Mathematics

Mathematics in its purest form is an art concerned with the exploration and expression of ideas. In its practical form, mathematics is a symbolic language and is concerned with the application of mathematical ideas and tools to the sciences and other areas of human endeavor.

The study of mathematics is grounded in problem solving and includes the ability to think in a certain, organized way. It is basic to careers in the natural sciences, essential to the effective use of computer technology, and valuable in related fields such as the social sciences, business, and industrial technology.

The Mathematics majors offered by the Department of Mathematics provide students with a core of knowledge in mathematics and allow specialization in both teaching and non-teaching programs.

Programs

- Elementary Education, B.S. (Mathematics Endorsement (Teacher Licensure)) *major*
- Mathematics Education, B.S. ((Teacher Licensure)) *major*
- Mathematics, B.S. (General Emphasis) *major*
- Mathematics, B.S. (Applied Emphasis) *major*
- Mathematics, B.S. (Actuarial Emphasis) *major*
- Mathematics *minor*

Career Directions

Actuarial Fields
Business and Industry
Computer Science
Data Processing
Economics
Engineering
Environmental Technology
Government
Mathematics Teaching
Medical Research
Natural Sciences
Statistics
Also: Graduate Study

Preparation

Recommended High School Courses
Computer Science
Mathematics at each grade level

Elementary Education, B.S. *major* Mathematics Endorsement (Teacher Licensure)

Required Credits: 85
Required GPA: 2.50

I ELEMENTARY EDUCATION FOUNDATION COURSES

COMPLETE THE FOLLOWING COURSES:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4799 The Professional Teacher (1 credit)
- HLTH 3400 Health and Drugs in Society (2 credits)

COMPLETE THE FOLLOWING COURSE:

- ED 4820 Student Teaching - Elementary (1-16 credits)

II ELEMENTARY EDUCATION MAJOR COURSES

COMPLETE THE FOLLOWING COURSES:

- ED 3201 Language Arts I (3 credits)
- ED 3202 Language Arts II (3 credits)
- ED 3203 Language Arts III (3 credits)
- ED 3221 Elementary Math Methods (3 credits)
- ED 3222 Elementary Science Methods (3 credits)
- ED 3240 Social Studies in the Elementary School (3 credits)
- ED 3301 Creative Expressions (3 credits)
- ED 3302 Creative Process Foundations: Patterns (3 credits)
- HLTH 4100 Teaching Elementary School Health (2 credits)
- PHED 4200 Methods of Teaching Elementary Physical Education to Classroom Teachers (1 credit)

COMPLETE THE FOLLOWING COURSE:

- MATH 1011 Mathematics for Elementary School Teachers I (3 credits)

COMPLETE THE FOLLOWING COURSE:

- MATH 1013 Mathematics for Elementary School Teachers II (3 credits)

MATHEMATICS ENDORSEMENT

ENDORSEMENT CORE:

- ED 4737 Content Area Reading (3 credits)
- ED 3417 Teaching and Learning in the Middle School (3 credits)
- ED 4840 Student Teaching - Special Fields (5 credits)

COMPLETE THE FOLLOWING COURSES:

- MATH 3064 Number Concepts for Teachers (4 credits)
- MATH 3065 Mathematical Foundations of Algebra for Teachers (4 credits)
- MATH 3066 Geometry and Technology in the Mathematics Classroom (4 credits)
- MATH 3067 Data Investigations, Probability, and Statistics for Teachers (4 credits)

Mathematics Education, B.S. *major* (Teacher Licensure)

The Mathematics Bachelor of Science (Teacher Licensure) follows the guidelines

of the National Council of Teacher of Mathematics for undergraduate programs for teachers of mathematics. Students majoring in this degree should also check the Professional Education requirements found in Professional Education: Secondary.

Note: If the student's high school mathematics courses and/or the Mathematics Placement Test indicate a lack of readiness for calculus, the student will be placed in one of the following precalculus sequences: MATH 1470; or MATH 1170 and MATH 1180; or MATH 1170 and MATH 1470. Students who need to take more than one course in preparation for calculus may not be able to complete this program without exceeding 120 credits.

Required Credits: 76
Required GPA: 2.50

I REQUIRED CORE COURSES

COMPLETE THE FOLLOWING COURSES:

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)

II REQUIRED ELECTIVES

COMPLETE THE FOLLOWING COURSES:

- MATH 3065 Mathematical Foundations of Algebra for Teachers (4 credits)
- MATH 3560 Classical and Modern Geometry (3 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- MATH 3067 Data Investigations, Probability, and Statistics for Teachers (4 credits)
- STAT 2610 Applied Statistics (4 credits)
- STAT 3631 Probability and Statistics I (4 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- MATH 4350 Abstract Algebra (3 credits)
- MATH 4371 Modern Algebra (3 credits)

III REQUIRED CONCENTRATION, SECOND EDUCATION MAJOR OR MIDDLE LEVEL ENDORSEMENT

COMPLETE ONE OF THE FOLLOWING OPTIONS:

Note: If taken under II. above, MATH 3067 or STAT 3631 may be used to meet this requirement.

A. APPLIED MATHEMATICS/ CALCULUS CONCENTRATION
COMPLETE 2 OF THE FOLLOWING COURSES:

- MATH 2490 Differential Equations (4 credits)
- MATH 3710 Mathematical Modeling (3 credits)
- MATH 3720 Numerical Methods (3 credits)
- MATH 4410 Introduction to Analysis (3 credits)
- MATH 4760 Topics in Applied Mathematics (3 credits)

B. COMPUTER SCIENCE CONCENTRATION
COMPLETE 2 OF THE FOLLOWING COURSES:

- CS 2270 Introduction to Web Programming (3 credits)
- CS 2321 Computer Science I (4 credits)
- CS 2322 Computer Science II (4 credits)

C. MIDDLE LEVEL MATHEMATICS CONCENTRATION
COMPLETE 2 OF THE FOLLOWING COURSES:

- MATH 3064 Number Concepts for Teachers (4 credits)
- MATH 3066 Geometry and Technology in the Mathematics Classroom (4 credits)
- MATH 3067 Data Investigations, Probability, and Statistics for Teachers (4 credits)

D. STATISTICS CONCENTRATION
COMPLETE 2 OF THE FOLLOWING COURSES:

- STAT 3610 Time Series Analysis (3 credits)
- STAT 3631 Probability and Statistics I (4 credits)
- STAT 3632 Probability and Statistics II (3 credits)

E: COMPLETE A SECONDARY EDUCATION MAJOR
(OTHER THAN MATHEMATICS)

F: COMPLETE A MIDDLE LEVEL ENDORSEMENT
(OTHER THAN MATHEMATICS)

REQUIRED PROFESSIONAL EDUCATION COURSES

COMPLETE THE FOLLOWING COURSES:

- ED 3100 Introduction to the Foundations of Public School Education (3 credits)
- ED 3110 Educational Psychology (3 credits)
- ED 3140 Human Relations In Education (3 credits)
- ED 3350 Pedagogy: Planning for Instruction (3 credits)
- ED 3440 Mathematics Methods in the Secondary School (4 credits)
- ED 3780 Adaptation and Management: Designing the Learning Environment (3 credits)
- ED 4737 Content Area Reading (3 credits)
- ED 4799 The Professional Teacher (1 credit)
- HLTH 3400 Health and Drugs in Society (2 credits)

COMPLETE 12 CREDITS OF THE FOLLOWING COURSE

- ED 4830 Student Teaching - Secondary (1-12 credits)

Program Learning Outcomes | Mathematics Education, B.S.

1. Knowledge: Students will understand the content and methods of the core areas of undergraduate mathematics.

2. Analysis: Students will identify, interpret and analyze problems, discern structure and pattern and make conjectures.

3. Application: Students will apply appropriate procedures and technology to solve problems.

4. Proof: Students will apply creative and analytic thinking to develop clear and valid mathematical arguments.

5. Communication: Students will communicate mathematical ideas and

understanding effectively.

6. Pedagogy: Student will develop an understanding of a variety of pedagogical techniques and be able to apply them to the design of lessons and curriculum that communicate mathematical concepts to learners with diverse learning styles and ability levels.

7. Career Readiness: Students will be prepared for careers in education and further study in mathematics.

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Mathematics, B.S. *major*
General Emphasis

Note: If the student's high school mathematics courses and/or the Mathematics Placement Test indicate a lack of readiness for calculus, the student will be placed in one of the following precalculus sequences: MATH 1470; or MATH 1170 and MATH 1180; or MATH 1170 and MATH 1470.

Required Credits: 44
Required GPA: 2.25

I REQUIRED CORE COURSES

COMPLETE THE FOLLOWING COURSES:

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)

GENERAL EMPHASIS

COMPLETE THE FOLLOWING COURSE:

- STAT 3631 Probability and Statistics I (4 credits)

SELECT 1 OF THE FOLLOWING COURSES:

- MATH 4350 Abstract Algebra (3 credits)
- MATH 4371 Modern Algebra (3 credits)
- MATH 4410 Introduction to Analysis (3 credits)

REQUIRED ELECTIVES

SELECT 5 COURSES (not used above) FROM THE FOLLOWING:

- CS 2322 Computer Science II (4 credits)
- MATH 2490 Differential Equations (4 credits)
- MATH 3260 Mathematical Problem Solving (3 credits)
- MATH 3440 Introduction to Fractals & Chaos (3 credits)
- MATH 3560 Classical and Modern Geometry (3 credits)
- MATH 3710 Mathematical Modeling (3 credits)
- MATH 3720 Numerical Methods (3 credits)
- MATH 3820 History of Mathematics (3 credits)
- MATH 4240 Number Theory (3 credits)
- MATH 4350 Abstract Algebra (3 credits)
- MATH 4371 Modern Algebra (3 credits)
- MATH 4410 Introduction to Analysis (3 credits)
- MATH 4470 Advanced Calculus (3 credits)
- MATH 4760 Topics in Applied Mathematics (3 credits)
- STAT 3610 Time Series Analysis (3 credits)
- STAT 3632 Probability and Statistics II (3 credits)

SUGGESTED SEMESTER SCHEDULE FOR MATHEMATICS MAJOR, B.S.

The following is a list of required Mathematics Major, B.S. courses by year. This schedule is intended to help students plan their courses in an orderly fashion; however, these are only suggestions and this schedule is flexible.

Freshman

- MATH 1470 Precalculus (5 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- Liberal Education requirements

Sophomore

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)
- Courses in the Field of Emphasis (consult with advisor)
- Liberal Education requirements

Junior/Senior

- Courses in the Field of Emphasis (consult with advisor)
- Complete Liberal Education requirements

Mathematics, B.S. *major*
Applied Emphasis

Note: If the student's high school mathematics courses and/or the Mathematics Placement Test indicate a lack of readiness for calculus, the student will be placed in one of the following precalculus sequences: MATH 1470; or MATH 1170 and MATH 1180; or MATH 1170 and MATH 1470.

Required Credits: 40
Required GPA: 2.25

I REQUIRED CORE COURSES

COMPLETE THE FOLLOWING COURSES:

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)

APPLIED EMPHASIS

SELECT AT LEAST 6 COURES FROM THE FOLLOWING:

- CS 2322 Computer Science II (4 credits)
- MATH 2490 Differential Equations (4 credits)
- MATH 3710 Mathematical Modeling (3 credits)
- MATH 3720 Numerical Methods (3 credits)
- MATH 4410 Introduction to Analysis (3 credits)
- MATH 4760 Topics in Applied Mathematics (3 credits)
- STAT 2610 Applied Statistics (4 credits)
  or STAT 3631 Probability and Statistics I (4 credits)
- STAT 3610 Time Series Analysis (3 credits)
- STAT 3632 Probability and Statistics II (3 credits)

SUGGESTED SEMESTER SCHEDULE FOR MATHEMATICS MAJOR, B.S.

The following is a list of required Mathematics Major, B.S. courses by year. This schedule is intended to help students plan their courses in an orderly fashion; however, these are only suggestions and this schedule is flexible.

Freshman

- MATH 1470 Precalculus (5 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- Liberal Education requirements

Sophomore

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)
- Courses in the Field of Emphasis (consult with advisor)
- Liberal Education requirements

Junior/Senior

- Courses in the Field of Emphasis (consult with advisor)
- Complete Liberal Education requirements

Students seeking the Applied emphasis are encouraged to take significant coursework in related fields such as biology, business, chemistry, computer science, economics, geography, geology, environmental studies, physics or technology. Students planning to attend graduate school in applied mathematics or a related field should take both MATH 2490 Differential Equations and MATH 4410 Introduction to Analysis.

Mathematics, B.S. *major*
Actuarial Emphasis

Note: If the student's high school mathematics courses and/or the Mathematics Placement Test indicate a lack of readiness for calculus, the student will be placed in one of the following precalculus sequences: MATH 1470; or MATH 1170 and MATH 1180; or MATH 1170 and MATH 1470.

Required Credits: 57
Required GPA: 2.25

I REQUIRED CORE COURSES

COMPLETE THE FOLLOWING COURSES:

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)

ACTUARIAL EMPHASIS

COMPLETE THE FOLLOWING COURSES:

- ACCT 1101 Principles of Accounting I (3 credits)
- ACCT 1102 Principles of Accounting II (3 credits)
- BUAD 3771 Financial Management (3 credits)
- BUAD 3772 Advanced Financial Management (3 credits)
- CS 2321 Computer Science I (4 credits)
- ECON 2000 Markets and Resource Allocation (3 credits)
- ECON 2100 Macroeconomics and the Business Cycle (3 credits)
- STAT 3610 Time Series Analysis (3 credits)
- STAT 3631 Probability and Statistics I (4 credits)
- STAT 3632 Probability and Statistics II (3 credits)

SELECT ONE OF THE FOLLOWING COURSES:

- MATH 3710 Mathematical Modeling (3 credits)
- MATH 3720 Numerical Methods (3 credits)
- MATH 4760 Topics in Applied Mathematics (3 credits)

SUGGESTED SEMESTER SCHEDULE FOR MATHEMATICS MAJOR, B.S.

The following is a list of required Mathematics Major, B.S. courses by year. This schedule is intended to help students plan their courses in an orderly fashion; however, these are only suggestions and this schedule is flexible.

Freshman

- MATH 1470 Precalculus (5 credits)
- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)
- Liberal Education requirements

Sophomore

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 3310 Linear Algebra (4 credits)
- Courses in the Field of Emphasis (consult with advisor)
- Liberal Education requirements

Junior/Senior

- Courses in the Field of Emphasis (consult with advisor)
- Complete Liberal Education requirements

Mathematics *minor*

Required Credits: 20.0
Required GPA: 2.00

I REQUIRED COURSES

COMPLETE THE FOLLOWING COURSES:

- MATH 2471 Calculus I (5 credits)
- MATH 2472 Calculus II (5 credits)

II REQUIRED ELECTIVES

SELECT 10 SEMESTER CREDITS FROM THE FOLLOWING COURSES:

(Must include at least one MATH or STAT class numbered 3260 or above.)

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 2490 Differential Equations (4 credits)
- Any MATH course numbered 3260 or above
- Any STAT course except STAT 3660 Statistics for the Health Sciences (3 credits)

OR COMPLETE ALL OF THE FOLLOWING COURSES:

- MATH 2210 Discrete Mathematics (4 credits)
- MATH 2480 Multivariable Calculus (4 credits)
- MATH 2490 Differential Equations (4 credits)
- STAT 2610 Applied Statistics (4 credits)

Mathematics Courses

MATH 0800 Intermediate Algebra (3 credits)
An algebra course designed for students with an insufficient algebraic background for CS 1309, MATH 1100, MATH 1107, or MATH 1170. This course must be taken for a letter grade and, to use this course as a prerequisite for MATH 1100 or MATH 1107, a grade of C or better must be achieved, and to use this course as a prerequisite for CS 1309 or MATH 1170, a grade of B or better must be achieved. Credits are not applicable towards graduation. Topics include solving linear and quadratic equations, applications, linear inequalities, factoring, operations on polynomials, rational and radical expressions, and graphing linear equations.

MATH 1011 Mathematics for Elementary School Teachers I (3 credits)
This course meets the new BOT fundamental topics in arithmetic competencies. These topics include addition, subtraction, multiplication, and division of whole numbers; number theory related to fractions; decimals; and integers. This is the first of two mathematics courses providing the background for teaching in the elementary school. Emphasizes the use of mathematics manipulatives for modeling the basic operations. Prerequisite: Elementary education major or consent of instructor.

MATH 1013 Mathematics for Elementary School Teachers II (3 credits)
This course meets the new BOT introduction to higher mathematics competencies. These topics include geometry, discrete mathematics, probability, and statistics. This is the second of two mathematics courses providing the background for teaching in the elementary school. Emphasizes the use of mathematics manipulatives for modeling the basic concepts. Prerequisite: MATH 1011.

MATH 1100 Mathematical Reasoning (3 credits)
Mathematical reasoning and algebraic concepts applied to a selection of topics, which may include the mathematics of social choice, and the mathematics of management, geometry, and problem solving. Descriptive statistics and introductory probability and inferential statistics. A graphing calculator is required. Not open to students who have completed Math 1107 or Math 1170. Prerequisites: Two years of high school algebra and an appropriate score on the Mathematics Placement Test or completion of MATH 0800 with a grade of C or better. Liberal Education Category 4.

MATH 1107 Introduction to Mathematical Sciences (3 credits)
This course integrates the study of algebra, statistics, and computing in a laboratory-instruction environment. Topics include functions, graphical and tabular analysis, rate of change, syntax and semantics, the process of computing, data manipulation, sampling, statistical measures, basic probability, and correlation. Examples are drawn from a wide range of disciplines and content is taught within the framework of discipline-specific examples. Students learn to use the software package Microsoft Excel. Not open to students who have completed Math 1100 or Math 1170. Prerequisites: Two years of high school algebra and an appropriate score on the Mathematics Placement Test or MATH 0800 with a grade of C or better. Liberal Education Goal Area 4.

MATH 1170 College Algebra (4 credits)
Problem solving with linear, quadratic, rational and absolute value equations and inequalities; function notation and inverses; graphs of relations and functions; polynomial, rational, exponential, and logarithmic functions and applications; systems of equations and inequalities, matrices. Prerequisites: Successful completion of MATH 0800 with a grade of B or better, or three years of high school mathematics (including two years of algebra) and an appropriate score on the Mathematics Placement Test. Liberal Education Goal Area 4.

MATH 1180 Trigonometry (3 credits)
Trigonometric functions, identities, equations, and applications. Prerequisites: Successful completion of Math 1170, or 3 years of high school math (including two years of algebra), and an appropriate score on the Mathematics Placement Test. Liberal Education Goal Area 4.

MATH 1470 Precalculus (5 credits)
Intended to provide the essential mathematical background needed in calculus. Topics include equation solving, functions (including polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric), identities, applications, and parametric equations. A graphing calculator is required. Prerequisites: Three years of high school mathematics (including two years of algebra with a half year of trigonometry strongly recommended) and an appropriate score on the Mathematics Placement Test, or completion of MATH 1170 with a grade of C or better. Liberal Education Goal Area 4.

MATH 2210 Discrete Mathematics (4 credits)
Symbolic logic, number concepts, mathematical induction, set theory, relations and functions, graphs, trees, recurrence relations, and complexity of algorithms. Prerequisites: CS 1309 or Math 1470 or higher or three years of high school mathematics (including two years of algebra) and an appropriate score on the Mathematics Placement Test.

MATH 2471 Calculus I (5 credits)
Limits, differentiation and integration of algebraic and trigonometric functions; applications of the derivative and curve sketching; applications of integration. A graphing calculator is required. Prerequisite: An appropriate ACT math subscore or Mathematics Placement Test score or a grade of C or better in MATH 1470 or grades of C or better in both MATH 1170 and MATH 1180 or consent of instructor. Liberal Education Goal Area 4.

MATH 2472 Calculus II (5 credits)
Differentiation and integration of transcendental functions, techniques of integration, infinite sequences and series, parametric equations, polar coordinates, analytic geometry, and vectors. A graphing calculator is required. Prerequisite: A grade of C or better in MATH 2471. Liberal Education Goal Area 4.

MATH 2480 Multivariable Calculus (4 credits)
Three dimensional analytic geometry, spherical, and cylindrical coordinate systems, vectors, partial derivatives, and multiple integrals. A graphing calculator is required. Prerequisite: Successful completion of MATH 2472.

MATH 2490 Differential Equations (4 credits)
Ordinary differential equations including first order and second order linear equations, series solutions, Laplace transformations, existence and uniqueness theory, systems of linear and nonlinear equations, dynamical systems and applications. A graphing calculator is required. Prerequisite: MATH 2472.

MATH 3064 Number Concepts for Teachers (4 credits)
This course provides a background in number concepts that are pertinent to school mathematics. Topics include scientific notation, number sense, properties of integers, prime and composite numbers, divisors, GCDs, LCMs, the number of divisors, the sum of divisors, the Euclidean Algorithm, famous unsolved problems, finite mathematical systems, modular arithmetic, introductory graph theory and applications, permutations, combinations, sorting, congruences, sequences, direct and indirect proofs, mathematical induction, and traveling salesman problem and algorithms. Emphasis will be given to problem solving techniques as they relate to number concepts. Prerequisite MATH 1011 or equivalent or consent of instructor. Might not be offered every year.

MATH 3065 Mathematical Foundations of Algebra for Teachers (4 credits)
This course investigates concepts of patterns, relations, and functions. Prerequisites: MATH 1011 or equivalent or consent of instructor. Might not be offered every year.

MATH 3066 Geometry and Technology in the Mathematics Classroom (4 credits)
This course examines the concepts of patterns, shape and space; spatial sense; plane, solid, and coordinate geometry systems; generalizing geometric principals; limits, derivatives and integrals; and appropriate use of technology in the classroom. Prerequisites: MATH 1011 or equivalent or consent of instructor; (Might not be offered every year.)

MATH 3067 Data Investigations, Probability, and Statistics for Teachers (4 credits)
This course explores data investigations and concepts of randomness and uncertainty. The collection, display, analysis, and interpretation of data are studied. Additional topics include randomness, sampling, probability in simple and compound events, the prediction of outcomes using a variety of techniques, and the comparison of theoretical and empirical results of experiments. Prerequisite MATH 1011 or equivalent or consent of instructor.

MATH 3260 Mathematical Problem Solving (3 credits)
Investigation of problems and the process of problem solving across a variety of mathematical areas. Development and application of strategies used to solve problems with emphasis on multistep and nonroutine problems. Application of the process of mathematical modeling to real situations. Prerequisite: MATH 2210. (Might not be offered every year.)

MATH 3310 Linear Algebra (4 credits)
Systems of linear equations, linear transformations, matrix operations, vector spaces, eigenvalues and eigenvectors, orthogonality, and applications. Prerequisites: MATH 2210 and MATH 2472 or consent of instructor.

MATH 3440 Introduction to Fractals & Chaos (3 credits)
An introduction to the topics of fractal geometry, chaos, and dynamic mathematical systems. Topics included are iteration, fractals and fractal dimension, iterated function systems, Julia set, Mandelbrot set, and bifurcation. Prerequisites: MATH 2210 and MATH 2472. (Might not be offered every year.)

MATH 3560 Classical and Modern Geometry (3 credits)
Euclidean and non-Euclidean geometry, axiomatic systems, the geometry of solids, transformations, measurement, and fractal geometry. Prerequisite: MATH 2210.

MATH 3710 Mathematical Modeling (3 credits)
Mathematical modeling of applications that involve difference equations, matrices, probability, differentiation, and integration. Applications may be chosen from among the biological and p hysical sciences, economics, the social sciences, or other areas of interest. A graphing calculator is required. Prerequisite: MATH 2472. (Might not be offered every year.)

MATH 3720 Numerical Methods (3 credits)
Root finding techniques, fixed point iteration, polynomial interpolation, methods for solving linear and nonlinear systems of equations, numerical integration and differentiation, numerical solutions of differential equations, and the method of steepest descent. Prerequisite: MATH 2472.

MATH 3820 History of Mathematics (3 credits)
Historical investigation and presentation of the sources and growth of mathematical knowledge and principles, including Peano's axioms, the Axiom of Choice, and Russell's Paradox. Prerequisites: Junior or senior status and consent of the instructor. (Might not be offered every year.)

MATH 3961 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3962 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3963 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3964 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3965 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3966 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3967 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3968 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 3969 Special Purpose Instruction (3 credits)
A course intended for specific groups or organizations outside the University community.

MATH 4240 Number Theory (3 credits)
Properties of integers, primes and their distribution, linear and quadratic congruences, number-theoretic functions, Diophantine equations, Fibonacci numbers, primitive roots and quadratic reciprocity. Prerequisite: MATH 2210. (Might not be offered every year.)

MATH 4350 Abstract Algebra (3 credits)
A study of abstract algebraic systems with an emphasis on the development of number systems, properties of polynomials, rings, integral domains and fields. Prerequisites: MATH 3310. (Might not be offered every year.)

MATH 4371 Modern Algebra (3 credits)
A study of abstract algebraic systems with an emphasis on groups and an introduction to rings. Prerequisite: MATH 3310.

MATH 4410 Introduction to Analysis (3 credits)
Functions, sequences, and properties of limits. Topics from calculus including continuity, differentiation, and integration. Open and closed sets, cluster points, and other topological properties. Prerequisites: MATH 2210 and MATH 2472.

MATH 4470 Advanced Calculus (3 credits)
Properties of limits, vector valued functions, infinite series, Taylor series, uniform convergence, improper integrals, convergence in the mean and Fourier series. Prerequisite: MATH 2210 and MATH 2480. (Might not be offered every year.)

MATH 4760 Topics in Applied Mathematics (3 credits)
This course focuses on an advanced topic from applied mathematics. Possible foci include operations research, cryptography, computational science, and bioinformatics. May be repeated for credit with instructor permission. Prerequisite: MATH 2472. (Might not be offered every year.)

All-University Courses

The course numbers listed below, not always included in the semester class schedule, may be registered for by consent of the advisor, instructor, or department chair, or may be assigned by the department when warranted. Individual registration requires previous arrangement by the student and the completion of any required form or planning outline as well as any prerequisites.

1910, 2910, 3910, 4910 DIRECTED INDEPENDENT STUDY
1920, 2920, 3920, 4920 DIRECTED GROUP STUDY
1930, 2930, 3930, 4930 EXPERIMENTAL COURSE
1940, 2940, 3940, 4940 IN-SERVICE COURSE
1950, 2950, 3950, 4950 WORKSHOP, INSTITUTE, TOUR
1960, 2960, 3960, 4960 SPECIAL PURPOSE INSTRUCTION
1970, 2970, 3970, 4970 INTERNSHIP
1980, 2980, 3980, 4980 RESEARCH

1990, 2990, 3990, 4990 THESIS

Statistics Courses

STAT 2610 Applied Statistics (4 credits)
A nontheoretical introduction to statistics with an emphasis on applications in a variety of disciplines. Topics include measures of central tendency, position and dispersion; basic probability; hypothesis testing; estimation; analysis of variance; linear correlation and regression; nonparametric statistics. Prerequisite: Three years of high school mathematics (including two years of algebra) and an appropriate score on the Mathematics Placement Test, or completion of MATH 1170 or higher. Liberal Education Goal Area 4.

STAT 3610 Time Series Analysis (3 credits)
Linear time models, seasonal models, stationary models, moving average, autoregressive and ARIMA models, model identification, confidence intervals and testing, forecasting and error analysis. Prerequisites: (MATH 2472 and STAT 2610) or STAT 3631. (Might not be offered every year.)

STAT 3631 Probability and Statistics I (4 credits)
Probability of finite sample spaces, discrete and continuous probability distributions, exploratory data analysis, statistical models. Prerequisites: MATH 2472.

STAT 3632 Probability and Statistics II (3 credits)
Multivariable distributions, sampling distribution theory, estimation, hypothesis testing, regression and correlation. Prerequisites: MATH 2480 and STAT 3631. (Might not be offered every year.)

STAT 3650 Probability and Statistics for Secondary Teachers (4 credits)
Topics include descriptive statistics and graphical representations, basic probability and commonly encountered distributions, random variables, expectation and variance, sampling theory, and inferential statistics including univariate and bivariate data. Calculus is employed in the development of these concepts. Technology is used extensively to motivate and explain concepts and techniques. The course emphasizes and models exercises and pedagogy appropriate for the secondary school classroom. Prerequisite: MATH 2471.

STAT 3660 Statistics for the Health Sciences (3 credits)
Introduction to descriptive and inferential statistics in the context of the health sciences. Covers data types, methods for summarizing and displaying data, measures of central tendency and variability, hypothesis testing including the analysis of variance and nonparametric techniques, correlation and regression. Students learn to use the statistical software package SPSS for data analysis. Prerequisite: MATH 1170 or consent of instructor.

All-University Courses

The course numbers listed below, not always included in the semester class schedule, may be registered for by consent of the advisor, instructor, or department chair, or may be assigned by the department when warranted. Individual registration requires previous arrangement by the student and the completion of any required form or planning outline as well as any prerequisites.

1910, 2910, 3910, 4910 DIRECTED INDEPENDENT STUDY
1920, 2920, 3920, 4920 DIRECTED GROUP STUDY
1930, 2930, 3930, 4930 EXPERIMENTAL COURSE
1940, 2940, 3940, 4940 IN-SERVICE COURSE
1950, 2950, 3950, 4950 WORKSHOP, INSTITUTE, TOUR
1960, 2960, 3960, 4960 SPECIAL PURPOSE INSTRUCTION
1970, 2970, 3970, 4970 INTERNSHIP
1980, 2980, 3980, 4980 RESEARCH
1990, 2990, 3990, 4990 THESIS