

MATHEMATICS

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DEGREE PROGRAMS

Bachelor of Arts or Bachelor of Science, Major in Mathematics

Bachelor of Science in Education, Major in Mathematics

Master of Science, Major in Mathematics

BACCALAUREATE DEGREES

The Department of Mathematics offers courses leading to the degrees of Bachelor of Arts, Bachelor of Science, and Bachelor of Science in Education.

Programs are planned to meet the current recommendations of the undergraduate curriculum in mathematical sciences proposed by the Mathematical Association of America, and the guidelines for the preparation of teachers adopted by the National Council of Teachers of Mathematics.

The Bachelor of Arts degree is recommended for students who plan to pursue mathematical study at the doctoral level. It is also recommended, in conjunction with the teacher certification program, for strong students who plan to become teachers of mathematics, particularly in higher education.

The Bachelor of Science degree is recommended for students who plan to pursue work in industry immediately after graduation or who plan to pursue further mathematical study.

The Bachelor of Science in Education is recommended for most students who plan to become secondary or middle school teachers of mathematics.

Bachelor of Arts, Major in Mathematics

A. General Education Requirements*

	<i>Hours</i>
Basic Skills**	15
Core Courses	17
Natural Sciences	8
Languages and Cultures	10
(10 hours in one foreign language required for the B.A. degree)	
Fine Arts	3
Economy and Society	3
Total	56

B. Major (Mathematics) Requirements

MATH 150	Calculus I	5
MATH 155	Calculus II	5
MATH 212	Matrix Algebra	2
MATH 253	Calculus III	3
MATH 543	Probability and Statistics	3
MATH 607	History of Mathematics	3
MATH 617	Linear Algebra	3
MATH 656	Mathematical Modeling or	
MATH 627	Linear Programming	3
MATH 699	Senior Seminar	1
CSIS 225	Computer Applications for Science and Technology or	
CSIS 235	Pascal or	
CSIS 240	C++ Programming	3
Electives***	minimum of	15
Total		46

* Courses must be taken from the list approved by the General Education Committee. See page 47.

** Five hours of general education basic skills requirements are satisfied by course requirements in Mathematics and Computer Science.

*** Electives must be chosen from three or more different areas, as listed below for the Bachelor of Science degree, one area being basic theoretical mathematics. At least two electives must be chosen from one area. A course

may not be counted as both an elective and a core course.

An appropriate minor is required. The degree requirements for a B.A. major in mathematics requires a minimum of 124 semester hours.

Bachelor of Science, Major in Mathematics

A. General Education Requirements*

	<i>Hours</i>
Basic Skills**	15
Core Courses	17
Natural Sciences	8
Languages and Cultures	10
Fine Arts	3
Economy and Society	3
Total	49

* Courses must be taken from the list approved by the General Education Committee. See page 47.

** Five hours of general education basic skills requirements are satisfied by the requirements in Mathematics and Computer Science.

B. Major (Mathematics) Requirements

MATH 150	Calculus I	5
MATH 155	Calculus II	5
MATH 212	Matrix Algebra	2
MATH 253	Calculus III	3
MATH 543	Probability and Statistics	3
MATH 617	Linear Algebra	3
MATH 656	Mathematical Modeling or	
MATH 627	Linear Programming	3
MATH 699	Senior Seminar	1
CSIS 225	Computer Applications for Science and Technology or	
CSIS 235	Pascal or	
CSIS 240	C++ Programming	3
Electives*	minimum of	18
Total		46

* Electives must be chosen from three or more different areas as listed below. At least two electives must be chosen from the Basic Theoretical Mathematics area. One of the electives must be MATH 613 Abstract Algebra or MATH 557 Analysis I.

AREAS:

Basic Theoretical Mathematics:		
MATH 413	Fundamentals of Mathematical Thought	3
MATH 513	Discrete Structures	3
MATH 557	Analysis I	3
MATH 613	Abstract Algebra	3

Applications:

MATH 553	Differential Equations	3
MATH 558	Vector Calculus	3
MATH 569	Numerical Analysis I	3
MATH 627	Linear Programming	3
MATH 656	Mathematical Modeling	3
MATH 726	Operations Research	1-3
MATH 763	Numerical Analysis II	3

Geometry:

MATH 636	Basic Concepts of Geometry	3
MATH 733	Topology	3

History:

MATH 607	History of Mathematics	3
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Probability and Statistics:

MATH 643	Mathematical Statistics	3
MATH 646	Statistical Methods I	3

An appropriate minor is required. The degree requirements for a B.S. major in mathematics requires a minimum of 124 semester hours.

Bachelor of Science in Education, Major in Mathematics for Secondary Teaching (Grades 7-12)

A. General Education Degree Requirements for students preparing to teach*

All students preparing to teach must meet the general education requirements for all baccalaureate degrees as well as the requirements for teacher certification. The following plan will satisfy both requirements.

	<i>Hours</i>
Basic Skills**	18
Core Courses	17
Natural Sciences	8
Languages and Cultures	10
Fine Arts	3
Economy and Society	3

Total	52
* See general education degree requirements for students preparing to teach secondary school, page 48. Also see scholastic achievement requirements on common core courses for admission to teacher education for secondary teaching majors, page 174.	
** Six hours of general education basic skills mathematics requirements are satisfied by the requirements in Mathematics. Two hours of general education basic skills are satisfied by the required programming course in Computer Science.	
B. Major (Mathematics) Requirements	
MATH 150 Calculus I	5
MATH 155 Calculus II	5
MATH 212 Matrix Algebra	2
MATH 253 Calculus III	3
MATH 471 Manipulatives for Teaching Mathematics	1
MATH 472 Calculators in Teaching Mathematics	1
MATH 473 Mathematical Software	1
MATH 513 Discrete Structures	3
MATH 543 Probability and Statistics	3
MATH 607 History of Mathematics	3
MATH 613 Abstract Algebra	3
MATH 636 Basic Concepts of Geometry	3
MATH 656 Mathematical Modeling	3
MATH 699 Senior Seminar	1
Mathematics Elective***, minimum of	5
A computer programming course which will also satisfy the General Education computing requirement.	
Total	42

*** Electives must be selected from MATH 143 Elementary Statistics or mathematics courses numbered above 253, exclusive of courses listed for elementary education majors MATH 509, MATH 705, and exclusive of MATH 306 Development of the Real Number Systems.

C. Professional Education	
CURIN 305 Explorations in Education****	2
CURIN 306 Pre-Professional Laboratory I****	1
PSYCH 263 Developmental Psychology	3
PSYCH 357 Educational Psychology	3
MATH 479 Techniques for Teaching Mathematics	3
SLS 510 Overview of Education for Exceptional Students	3
CURIN 511 Methods and Materials in Middle Level Education@	3
CURIN 520 Middle and Secondary Reading	3
Professional Semester	17
CURIN 458 Methods and Curriculum	3
CURIN 462 Secondary and Middle Level Education	2
CURIN 464 Foundations of Measurement and Evaluation	2
CURIN 480 Supervised Teaching in the Secondary School	3
CURIN 482 Supervised Teaching in the Secondary School	5
MATH 579 Supervised Student Teaching and Follow-Up of Teachers	2
Total	35-38@

**** Concurrent enrollment required in CURIN 305 and 306. The degree requirements for a B.S. in Education with a major in mathematics requires a minimum of 124 semester hours.
 @Required of students seeking middle level certification.

Minor in Teaching General Mathematics (Grades 7-12)

This minor in mathematics is a second teaching option (not a major) which will satisfy teacher certification requirements for General Mathematics (91-1-108b).

MATH 143 Elementary Statistics or	
MATH 543 Probability and Statistics	3
MATH 150 Calculus I	5
MATH 212 Matrix Algebra	2
MATH 471 Manipulatives for Teaching Mathematics	1
MATH 472 Calculators in Teaching Mathematics	1
MATH 473 Mathematical Software	1
MATH 479 Techniques for Teaching Mathematics	3
MATH 513 Discrete Structures	3
MATH 607 History of Mathematics	3
MATH 636 Basic Concepts of Geometry	3
Mathematics elective chosen from any course that counts toward a mathematics major	
A computer programming course which will also satisfy the General Education computing requirement.	
Total	28

Minor in Teaching Middle School Mathematics (Grades 5-9)**

This minor in mathematics for elementary education majors

has been designed to satisfy teacher certification requirements for Middle-Level Education Mathematics (91-1-108c).

MATH 143 Elementary Statistics or	
MATH 543 Probability and Statistics	3
MATH 306 Development of the Real Number Systems	3
MATH 471 Manipulatives for Teaching Mathematics	1
MATH 472 Calculators in Teaching Mathematics	1
MATH 473 Mathematical Software	1
MATH 479 Techniques for Teaching Mathematics	3
MATH 509 Informal Geometry	3
Mathematics elective*	6
A computer programming course which will also satisfy the General Education computing requirement.	
Total	21

* Electives must be selected from mathematics courses listed for the major in mathematics or from MATH 705 Topics in Elementary Mathematics.

**Students seeking middle-level endorsement must also take CURIN 511 Methods and Materials in Middle Level Education.

Minor in Mathematics

A minor in mathematics is supportive of various areas, particularly the biological, physical, computer, managerial, and social sciences. Consult the department for recommended courses.

Required Courses:	
MATH 150 Calculus I	5
MATH 212 Matrix Algebra	2
MATH 143 Elementary Statistics or	
MATH 543 Probability and Statistics or	
CSIS 225 Computer Applications for Science and Technology or	
CSIS 235 Pascal or	
CSIS 240 C++ Programming	3
Electives from approved mathematics courses numbered 143 or above. 10	
Total	20

GRADUATE DEGREES

Master of Science

Mathematics

- Community College Teaching (Mathematics)
- Secondary Teaching (Mathematics)

The Department of Mathematics offers courses leading to the degree of Master of Science. Candidates for this degree must meet the requirements for Option I, Option II, or Option III as described on pages 62 and 63 of this catalog. The prerequisite for starting a major is eight hours of acceptable courses in mathematics beyond MATH 253 Calculus III.

A minimum of 20 hours of acceptable courses in mathematics is required. MATH 863 Seminar in Mathematics, MATH 890 Research and Thesis or MATH 891 Research Problem, and other 800-level courses for a minimum of 15 hours credit should be included. A program with an applied or theoretical emphasis is available.

The Department of Mathematics offers work in the community college teaching program in cooperation with the Department of Special Services and Leadership Studies. The Master of Science degree with an emphasis in mathematics is granted by the Department of Special Services and Leadership Studies. Consult the college teaching programs described in the Special Services and Leadership Studies section of the catalog for additional information.

DESCRIPTION OF COURSES

Students who have completed intermediate or college algebra in high school may not enroll in the same courses for college credit. They may attend any of these classes for review purposes. Trigonometry may be repeated in college for full credit if approved by the student's major adviser. Students with strong preparation in high school trigonometry and two years of algebra may begin their college mathematics with MATH 150 Calculus I. A curriculum requirement of college algebra may be met by completing MATH 113 College Algebra, MATH 110 College Algebra with Review, MATH 126 Pre-Calculus, MATH 150 Calculus I, or MATH 153 Introduction to Analytic Processes. The department cooperates with other departments and with the students in an effort to insure that they enroll in the courses that are most appropriate for them.

UNDERGRADUATE

MATH 017. Elementary Algebra. 3 hours. A beginning course in algebra designed to prepare the student for MATH 019 Intermediate Algebra. Offered on a Pass-Fail basis only. Not counted toward the total hours required for a degree.

MATH 019. Intermediate Algebra. 2 hours. An intermediate course in algebra designed to prepare the student for MATH 110 College Algebra with Review. Not counted toward the total hours required for a degree. Prerequisite: MATH 017 Elementary Algebra, or one unit of high school algebra.

MATH 110. College Algebra with Review. 5 hours. (Only 3 hours count toward a degree). Operations with algebraic expressions; linear and quadratic functions; graphs of polynomial and rational functions; systems of equations; logarithmic and exponential functions; arithmetic and geometric progressions; permutations and combinations. This course is slower paced than MATH 113 College Algebra, but covers the same material. Not recommended for those having four years of high school mathematics, including two units of algebra, one unit of geometry, and one-half unit of advanced or senior mathematics. Closed to students with a grade of "C" or better in a course with number higher than 110. Prerequisite: MATH 019 Intermediate Algebra or one unit of high school algebra.

MATH 113. College Algebra. 3 hours. Operations with algebraic expressions; linear and quadratic functions; graphs of polynomial and rational functions; systems of equations; logarithmic and exponential functions; arithmetic and geometric progressions; permutations and combinations. Not recommended for those having four years of high school mathematics, including two units of algebra, one unit of geometry, and one-half unit of advanced or senior mathematics. Closed to students with credit in MATH 110 College Algebra with Review or MATH 126 Pre-Calculus or MATH 153 Introduction to Analytic Processes, or students with a letter grade of "C" or better in MATH 150 Calculus I. Prerequisite: MATH 019 Intermediate Algebra or 1.5 units of high school algebra.

MATH 114. Elements of Technical Analysis. 3 hours. Basic mathematics for technology students. Special emphasis on units of measurement, accuracy, use of calculators, beginning algebra, solutions of equations, use of graphs. Open only to candidates for the Associate of Applied Science degree. Closed to students with credit in MATH 110 College Algebra with Review or MATH 113 College Algebra.

MATH 122. Plane Trigonometry. 3 hours. The trigonometric functions; solutions of right and oblique triangles; identities; properties of circular functions; and complex numbers; applications. Prerequisite: MATH 110 College Algebra with Review or MATH 113 College Algebra. Closed to students with credit in MATH 126 Pre-Calculus.

MATH 126. Pre-Calculus. 4 hours. Pre-Calculus properties of the real number system, limits, functions, continuity, trigonometry, and graphics. Not open to students with credit in MATH 113 College Algebra, MATH 114 Elements of Technical Analysis, MATH 122 Plane Trigonometry, MATH 150 Calculus I, or MATH 153 Introduction to Analytic Processes. Prerequisite: Two units of high school algebra and trigonometry or permission of instructor.

MATH 143. Elementary Statistics. 3 hours. Basic concepts of statistics and probability applicable to all disciplines. Topics include data analysis, probability, discrete and continuous distributions, sampling, and statistical inference. Not open to students with credit in MATH 543 Probability and Statistics. Prerequisite: MATH 110 College Algebra with Review or MATH 113 College Algebra or MATH 126 Pre-Calculus.

MATH 150. Calculus I. 5 hours. Students with credit in MATH 153 Introduction to Analytic Processes receive only 3 hours credit. Functions, limits, derivatives and integrals. Applications to science, business, and technology. Prerequisite: MATH 122 Plane Trigonometry and a grade of C or higher in MATH 110 College Algebra with Review or MATH 113 College Algebra or MATH 126 Pre-Calculus or permission of instructor.

MATH 153. Introduction to Analytic Processes. 3 hours. Topics in differential and integral calculus and linear algebra for business applications. Closed to students with credit in MATH 150 Calculus I. Prerequisite: Grade of C or higher in MATH 110 College Algebra with Review or MATH 113 College Algebra or MATH 126 Pre-Calculus.

MATH 155. Calculus II. 5 hours. Continuation of MATH 150 Calculus I. Differentiation and integration techniques, transformations, polar coordinates, conics, transcendental functions, series and vectors. Prerequisite: Grade of "C" or higher in MATH 150 Calculus I or permission of instructor.

MATH 170. Mathematical Explorations. 1-3 hours. Directed class or seminar at the beginning college level. May be repeated.

MATH 212. Matrix Algebra. 2 hours. Algebra of matrices, determinants, the inverse and rank of a matrix, linear vector space concepts, and eigenvalues. Linear programming. Prerequisite: MATH 110 College Algebra with Review or MATH 113 College Algebra or MATH 126 Pre-Calculus.

MATH 253. Calculus III. 3 hours. Continuation of MATH 155 Calculus II. Vectors, solid analytic geometry, multivariable and vector calculus, and multiple integration. Prerequisite: MATH 155 Calculus II.

MATH 306. Development of the Real Number Systems. 3 hours. Development of the structure of the various number systems through Real Numbers. Use of technology, such as the calculator and computer, as tools for problem solving with emphasis on strategies. Introduces statistical measures of central tendency, normal distributions and simulations in probability. Closed to students with credit in MATH 150 Calculus I. Prerequisite: MATH 110 College Algebra with Review or MATH 113 College Algebra or MATH 126 Pre-Calculus.

MATH 413. Fundamentals of Mathematical Thought. 3 hours. Symbolic logic and axiomatic set theory, set theoretic constructions, relations, functions, and paradoxes. Development of the natural number system. Finite geometry. Offered spring semester.

MATH 471. Manipulatives for Teaching Mathematics. 1 hour. The use of mathematical manipulatives in teaching. Manipulatives to include geoboard, Lenart sphere, algebra tiles, Mira.

MATH 472. Calculators in Teaching Mathematics. 1 hour. Uses of graphing calculators in teaching. Programming activities on the calculator will be explored. Prerequisite: MATH 150 Calculus I.

MATH 473. Mathematical Software. 1 hour. Uses of mathematical software in teaching. Programming activities using current software packages will be explored. Prerequisite: MATH 150 Calculus I.

MATH 513. Discrete Structures. 3 hours. Elements of propositional logic, sets, algorithms, number theory, proofs, counting, mappings, relations, trees, graphs, digraphs, and Boolean algebra. May be taken for honors.

MATH 543. Probability and Statistics. 3 hours. Probability theory, random variables, discrete and continuous distributions and density functions, mathematical expectation, moment generating functions. Prerequisite: MATH 155 Calculus II. May be taken for honors.

MATH 553. Differential Equations. 3 hours. Standard types of ordinary equations of the first and second order, linear equations with constant coefficient solution by series, and applications to geometry and physical science. Prerequisite: MATH 253 Calculus III and MATH 212 Matrix Algebra. Offered spring semester.

MATH 557. Analysis I. 3 hours. A proof-oriented treatment of the real number system, sequences, the topology of real numbers, continuous functions, differentiation, and integration. Prerequisites: MATH 253 Calculus III. May be taken for honors. Offered fall semester.

MATH 558. Vector Calculus. 3 hours. n-space. Subspaces and bases. Eigenvalues. Diagonalizing a matrix. Chain rule. Taylor's formula. Optimization. LaGrange multipliers. Gradient, curl and divergence. Green's, Stoke's, and Gauss' theorems. Curvilinear coordinates. Prerequisites: MATH 253 Calculus III and either MATH 212 Matrix Algebra or MATH 617 Linear Algebra. May be taken for honors. Offered concurrently with MATH 758 Vector Calculus. Offered fall semester.

MATH 569. Numerical Analysis I. 3 hours. Numerical methods for interpolation, integration, systems of linear equations, nonlinear equations, and ordinary differential equations. Error analysis. Several programming exercises. Prerequisites: MATH 155 Calculus II, MATH 212 Matrix Algebra and programming ability. May be taken for honors. Offered fall semester.

MATH 607. History of Mathematics. 3 hours. The practice of mathematics in ancient, medieval, and modern times. Current developments in the philosophy and foundations of mathematics. Social and institutional factors. Standards of rigor. Prerequisite: MATH 150 Calculus I. Offered concurrently with MATH 707 History of Mathematics. May be taken for honors. Offered spring semester.

MATH 613. Abstract Algebra. 3 hours. Elements of group theory and ring theory; subgroups, cyclic and permutation groups, homomorphisms, quotient groups, isomorphism theorems, subrings, and ideals. Applications to modular arithmetic, partitions and equivalence relations, polynomial rings, complex numbers, integral domains, and fields. Prerequisite: MATH 617 Linear Algebra or MATH 513 Discrete Structures. May be taken for honors. Offered fall semester.

MATH 617. Linear Algebra. 3 hours. Gaussian elimination; vector spaces, subspaces; bases and dimension; linear transformation; orthogonal projections and least squares; determinants, eigenvalues and eigenvectors; positive definite matrices; diagonalization of matrices and canonical form. May be taken for honors. Offered concurrently with MATH 717 Linear Algebra. Offered spring semester.

MATH 627. Linear Programming. 3 hours. Simplex algorithm. Topics such as duality, revised and dual simplex algorithms, sensitivity analysis, transportation and assignment problems, network and flows. Prerequisite: MATH 212 Matrix Algebra or MATH 617 Linear Algebra. May be taken for honors. Offered concurrently with MATH 727 Linear Programming. Offered fall semester.

MATH 636. Basic Concepts of Geometry. 3 hours. Elementary geometry from an advanced standpoint with emphasis on structure and proof. Metric and synthetic approaches to two- and three-dimensional Euclidean geometries; constructions; and non-Euclidean geometries. May be taken for honors. Offered fall semester.

MATH 643. Mathematical Statistics. 3 hours. Sampling theory, statistical inference: estimation and tests of hypotheses, multivariate distributions. Prerequisites: MATH 253 Calculus III and MATH 543 Probability and Statistics. May be taken for honors. Offered concurrently with MATH 743 Mathematical Statistics. Offered spring semester.

MATH 646. Statistical Methods I. 3 hours. Applied statistics, methods of estimation and tests of hypotheses, categorical data, introduction to analysis of variance, correlation, regression, and experimental design. Prerequisites: MATH 143 Elementary Statistics or MATH 543 Probability and Statistics. May be taken for honors. Offered concurrently with MATH 746 Statistical Methods I.

Offered fall semester.

MATH 656. Mathematical Modeling. 3 hours. Problems arising from areas and disciplines other than mathematics. Description of the problem at its source, analysis of the key factors and simplifying assumptions, presentation of the problem in a tractable form, solution and testing of the selected model. Prerequisite: MATH 155 Calculus II and MATH 212 Matrix Algebra. May be taken for honors. Offered spring semester.

MATH 670. Topics in Mathematics: (____). 1-3 hours. Directed class or seminar study at the undergraduate level. May be repeated. May not be taken for graduate credit. Prerequisite: Permission of instructor.

MATH 687. Reading in Mathematics. 1-3 hours. Directed reading for superior undergraduate students. May be repeated for a maximum of 3 hours. Prerequisite: Permission of instructor.

MATH 699. Senior Seminar. 1 hour. Activities include: student presentations, review of major courses, and assessment. Required of all senior mathematics majors, both teaching and non-teaching. Should be taken the senior year.

SENIOR-GRADUATE

MATH 707. History of Mathematics. 3 hours. The practice of mathematics in ancient, medieval, and modern times. Current developments in the philosophy and foundations of mathematics. Social and institutional factors. Standards of rigor. Prerequisite: MATH 150 Calculus I. Offered concurrently with MATH 607 History of Mathematics. May be taken for honors.

MATH 717. Linear Algebra. 3 hours. Gaussian elimination; vector spaces; subspaces, bases and dimension; linear transformations; orthogonal projections and least squares; determinants; eigenvalues and eigenvectors; positive definite matrices; diagonalization of matrices and canonical form. May be taken for honors. Offered concurrently with MATH 617 Linear Algebra.

MATH 726. Operations Research. 1-3 hours. Mathematical programming and probabilistic models applied to managerial decisions. May be repeated for maximum of 3 hours. Prerequisite: MATH 543 Probability and Statistics and MATH 627 or MATH 727 Linear Programming. May be taken for honors.

MATH 727. Linear Programming. 3 hours. Simplex algorithm. Topics such as duality, revised and dual simplex algorithms, sensitivity analysis, transportation and assignment problems, network and flows. Prerequisite: MATH 212 Matrix Algebra. Offered concurrently with MATH 627 Linear Programming. May be taken for honors.

MATH 733. Topology. 3 hours. Topological structures: Open sets, neighborhoods, closed sets, subspaces, product spaces, quotient spaces; separation axioms; limits and continuity, filters and sequences; compactness and connectedness; countability axioms and separability; metric spaces. May be taken for honors.

MATH 743. Mathematical Statistics. 3 hours. Sampling theory, statistical inference: estimation and tests of hypotheses, multivariate distributions. Prerequisites: MATH 253 Calculus III and MATH 543 Probability and Statistics. Offered concurrently with MATH 643 Mathematical Statistics. May be taken for honors.

MATH 746. Statistical Methods I. 3 hours. Applied statistics, methods of estimation and tests of hypotheses, categorical data, introduction to analysis of variance, correlation, regression, and experimental design. Prerequisites: MATH 143 Elementary Statistics or MATH 543 Probability and Statistics. Offered concurrently with MATH 646 Statistical Methods I. May be taken for honors.

MATH 755. Elementary Partial Differential Equations. 3 hours. Fourier series, Legendre polynomials, Bessel functions. Separation of variables. Heat, wave and potential equations. Finite difference methods. Ritz and Galerkin methods. Finite element method. Prerequisite: MATH 553 Differential Equations. May be taken for honors. Offered spring semester.

MATH 757. Analysis II. 3 hours. A theoretical treatment of the calculus of several variables. Implicit function theorem and inverse function theorem. Prerequisite: MATH 557 Analysis I. May be taken for honors. Offered spring semester.

MATH 758. Vector Calculus. 3 hours. n-space. Subspaces and bases. Eigenvalues. Diagonalizing a matrix. Chain rule. Taylor's formula. Optimization. Lagrange multipliers. Gradient, curl and divergence. Green's, Stoke's, and Gauss' theorems. Curvilinear coordinates. Prerequisites: MATH 253 Calculus III and either MATH 212 Matrix Algebra or MATH 617 Linear Algebra. Offered concurrently with MATH 558 Vector Calculus. May be taken for honors.

MATH 763. Numerical Analysis II. 3 hours. Numerical linear algebra: Gaussian elimination, orthogonal transformations, least squares, algebraic eigenvalue problem, iterative methods, numerical solution of partial differential equations. Prerequisites: MATH 212 Matrix Algebra or MATH 617 Linear Algebra. May be taken for honors. Offered spring semester.

MATH 773. Expository Mathematics: (____). 1-6 hours. Analysis and synthesis of expository mathematics. Role of key mathematical concepts, teaching techniques, and/or learning devices in modern mathematics. May be repeated for a maximum of 6 hours.

GRADUATE

MATH 813. Algebra I. 3 hours. Theory of rings and modules; polynomial rings, homomorphisms, quotient rings, ideals, rings of fractions, integral domains, and modules. Prerequisite: MATH 613 Abstract Algebra.

MATH 836. Advanced Geometry. 3 hours. Development of non-euclidean geometries and advanced euclidean topics.

MATH 840. Topics in Statistics. (____). 1-3 hours. Directed class or seminar study. Prerequisite: Permission of instructor. May be repeated for a maximum of 6 hours.

MATH 853. Functions of a Complex Variable. 3 hours. General theory of analytic functions, conformal representation and mapping, trigonometric and hyperbolic functions, expansions in power series, definite integrals, and calculus of residues. Prerequisites: MATH 557 Analysis I and permission of instructor.

MATH 856. Real Functions I. 3 hours. Measure theory and integration: measure space, measurable functions, integrals of simple functions, integration of measurable functions, theory of normed linear spaces, spaces of integral functions, Banach and Hilbert spaces. Prerequisite: MATH 557 Analysis I.

MATH 863. Seminar in Mathematics. (____). 1-6 hours. Intensive study in a selected area of mathematics. May be repeated for a maximum of 6 hours.

MATH 870. Topics in Mathematics: (____). 1-3 hours. Directed class or seminar study. May be repeated if topics are different. A maximum of 6 hours can be applied toward a degree. Prerequisite: Permission of instructor.

MATH 871. Seminar: Teaching of Mathematics. 1-3 hours. Problems in teaching modern concepts; trends and curriculum changes; evaluation of student progress. Prerequisite: Permission of instructor.

MATH 880. Advanced Reading in Mathematics. 1-3 hours. Directed reading. May be repeated for a maximum of 6 hours. Prerequisite: Permission of instructor.

MATH 890. Research and Thesis. 1-5 hours. A total of 4 or 5 hours credit is required. May be repeated for a maximum of 5 hours.

MATH 891. Research Problem. 1-5 hours. A total of 4 or 5 hours credit is required. May be repeated for a maximum of 5 hours.

ELEMENTARY EDUCATION MAJORS

MATH 509. Informal Geometry. 3 hours. Fundamental ideas which are the irreducible common core of geometric knowledge. Relationships between points, lines, and planes; set theory, deductive proof and problem solving. For elementary education majors only.

SENIOR-GRADUATE

MATH 705. Topics in Elementary Mathematics: (____). 1-3 hours. Topics relevant to the elementary classroom will be developed in laboratory or seminar setting. May be repeated if topic is different. A maximum of 3 hours credit can be applied toward a degree. Prerequisite: Elementary teaching experience.

PROFESSIONAL COURSES

MATH 479. Techniques for Teaching Mathematics. 1, 2 or 3 hours. Techniques, methods, and course content used in teaching mathematics in the secondary school. Offered by the Department of Mathematics. Concurrent, one hour weekly departmental tutorial service required. To be taken before the professional semester. Prerequisite: Admission to teacher education and PSYCH 357 Educational Psychology. Demonstrable skill at the College Algebra level is required for passing the class.

MATH 579. Supervised Student Teaching and Follow-Up of Teachers. 2 hours. Departmental representatives will visit each student teacher during the professional semester. Additionally, departmental representatives will follow up with each area student during the first year of teaching with assistance and support. Concurrent enrollment in the professional semester is required. Offered on a Pass-Fail basis only.