfies SEEDS Quantitative Reasoning student learning outcome in alignment with Educated Citizenry value. Mutually Exclusive with HONP 104.

MATH 105 Mathematics in the Movies (3 credits)
Did you know that math is essential to movies and that films like The Incredibles, WALL-E, Monsters Inc, Finding Nemo and several others owe much of their effects to math? In this course, students will learn to recognize, explain and apply mathematical ideas that are present in various mainstream animated and live-action movies. We will examine how different mathematical topics such as statistics, probability, graph theory, geometry, number theory and other branches of mathematics make their way into movies and how they can help us develop critical thinking skills. A basic knowledge of algebra is sufficient to understand the mathematical ideas discussed in this course. By the end of the course, students will have a good understanding of how different aspects of math can be recognized, assimilated and applied to everyday life. Satisfies SEEDS Quantitative Reasoning student learning outcome in alignment with Educated Citizenry value.

MATH 106 Creative Thinking through Mathematics (3 credits)
Explorations of mathematics that foster creative thinking and interdisciplinary approaches. Topics include fractals, symmetry, recreational mathematics, projective geometry, probability, statistics, and mathematics of arts and design. Students are encouraged to broaden their understanding of the meaning and utility of mathematical and creative thinking. Satisfies Mathematics GenEd requirement; satisfies SEEDS Quantitative Reasoning student learning outcome in alignment with Educated Citizenry value.

MATH 107 The Mathematics of Music (3 credits)
In this course, students will learn to recognize, explain and apply mathematical ideas that are present in music theory and practice. We will discuss topics such as sequences and series present in musical rhythm, algebra of musical scales, symmetries in music and elements of group theory and others. A basic knowledge of algebra concepts is sufficient to understand the mathematical ideas discussed in this course. No specific musical knowledge or training is necessary for the course. By the end of the course, students will develop their analytical skills, enhance their appreciation of music and expand their love and respect for mathematics.

MATH 108 Transition to College Mathematics (3 credits)
Prerequisite(s): Department Permission Required. Restriction(s): Students who have received credit for a higher level mathematics may not take this course. This course is designed as a transition from high school expectations to the study of mathematics at the collegiate level. The course will focus on the development of skills and habits of mind, such as modeling, estimation, problem-solving, and applications of mathematics to the real world through topics such as real numbers, algebraic operations, rules of exponents, polynomials, factoring, linear equations, linear inequalities, polynomials, graphing linear equations and inequalities, and rational expressions, among others. Appropriate technology will be adopted to aid in the problem solving. Emphasis, in this course, will be on the process of finding solutions, adopting an inquiry based approach and making interdisciplinary connections. Enrollment will be determined on the basis of the math placement test results.

MATH 111 Applied Precalculus (4 credits)
Prerequisite(s): Placement into the course is based on the outcome of the ALEKS Placement Assessment or earning a C- or higher in MATH 108. This course covers topics including trigonometric, exponential, logarithmic, rational, and polynomial functions, that are basic to success in the calculus sequence. This course contains weekly lectures and also a session, once a week, where students participate in group-work and inquiry based assignments.

MATH 118 Mathematics and Computer Science for the Life Sciences II (3 credits)
Mathematical models; hypothesis testing; genetics models; diversity in populations; randomness; contingency tables; regression analysis; tests of biological models. Methods of course applied to real biological data throughout with micro-computers used as a tool.

MATH 122 Calculus I (4 credits)
Prerequisite(s): MATH 111 with a grade of C- or higher or placement through the ALEKS Placement Assessment. Limits, continuity; derivative and differentiation; applications of the derivative, maxima, minima, and extreme considerations; antiderivatives; Riemann integral. Satisfies Mathematics GenEd requirement; satisfies SEEDS Quantitative Reasoning student learning outcome in alignment with Educated Citizenry value.

MATH 175 Visualization Programming in Mathematics (3 credits)
Prerequisite(s): MATH 111 or higher. This course introduces students to the essential tools and techniques for visualizing mathematical data and developing computational solutions. Through hands-on experience with software such as Excel, Desmos, MATLAB, R, Octave, and Maple, students will learn to create effective visual representations of mathematical concepts and datasets. The course emphasizes the importance of clear communication in mathematics, equipping students with the skills to present complex information in an accessible manner. In addition to traditional programming and visualization methods, the course explores the integration of Artificial Intelligence (AI) as a tool for code generation and problem-solving. Students will learn how to leverage AI technologies to enhance their programming capabilities, streamline workflows, and tackle complex mathematical problems more efficiently. By the end of the course, students will have developed a strong foundation in mathematical visualization and programming, as well as an understanding of how AI can be utilized to augment these skills. This interdisciplinary approach ensures that students are well-prepared to apply their knowledge in various fields, including academia, industry, and research, where the ability to visualize and compute complex mathematical data is crucial.

MATH 190 Special Topics in Undergraduate Mathematics (1-4 credits)
Topics of current interest and importance that are accessible by first- and second-year students. May be repeated once for a maximum of 8 credits.

MATH 210 Mathematics and Society (3 credits)
Prerequisite(s): MATH 111. This is an introduction to mathematical modeling of societal issues; real-world practical issues faced by our communities will be used to motivate and introduce the modeling process. Discrete, continuous, deterministic, and stochastic models will be presented. Students will develop models based on their own interests (pandemics, health, environment, social media, bias and ethics, disinformation, business, financial, neighborhood issues) or by working with a government agency, or NGO, or by interacting with Citizen Science Projects, to deal with problems they will address as citizens. A final report/model will be presented in class or delivered to the organization they are working with. The presentation will include the details of the mathematical analysis, but must be at a level that is understandable by non-mathematicians. Mathematical topics used to develop the modeling process will be selected from areas such as difference equations, least-squares, linear programming, graph theory, decision theory, game theory, or differential equations. Graphing calculators, spreadsheets (such as Excel) and appropriate mathematical software will be used. Knowledge of topics typically covered in a course in algebra and trigonometry are sufficient preparation for this class. Satisfies SEEDS Quantitative Reasoning student learning outcome in alignment with Educated Citizenry value.

MATH 221 Calculus II (4 credits)
Prerequisite(s): MATH 122 with grade of C- or better. Riemann integral applications, transcendental functions, techniques of integration, improper integrals, L'Hospital's Rule, infinite series, vector algebra.

MATH 222 Calculus III (4 credits)
Prerequisite(s): MATH 221 with a grade of C- or higher. Partial differentiation, and extreme considerations; polar, cylindrical, and spherical coordinates, multiple integration; introduction to line integrals, vector calculus.

MATH 224 Introduction to Differential Equations (3 credits)
Prerequisite(s): MATH 221 with a grade of C- or higher. The course introduces students to the study of differential equations, including: fist order equations, mathematical modeling, qualitative methods, numerical methods, and second order equations. The solutions of linear systems of differential equations are presented by a brief introduction to elementary algebra. Emphasis is on the applications and techniques for finding solutions.

MATH 225 Linear Algebra (4 credits)
Prerequisite(s): MATH 122 with a grade of C- or higher. The course content will cover the foundations of the algebra of vector spaces, matrix operations, matrix invertibility theorems, linear independence, span, basis, linear transformations, finite dimensional Hilbert Spaces, Gram-Schmidt process, projections, eigenvalues and eigenvectors, and applications. The focus of the course will be to develop advanced mathematical skills in reading and understanding abstract mathematical definitions, constructing examples, and developing mathematical proofs. Meets the Graduation Writing Requirement for majors in Mathematics. Equivalent course MATH 335 effective through Fall 2020.

MATH 271 Special Topics in Modern Mathematics (3 credits)
Prerequisite(s): A score of 76 or higher on the ALEKS Placement Assessment, or MATH 111 with a grade of C# or higher. An introduction to mathematics education through the lens of selected school mathematics issues, which may include topics (eg., functions, analytic geometry, modeling, special theorems) and tools (technologies, hand-held manipulatives). Attention is given to exploring these issues from a learning point of view and to the instructor's positionality as a model for prospective teachers taking the class. Equivalent course MATH 471 effective through Spring 2019.

MATH 320 Transitions to Advanced Mathematics (3 credits)
Prerequisite(s): MATH 225 with a grade of C- or higher; and MATH 221 may be taken as a prerequisite with grade of C- or higher or as a corequisite. This course will help students explore mathematics and make conjectures using technology. Students will enhance their understanding of mathematical models and to develop communication skills through the use of written reports and oral presentations of projects. The course content introduces students to difference equations, elementary linear algebra and ordinary differential equations. Further, the course will develop proof-writing skills and introduce students to the explore-conjecture-proof strategy.

MATH 323 Complex Variables (3 credits)
Prerequisite(s): MATH 222 with a grade of C- or higher. This course is a study of the arithmetic and algebra of complex numbers, and an introduction to the differentiation and integration of complex functions. Topics include: rectangular and polar form of complex numbers, algebra of complex numbers, differentiation, Cauchy-Riemann equations, and contour integrals.

MATH 325 Ordinary Differential Equation (4 credits)
Prerequisite(s): MATH 221 with a grade of C- or higher, and MATH 225 or PHYS 210 or PHYS 220 as a co-requisite or prerequisite. A course in the theory and applications of ordinary differential equations which emphasizes qualitative aspects of the subject. Topics include analytic and numerical solution techniques for linear and nonlinear systems, graphical analysis, existence-uniqueness theory, bifurcation analysis, and advanced topics. Equivalent course MATH 420 effective through Fall 2020.

MATH 340 Probability (3 credits)
Prerequisite(s): MATH 221 with a grade of C- or higher. Chance and variability, elements of combinatorics, Bayes' theorem, random variables, binomial, poisson and normal distributions, applications to statistics.

MATH 350 College Geometry (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher. The study of a wide range of advanced concepts in Euclidean geometry suitable for teaching foundations of axiomatic systems at the high school or middle school level. Topics involving triangle congruence, parallel line postulate, properties of polygons and circles, area, volume, Pythagorean Theorem, similarity, transformations and geometric constructions will be studied from an advanced, proof-based perspective. Basics of Non- Euclidian geometries will be introduced. Geometers' Sketchpad and other software will be utilized.

MATH 362 Mathematics of Sports (3 credits)
Prerequisite(s): MATH 225. In this project based course, students will learn to use mathematical and appropriate computational tools to help predict and analyze sports performances and outcomes. Some of the mathematical topics discussed in this course will include basic differential equations, probability and statistics, predictive analytics, mechanics and its application to different sports (such as football, soccer and tennis) and network theory and its application to collaboration in team sports. Through playing sports themselves and examining videos of various past sports events, students will generate data which will be analyzed via imaging tools and mathematical software such as Maple, Mathematica and Gephi. Coaches and athletes from local sports teams will also be invited as guest lecturers. A basic knowledge of Calculus 1 concepts and some knowledge of matrix theory is sufficient to understand the mathematical models introduced in this course. By the end of the course, students will have a good understanding of how math can be effectively used in various sports.

MATH 364 Operations Research I (3 credits)
Prerequisite(s): MATH 225 with a grade of C- or higher. Linear programming, transportation problem, assignment problem, duality, sensitivity analysis, network flows, dynamic programming, nonlinear programming, integer programming. Equivalent course MATH 464 effective through Fall 2020.

MATH 365 Mathematics and Music (3 credits)
Prerequisite(s): MATH 221 with a grade of C- or higher. Mathematics of Musical Instruments, Sound Waves and Harmonics, Elements of Fourier Theory, Consonance and Dissonance, Scales and Temperaments, Symmetry in Music.

MATH 369 Mathematical Modeling (3 credits)
Prerequisite(s): MATH 221 and MATH 225 with a grade of C- or higher. The art of constructing mathematical models for "real world" problems, solving the model, and testing the accuracy of the model. Problems will be selected from business, science, computer science, and the social sciences. Equivalent course MATH 469 effective through Fall 2020.

MATH 370 Mathematics for Teaching (3 credits)
Prerequisite(s): MATH 350 with a grade of C- or higher. Restriction(s): Admission into the Teacher Education program. This course will focus on the Common Core State Standards Mathematics (CCSSM) aligned with the content areas of number and quantity, pre-algebra and algebra, and statistics and probability. These topics will be presented with the goal of fostering pre-service mathematics teachers' (PSMT's) understanding of and commitment to teaching mathematics that promotes student understanding. PSMTs will explore mathematical content deeply while also discussing related pedagogical tools, including teaching methods, curricula, lesson planning, technology resources, and assessment practices.

MATH 375 History of Mathematics (3 credits)
Prerequisite(s): MATH 225 with a grade of C- or higher. This course surveys the origins and evolution of mathematical ideas from antiquity to the present. Emphasis will be on the role of mathematics as an integral part of our cultural heritage and its relationship to areas such as science, art, religion, philosophy and literature. Classical mathematical methods will be examined by reading selected original works by great mathematicians. Satisfies SEEDS Historical Thinking student learning outcome in alignment with Educated Citizenry value.

MATH 398 Vector Calculus (3 credits)
Prerequisite(s): MATH 222 with a grade of C- or higher. Topics include the algebra of the differential and integral calculus; gradients, divergence and curl of a vector field, and integral theorems together with applications drawn from the physical sciences.

MATH 421 Partial Differential Equations (3 credits)
Prerequisite(s): MATH 325 with a grade of C- or higher. Partial differential equations arise in the mathematical modeling of many physical, chemical, and biological phenomena. They play a crucial role in diverse subject areas, such as fluid dynamics, electromagnetism, material science, astrophysics, financial modeling, and hydrogeology, for example. This course is an introduction to partial differential equations with emphasis on the wave, diffusion and Laplace equations. The focus will be on understanding the physical meaning and mathematical properties of solutions of partial differential equations. Methods of solutions include separation of variables using orthogonal series, transform methods, method of characteristics, and some numerical methods.

MATH 425 Advanced Calculus I (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher; and MATH 222 may be taken as prerequisite or corequisite. Properties of the real number system, limits, continuous functions, intermediate value theorem, derivative, mean value theorem, Riemann integral.

MATH 426 Advanced Calculus II (3 credits)
Prerequisite(s): MATH 425 with a grade of C- or higher. This course is a continuation of MATH 425. Topics include functions of several variables, partial derivatives, Green's theorem, Stoke's theorem, divergence theorem, implicit function theorem, inverse function theorem, infinite series and uniform convergence.

MATH 431 Foundations of Modern Algebra (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher. Fundamental concepts of algebra including groups, rings, integral domains and fields, with important examples.

MATH 433 Theory of Numbers (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher. This course presents the principal ideas of classical elementary number theory, emphasizing the historical development of these results and the important figures who worked on them. Topics studied include the following: divisibility, primes, and the Euclidean Algorithm; number-theoretic functions, linear congruencies, the Chinese Remainder Theorem, the Theorems of Fermat, Euler, and Wilson; quadratic congruencies and the Law of Quadratic Reciprocity; Diophantine equations and Fermat's Last Theorem; continued fractions; Pell's equation and the sum of two squares.

MATH 450 Foundations of Geometry (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher. The course deals with the fundamental ideas common to Euclidean and Non-Euclidean geometries; projective, affine, and metric geometries.

MATH 451 Topology (3 credits)
Prerequisite(s): MATH 320 with a C- or higher; and MATH 425 or MATH 431 with a C- or higher or permission of the department. Point set topology including topics such as, metric spaces, limit points, derived sets, closure, continuity, compact sets and connected sets.

MATH 460 Introduction to Applied Mathematics (3 credits)
Prerequisite(s): MATH 325 with a grade of C- or higher. This course is a survey of applied mathematical techniques, including such topics as control theory (feedback control systems, Nyquist and Popov plots, pole shifting, Laplace transforms) and classical boundary value problems (Sturm-Liouville equations with solution techniques involving Fourier series). Applications will use the theory of calculus of variations which includes the variational derivative, the general variation of a functional, variation in parametric form, and the invariance of the Euler's equations.

MATH 461 General Relativity (3 credits)
Prerequisite(s): MATH 325 and; PHYS 191 or PHYS 192. An introduction to Einstein's geometric theory of gravity. Topics will include: special relativity, 4-vectors, the twin paradox, the metric tensor, non-Euclidean geometry, the equivalence principle, the gravitational redshift, geodesics, the Schwarzschild solution, and black holes.

MATH 463 Numerical Analysis (3 credits)
Prerequisite(s): MATH 225 and MATH 325 with a grade of C- or higher. Finite differences, approximation theory, linear and non-linear equations, error analysis.

MATH 465 Operations Research II (3 credits)
Prerequisite(s): MATH 225 with a grade of C- or higher and MATH 340 with a grade of C- or higher. Game theory, queuing models, inventory models, Markov processes, reliability theory and applications.

MATH 470 Teaching of Mathematics (4 credits)
Prerequisite(s): MATH 370 with a grade of C- or higher. Restriction(s): Admission into the Teacher Education Program. Selection, organization, and presentation of secondary mathematics, classroom activities, lesson planning, techniques of motivation, evaluation, multisensory aids, principles of learning, and applications of the microcomputer to classroom teaching.

MATH 478 Theoretical Fluid Dynamics (3 credits)
Prerequisite(s): MATH 222, MATH 225, and MATH 320 with a grade of C- or higher. Mechanics of continuous media, liquids and gases; stress, viscosity, Navier-Stokes and Euler Equations, exact solutions, potential flow, circulation and vorticity, dimensional analysis and asymptotic models, boundary layers, stability theory and applications to industrial environmental problems. Equivalent course MATH 368 effective through Summer 2021.

MATH 485 Applied Combinatorics and Graph Theory (3 credits)
Prerequisite(s): MATH 340 with a grade of C- or higher. Problem solving by counting, enumeration, and graph theory. Permutation, combinations, binomial coefficients, generating functions, and recurrence relations, partitions, inclusion-exclusion, Polya's formula, graph theoretic models, trees, circuits, networks, matching, and their applications to puzzles, games, tournaments, traffic patterns, transportation.

MATH 487 Introduction to Mathematical Cryptography (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher. A modern introduction to the application of number theory, combinatorics and abstract algebra to cryptography. Specifically, this includes modular arithmetic, generating polynomials and matrix algebra over rings and fields. A discussion of a broad range of applications of mathematics to the security of credit cards, cell phones and codes among numerous other current examples will be covered. Current industry protocols will be explored.

MATH 490 Honors Seminar (3 credits)
Prerequisite(s): MATH 320 with a grade of C- or higher; and departmental approval. This course will concentrate on subject matter not usually covered within standard mathematics courses. A written and oral report are required.

MATH 491 Research in Mathematics Education (3 credits)
Prerequisite(s): MATH 350 and departmental approval. Research in Mathematics Education Research in an area of mathematics education agreed upon by the student and the instructor. The results of the research will be the basis of a seminar, colloquium, or conference presentation to be given by the student. May be repeated for a maximum of 6 credits with either a new research topic or continued research on the current topic.

MATH 495 Special Topics in Advanced Undergraduate Mathematics (1-3 credits)
Prerequisite(s): MATH 320 or MATH 325 with a grade of C- or higher; and MATH 340 with a grade of C- or higher; and departmental approval. Study of advanced topics in undergraduate mathematics. May be repeated for a maximum of 6 credits as long as the topic is different.

MATH 497 Mathematics Research I (1-3 credits)
Prerequisite(s): MATH 320 or MATH 325 or MATH 340 with a grade of C- or higher; and departmental approval. Individual research in a mathematical area agreed upon by the student and the instructor. The results of the research will be a basis of a seminar or colloquium to be given by the student. Students must not accumulate more than 6 credits total in courses MATH 497, 498.

MATH 498 Mathematics Research II (1-3 credits)
Prerequisite(s): MATH 320 or MATH 325 or MATH 340 with a grade of C- or higher; and departmental approval. Individual research in a mathematical area agreed upon by the student and the instructor. The results of the research will be a basis of a seminar or colloquium to be given by the student. Students must not accumulate more than 6 credits total in courses MATH 497, 498.

MATH 499 Math Senior Workshop (1 credit)
Prerequisite(s): MATH 320. Restriction(s): Senior Status. The course aims to provide a synthesizing experience, as a retrospective of the experiences acquired in the program and also aims to give students a glimpse of what awaits them after graduation. The course will discuss important topics such as: Math Career preparation, Writing in Math, Reading mathematical papers, Ethics in Mathematical Sciences etc. Guest speakers from schools and industry will help students get a glimpse of how math can be applied in different ways in the real world.

MATH 502 Mathematics for Computer Science II (3 credits)
Prerequisite(s): Graduate program coordinator's permission. An introduction to linear algebra, vectors, matrices, counting rules, probability theory, random variables, Poisson and binomial distribution, with applications to Computer Science. May not be used for credit by Mathematics and Computer Science majors.

MATH 503 Mathematics for Computer Science III (3 credits)
Prerequisite(s): Graduate program coordinator's permission. Differential and integral calculus, infinite series, applications to computer science. May not be used for credit by Mathematics and Computer Science majors.

MATH 510 Workshop in Mathematics Education I (1-4 credits)
Prerequisite(s): Permission of graduate program coordinator. Specific contemporary topics and current issues in school mathematics. May be repeated for a maximum of 8 credits as long as the topic is different.

MATH 511 Workshop in Mathematics Education II (1-4 credits)
Prerequisite(s): Permission of graduate program coordinator. Specific contemporary topics and current issues in school mathematics. May be repeated for a maximum of 8 credits as long as the topic is different.

MATH 513 Educational Technology for School Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator. This course is designed to provide experiences in the integration of technology into school mathematics classes. The primary emphases are on the analysis and evaluation of computer software and applications addressing school mathematics courses. The use of dynamic geometry and algebra environments, web-based applications, coding platforms,spreadsheets, SmartBoards, graphing calculators, and smartphones will be explored as tools to enhance the teaching and learning of school mathematics. The course also includes current literature describing exemplary models and practices in the use of technology in the mathematics classroom.

MATH 514 Advanced Placement Computer Science Concepts (3 credits)
Prerequisite(s): Graduate program coordinator's permission. This course is specifically designed to help senior high school teachers prepare to instruct the AP course in computer science. Topics include the problem solving process, good programming style, the syntax of the current AP language, and their applications to computer science. Additional topics include algorithms, data structures, procedures, program design, sorting and searching. Minimal prior knowledge of a high level language is assumed. May not be used for credit for Computer Science majors.

MATH 515 Intermediate Analysis I (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Properties of the real number system, limits, continuous functions, intermediate value theorem, derivative, mean value theorem, Riemann integral.

MATH 516 Intermediate Analysis II (3 credits)
Prerequisite(s): MATH 515 or MATH 425 or equivalent, permission of graduate program coordinator. This course is a continuation of MATH 515. Topics include functions of several variables, partial derivatives, Green's theorem, Stoke's theorem, divergence theorem, implicit function theorem, inverse function theorem, infinite series, uniform convergence.

MATH 518 Foundations of Abstract Algebra (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Fundamental concepts of algebra including groups, rings, integral domains and fields, with important examples.

MATH 519 Teaching Mathematics (3 credits)
Selection, organization, and presentation of secondary mathematics, classroom activities, lesson planning, techniques of motivation, evaluation, multi-sensory aids, principles of learning, assessment, and applications of technology to classroom teaching.

MATH 520 Introduction to Complexity Theory (3 credits)
Prerequisite(s): MATH 222, MATH 225 and MATH 325. In this course students will learn about the mathematical tools used to understand complex systems. Topics covered include an introduction to networks, dynamics, fractals, optimization, information theory, self-organization and agent-based modeling. Students will also get a sense of how these topics fit together to help explain the notion of complexity in mathematics, nature and society. The course will discuss the work of prominent experts in the field such as Holland, Barabasi, Wolfram, Axelrod, Kauffman, Bak, and Gell-Mann.

MATH 521 Real Variables I (3 credits)
Prerequisite(s): MATH 426 and permission of graduate program coordinator. Real number system, Lebesgue measure and integration, differentiation, Fourier series, LP, metric, normed vector, Banach and Hilbert spaces.

MATH 522 Real Variables II (3 credits)
Prerequisite(s): MATH 521, permission of graduate program coordinator. Real number system, Lebesgue measure and integration, differentiation, Fourier series, LP, metric, normed vector, Banach and Hilbert spaces.

MATH 525 Complex Variables I (3 credits)
Prerequisite(s): MATH 426 and permission of graduate program coordinator. Integration and differentiation in the complex domain, Cauchy's theorem, Cauchy's integral formula, Laurent expansion, residues, elements of conformal mapping, series and product representations.

MATH 526 Complex Variables II (3 credits)
Prerequisite(s): MATH 525, permission of graduate program coordinator. Integration and differentiation in the complex domain, Cauchy's theorem, Cauchy's integral formula, Laurent expansion, residues, elements of conformal mapping, series and product representations.

MATH 530 Mathematical Computing (3 credits)
Prerequisite(s): Permission of the graduate program coordinator or consent of the instructor. Introduction to mathematical computing techniques using a computer algebra system and algorithmic approach to solving mathematical problems. Mathematical applications taken from various areas of mathematics, the sciences, engineering, and business.

MATH 531 Abstract Algebra I (3 credits)
Prerequisite(s): MATH 431 and permission of graduate program coordinator. Basic algebraic structures including groups, rings, fields, modules and lattices.

MATH 532 Abstract Algebra II (3 credits)
Prerequisite(s): MATH 531, permission of graduate program coordinator. Basic algebraic structures including groups, rings, fields, modules and lattices.

MATH 535 Linear Algebra I (3 credits)
Prerequisite(s): MATH 225 and permission of graduate program coordinator. Vector spaces and linear transformations, including inner product, matrix representations, binary and quadratic forms, eigenvectors, canonical forms, and functions of matrices.

MATH 536 Linear Algebra II (3 credits)
Prerequisite(s): MATH 535, permission of graduate program coordinator. Vector spaces and linear transformations, including inner product, matrix representations, binary and quadratic forms, eigenvectors, canonical forms, and functions of matrices.

MATH 540 Probability (3 credits)
Prerequisite(s): MATH 340 and permission of graduate program coordinator. Sample spaces and events, combinatorial analysis, conditional probability and stochastic independence, random variables and probability distributions, expected value and variance, probability generating functions, continuous random variables.

MATH 551 Topology (3 credits)
Prerequisite(s): MATH 425, and permission of graduate program coordinator. Basic point-set topology, topological spaces, homeomorphisms, compactness, connectedness, separation properties, uniformities, metrizability, introductory algebraic topology, homology groups and homotopy.

MATH 554 Projective Geometry (3 credits)
Prerequisite(s): MATH 225 and permission of graduate program coordinator. Projective planes and spaces are studied by synthetic and analytic approaches. Topics covered include the theorems of Desargues and Pappus, harmonic sequences, projectivities, coordinatization, finite planes, and conics.

MATH 560 Numerical Analysis (3 credits)
Prerequisite(s): MATH 225, and permission of graduate program coordinator. Error analysis, interpolation and approximation theory, numerical solution of linear and nonlinear equations, numerical differentiation and integration, numerical solution of differential equations.

MATH 562 General Relativity (3 credits)
Prerequisite(s): MATH 325 and permission from the Graduate Coordinator. An introduction to Einstein's geometric theory of gravity. Topics will include: special relativity, 4-vectors, the twin paradox, the metric tensor, non-Euclidean geometry, the equivalence principle, the gravitational redshift, geodesics, the Schwarzschild solution, and black holes.

MATH 564 Ordinary Differential Equations (3 credits)
Prerequisite(s): MATH 225, MATH 325 and permission of graduate program coordinator. Linear and nonlinear equations, Green's functions, power series solutions, autonomous systems, existence and uniqueness, singularities, Sturm-Liouville systems.

MATH 566 Partial Differential Equations (3 credits)
Prerequisite(s): MATH 225, MATH 325 and permission of graduate program coordinator. First order equations, separation of variables, series solutions, hyperbolic, parabolic and elliptic equations, characteristics, transform methods.

MATH 568 Applied Mathematics: Continuous (3 credits)
Prerequisite(s): MATH 225, MATH 325, MATH 340, MATH 425 and permission of graduate program coordinator. Formulation, manipulation and evaluation of mathematical models of continuous systems. Topics selected from: conservation principles and the classical equations of mathematical physics, applications of the qualitative and quantitative theory of ordinary and partial differential equations, optimization, calculus of variations, stability theory, stochastic models.

MATH 569 Applied Mathematics: Discrete (3 credits)
Prerequisite(s): MATH 225, and MATH 340, and MATH 425, and permission of graduate program coordinator. Introduction to the basic ideas of discrete mathematics and its applications. Counting principles, permutations, combinations, algorithms, complexity, graphs, trees, searching and sorting, recurrence relations, generating functions, inclusion-exclusion, the pigeonhole principle, chromatic number, eulerian chains and paths, hamiltonian chains and paths, flows in networks, finite Markov chains.

MATH 570 Administration and Supervision of Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Problems of organization, administration and supervision in the mathematics program of the school. Functions, duties and qualifications of the supervisor investigated. Current problems and research findings.

MATH 571 Curriculum Construction in Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Contemporary proposals for the mathematics of grades K through 12. Consideration is given to the problem of implementation of current recommendations. Examination is made of mathematical concepts underlying various programs.

MATH 572 Contemporary Teaching of Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Pedagogy, resources, and research related to the teaching of standards-based mathematics in grades 6-12. Emphasis is on creating student-centered learning environments, resources and materials for contemporary mathematics classrooms, models of effective teaching and learning, alternative assessment, appropriate uses of technology and multicultural aspects of mathematics.

MATH 573 Mathematics Materials for Teachers of Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator. The construction, adaptation and effective use of classroom materials and activities designed to enhance and expand the teaching of mathematics and mathematical thinking in the middle and high school grades with special attention given to basic commercial and simple teacher- and student-made manipulatives and models with broad use from the development of concepts and skills to their maintenance, review, and extension plus applications to problem solving.

MATH 574 Problem Analysis in Secondary Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Psychology and techniques of problem-solving. Discovery and heuristic methods. Intuitive and inductive reasoning in the solution of nonroutine problems from high school mathematics. Problem formation and solution.

MATH 575 Special Topics in Mathematics Education (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Selection of topics associated with secondary and early college years of mathematics investigated from an advanced point of view. Topics selected to give the teacher a professionalized subject matter viewpoint of such areas as algebra, geometry, number theory, real and complex analysis, probability and history of mathematics May be repeated for a maximum of 6 credits.

MATH 576 Research Seminar in Mathematics Education (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Designed for matriculated graduate students in the mathematics education program. Students survey and analyze recent research projects.

MATH 580 Combinatorial Mathematics (3 credits)
Prerequisite(s): MATH 222 and graduate program coordinator's permission. Arrangements and selections, binomial coefficients, Stirling numbers, generating functions, recurrence relations, inclusion-exclusion, Polya enumeration formula, combinatorial graph theory, combinatorial geometries.

MATH 581 Graph Theory (3 credits)
Prerequisite(s): MATH 222 and MATH 225 and graduate program coordinator's permission. Graphs, digraphs, and trees. Connectivity, separability, planarity, and colorability. Cliques, independent sets, matchings, flows and tours. Graphs as mathematical models; graph algorithms.

MATH 584 Operations Research (3 credits)
Prerequisite(s): MATH 425 and STAT 440 and permission of graduate program coordinator. An in-depth study of one or at most two topics in operations research, selected from linear programming and game theory, linear and nonlinear programming, queuing theory, inventory theory, simulation models.

MATH 585 Fundamentals of Scientific Computing (3 credits)
Prerequisite(s): MATH 325 and permission of the Graduate Program Coordinator. Theory and implementation of mathematical computing techniques. This course will present basic programming and graphing techniques to analyze mathematical models. Students will learn basic algorithm design, programming paradigms, simulation techniques, visualization software, and typesetting software for science and mathematics.

MATH 586 Fundamentals of Mathematical Models (3 credits)
Prerequisite(s): MATH 225, MATH 325 and permission of graduate program coordinator. The course investigates meaningful and practical problems across various disciplines including mathematical, social and educational sciences. Students will gain experience in the construction, computation, and analysis of mathematical models arising from various contexts and draw appropriate conclusions. Models will be developed in mathematical contexts including linear algebra, discrete mathematics, optimization, probability and differential equations. In order to learn about the modeling process, we will study real world problems that affect real people. Problems discussed and final projects conducted by students can be inspired by challenges faced by local non-profit organizations, educational institutions, government agencies or the university.

MATH 587 Fundamentals of Optimization (3 credits)
Prerequisite(s): MATH 585 and STAT 552 and permission of Graduate Coodinator. Introduction to applied optimization in various settings, both continuous and discrete. Topics selected from linear programming, non-linear programming, network optimization models, and feedback control with an emphasis on applications to business management, economics, game theory, and finance. The course will be team-taught, with the various areas of optimization introduced by faculty with expertise in that field.

MATH 588 Professional Science Master Mini-Projects (6 credits)
Prerequisite(s): MATH 585, MATH 586, MATH 587, STAT 552, and permission of the Graduate Program Coordinator. Students working in teams will be assigned problems selected from professional case studies and may include problems of current interest supplied by collaborating industries and/or advisory board members. Solution methodology will vary from problem to problem and will require the wide breadth of mathematical tools covered in the prerequisite courses. These include discrete and continuous modeling, optimization methods, and data analysis. Central to the professional experience, students will present problem statement, solution methodology, and results during class time. Emphasis will be placed on incorporating the skills developed in the PSM plus courses. Specifically, these skills involve understanding goals, leadership and teamwork, communication skills, marketing the project, discipline, flexibility, innovation, special appropriate technologies, quality of project outcomes, ethics (as applicable), and meeting potential employer expectations.

MATH 590 Special Topics in Advanced Mathematics (3 credits)
Prerequisite(s): Graduate program coordinator's permission. An in-depth study of a topic or topics selected from areas such as algebra, analysis, geometry, probability and statistics, and applied mathematics, with special emphasis upon recent developments in the field. May be repeated once for a maximum of 6 credits as long as the topic is different.

MATH 591 Applied Industrial Mathematics (3 credits)
Prerequisite(s): MATH 225, MATH 425, MATH 530, STAT 330 or permission of graduate program coordinator. Formulation, modeling, and solution of mathematical problems from engineering, science and business. Topics include statistical distributions, Monte Carlo method, function fitting, transforms optimization, regression analysis, cost-benefit analysis, ordinary differential equations, partial differential equations, numerical methods, divided differences, splines, Galerkin's method, and finite elements.

MATH 611 Leadership Development in Mathematics Education (3 credits)
Restriction(s): Acceptance in the master's program in Teaching Middle Grades Mathematics and permission of the graduate program coordinator. Students gain experience in recognizing, acquiring, and applying key leadership characteristics in the field of mathematics education at the middle and high school grades. Specific attention is given to how teachers become stewards of best practices and active educational change agents in their schools and community and through professional development and involvement.

MATH 690 Independent Study in Mathematics (3 credits)
Prerequisite(s): Permission of graduate program coordinator; departmental approval. Independent study under the direction of a faculty member, offering the opportunity to pursue topics in mathematics which may be outside the scope of regular curricular offerings or may be an extension of an existing course or courses. Approval must be obtained from the graduate coordinator and faculty advisor. May be repeated once for a maximum of 6 credits during the graduate program.

MATH 696 Capstone Project (3 credits)
Prerequisite(s): Permission of Graduate Program Coordinator.
Restriction(s): MS in Mathematics. Culminating project-based experience undertaken by students in their last year of study. Over the course of the semester, students will choose a project that ties the courses taken throughout their graduate studies and their future employment. The instructor will guide the students throughout the semester by presenting various research and presentation methods.

MATH 697 Culminating Experience for PSM (6 credits)
Prerequisite(s): Completion of 27 credits including MATH 585 and MATH 586 and MATH 587 and MATH 588 and STAT 552 and permission of the Graduate Program Coordinator. Students will work in teams to solve problems originating in the industry or to deliver industry related case studies. Each group will produce a written report of their work and give a PowerPoint presentation summarizing their report. Projects will require background knowledge in the PSM mathematical and technical core content and the communication/business plus course training. Each project will be mentored by a PSM faculty or advisory board member.

MATH 698 Master's Thesis (3 credits)
Prerequisite(s): Permission of graduate program coordinator. Independent research project done under faculty advisement. Students must follow the MSU Thesis Guidelines, which may be obtained from the Graduate School. Students should take MATH 699 if they don't complete MATH 698 within the semester.

MATH 699 Master's Thesis Extension (1 credit)
Prerequisite(s): MATH 698, permission of graduate program coordinator. Continuation of Master's Thesis Project. Thesis extension will be graded IP (In Progress) until thesis is completed, at which time a grade of Pass or Fail will be given.

MATH 740 Technological Tools for Education in Mathematics (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course will explore the research literature on technology tools for education in mathematics and science in order to create a richer and more egalitarian learning environment. Classroom practices and state and national science and mathematics standards will be examined in light of research knowledge on technology in education. The scholarly literature on other issues related to technological literacy, such as equity, will be discussed and explored.

MATH 741 Historical and Multicultural Foundations of Mathematical Thought (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course will trace the historical evolution of major themes and concepts in mathematics and the role and influence of various cultures in the development of these ideas. Multicultural perspectives will survey the impact of non-European cultures, including those of Asia, Africa, the Americas, and the Middle East, on the development of mathematical thought. The course will also trace major curriculum reform movements in the teaching and learning of mathematics throughout the United States during the nineteenth and twentieth centuries and their impact on contemporary school programs.

MATH 742 Mathematical Modeling in the Sciences (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. The exploration of mathematical models in the sciences and issues related to the teaching and learning of such models. Includes the collection and analysis of data using modern technology. Discussion of curricula that emphasize modeling and current research related to interdisciplinary approaches to teaching mathematics and science.

MATH 743 Advanced Perspectives on High School Mathematics (3 credits)
The exploration of mathematics content related to the high school curriculum, but developed from an advanced perspective. Emphasis on multiple representations and justification. Topics may include conic sections, rates of change, and combinatorics. Pedagogy will be discussed in relation to students' learning experiences in the course.

MATH 744 Special Topics in Mathematics Education (3 credits)
Prerequisite(s): MATH 512 or MATH 513. Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. Topics may be selected from areas such as curriculum development, mathematics education policy, cognition in mathematics, comparative education, teacher development, assessment, perspectives on mathematical content, and student development.

MATH 745 The Use of Teacher Knowledge in Mathematics Teaching (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. General and mathematics-specific domains of teacher knowledge are defined, critiqued, compared and contrasted. In addition, they are applied in analyzing and determining the domains' roles in lesson planning, responding to students' questions, addressing students' misconceptions, and assessing student understanding. The research history on teacher knowledge is examined and critiqued with an eye towards understanding the introduction and use of the domains of knowledge being employed by current educators and researchers. The role of these knowledge domains in implementing the NCTM Standards also is examined. Articles on teacher knowledge are discussed and analyzed. These ideas are employed in analyzing classroom or interview videotapes, audiotapes, and transcripts to determine the potential use of teacher knowledge as it is instantiated in more practical situations.

MATH 746 Designing for Mathematical Experience (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course focuses on the 3D design, production, and evaluation of new physical tools to support mathematics learning and/or generate powerful forms of mathematical experience. A design for learning approach is used to enrich students' images of mathematical experience and to develop their models of how learners learn mathematics in interaction with physical tools. Topics are organized around learning theories and design principles.

MATH 790 Independent Study in Mathematics Education (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. With the guidance of a member of the doctoral faculty, students investigate topics that are outside the scope of regular course offerings. This allows doctoral candidates the opportunity to explore research topics more deeply. May be repeated for a maximum of 6 semester hours.

MATH 811 Mathematics Education Leadership (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. Students will gain experience working for systemic change in educational programs and thus become capable of assuming a leadership role for such change. This course is designed to provide a long-term experience with nurturing pedagogy, leadership development, and stewardship of best practices. Candidates will work closely with faculty to develop goals and expectations for specific change in their work settings, where appropriate, then evaluate progress towards these goals. Candidates will conduct field work in this area, including experimental design, implementation, and evaluation of results. The course includes reading, seminars, and portfolio development as well as presentations from visiting faculty and other leaders in mathematics education.

MATH 812 Research in Mathematical Modeling for Middle Level and High School Grades (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course will examine, from a research in mathematics education perspective, mathematical modeling as a process of identifying a problem, determining a mathematical core, working within that core, and reexamining the problem to ascertain what mathematics reveals about the original problem. The use of mathematical modeling in classrooms will be examined and critiqued in the context of teaching and learning. Further, specific mathematical models will be explored, developed, and applied in the solution of contemporary problems, and the models will serve as unifying structures in the secondary curriculum.

MATH 813 Geometric and Spatial Thinking and Learning (3 credits)
Prerequisite(s): A background in undergraduate geometry comparable to MATH 350. Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course discusses specific topics from geometry, their impact on the changing geometry curriculum in the schools, their application through technology, and their connection to other areas within and outside mathematics. Examples include dimension, scaling, measurement, and fractal dimension, with their use as unifying themes that can be studied from several points of view, that make use of current visualization technology, and that can be applied across disciplines. Additional topics may be selected from finite and projective geometries, spherical and other non-Euclidean geometries. The roles these topics play in enhancing mathematical thinking and visualization skills, both in these classroom teachers and, ultimately, in the students whom these teachers teach, are emphasized. Classroom materials, activities, and techniques are discussed and developed and concepts explained and explored through various modes, such as hands-on manipulatives, interactive computer software, and graphing calculators.

MATH 814 Mathematical Thinking and Learning (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or permission of doctoral program director. This course provides a foundation for conducting research on mathematical thinking and learning, with applications in curriculum development, teacher education, and educational policy. The course is designed for mathematics education researchers seeking to deepen their understanding of the cognitive and conceptual foundations of mathematical thinking and learning. Students will examine how learners develop, apply, and communicate mathematical reasoning, with a focus on algebraic, statistical, geometric, or some other domain(s) of mathematical thought. Through engagement with research literature, theoretical frameworks, and empirical studies, students will analyze key processes of mathematical thinking and reasoning within any of these domains and critically examine methodologies for studying them while exploring their implications for instructional design and assessment. Special attention will be given to the mediating roles of language, embodiment, visualization, symbolic representation, technologies, and other social and cultural tools in mathematical cognition.

MATH 815 Theories of Learning Mathematics (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. Cognitive development and the application of critical thinking and problem solving strategies to the teaching and learning of mathematics. Mathematical models as unifying structures will be examined together with investigations into methods of acquiring mathematical knowledge and the nature of mathematical proof. Contemporary learning theories in mathematics will be surveyed and applied in specific classroom situations.

MATH 816 Mathematics Curricula (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course will engage graduate students in important questions regarding the development, use, and adoption of mathematics curricula in the United States and elsewhere. Students will explore theoretical and historical perspectives on the definition and role of curricula and examine research on the use and impact of various mathematics curricula, including those currently being used in mathematics classrooms. They will investigate the impact of advancing technology on conceptions and delivery of mathematics curricula and explore implications for the future of mathematics education. They will also engage in a critical analysis of a particular mathematics curriculum or collection of curricula.

MATH 821 Mathematics Education in Higher Education (3 credits)
Prerequisite(s): EDFD 820 or EDFD 821. Discussion of issues related to mathematics education at four-year colleges, spanning introductory mathematics courses to graduate-level teacher education and research courses. Research and policy initiatives related to collegiate mathematics education will be explored. The implication of these initiatives on teaching and learning at the college-level, as well on the role of faculty, will be discussed. This course is a prerequisite for MATH 822.

MATH 822 Mathematics Education in Higher Education Practicum (1 credit)
Prerequisite(s): MATH 821. Students will work with a faculty member on the planning, execution, and assessment of an undergraduate course in mathematics education. The course will prepare students for teaching mathematics education at two- and four-year universities.

MATH 825 Research in Mathematics Education (3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. This course will examine the nature of research in mathematics education, its designs and methodologies, and its impact on school curricula. Research studies in cognitive development, curriculum and instruction, the teaching-learning process, language and communication in mathematics classrooms, and critical contemporary issues in mathematics education will be examined, analyzed, and discussed from the perspective of the classroom teacher.

MATH 830 Doctoral Seminar in Mathematics Education (1-2 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. The purpose of the Doctoral Seminar in Mathematics Education is to build community among doctoral students and faculty and to provide a variety of opportunities for doctoral students to engage in dialogue and other forms of scholarly activity about research in mathematics education.

MATH 831 Scholarly Writing for Doctoral Research (1-3 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or permission from doctoral program director. This advanced writing course supports doctoral students in developing the scholarly writing skills necessary to produce a rigorous dissertation in mathematics education. Through iterative drafting, feedback, and reflection, students will learn to synthesize and critique relevant research to establish a compelling rationale for their studies. Emphasis will be placed on positioning the dissertation within existing scholarly conversations, articulating the significance of the study, and situating the researcher's positionality in relation to the research context and participants. Students will gain practice in justifying methodological choices in alignment with their research questions and theoretical frameworks. The course will provide strategies for structuring paragraphs and sections to guide readers through complex arguments, using transitions and signposting to enhance coherence across sections and chapters. Students will also engage in targeted revision and editing to improve clarity, conciseness, and correctness, ultimately crafting writing that is persuasive, precise, and aligned with academic conventions.

MATH 900 Dissertation Advisement (3-12 credits)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; or permission of graduate program coordinator. Advancement to Candidacy. This department requires 12 credits of MATH 900. While enrolled in MATH 900, students will work with their Dissertation Chair and their Dissertation Committee. Credits are reported as IP (In Progress) while the dissertation is being written. At the conclusion of the dissertation defense, a final grade of Pass or Fail will be recorded.

MATH 901 Dissertation Extension (1 credit)
Restriction(s): Matriculation in PhD in Mathematics Education or EdD in Mathematics Education; 12 credits of dissertation advisement. Once students have acquired 12 credits of MATH 900 Dissertation Advisement, they must enroll in 1 credit of MATH 901 in every semester in which they intend to work on the dissertation, up to and including the semester of the defense. Credits are reported as IP (In Progress) while the dissertation is being written. At the conclusion of the dissertation defense, a final grade of Pass or Fail will be recorded. MATH 901 may be repeated until the time limitation for completion of the doctoral program as specified in the Doctoral Policy Manual has been reached. Mutually Exclusive with EDCO 901.