MATHEMATICS (MA)

MA-050   Pre-Algebra Mathematics   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
The language of mathematics, terms and symbols, the real number system, arithmetic operations on real numbers, including exponents and roots, emphasis on fractions and decimals, and evaluation of expressions. Special topics on divisibility, figurate numbers, and introduction to college algebra. Three hours per week, plus mandatory attendance with mathematics lab. This course cannot be used to satisfy graduation requirements.

MA-100   Quantitative Reasoning and Problem Solving   **Credits: 3**
Prerequisite(s): MA-050 passed with a grade of C- or higher or MA-LVL2 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Basic mathematical concepts studied through solving problems in collaborative groups; examination of decision-making and problem-solving techniques and various formats for representing quantitative information.

MA-101   College Algebra   **Credits: 3**
Prerequisite(s): MA-050 passed with a grade of C- or higher or MA-LVL2 or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
The axioms and properties of the real number system. Manipulating expressions representing quantities; functions and their representations as rules, graphs or tabulations; linear and polynomial functions; zero, factoring techniques, and graphical properties of polynomials; the logarithm and exponential; solving systems of equations; sequences and summations; and combinations and permutations. Calculators required for selected topics. This course cannot be used in satisfaction of the general education mathematics requirement.

MA-103   Foundations of Elementary Mathematics   **Credits: 3**
Prerequisite(s): MA-050 passed with a grade of C- or higher or 3 credits in Math
Term Offered: Spring Term
Course Type(s): None
Careful examination of mathematical ideas behind the mathematics taught in grades K-8, and their history and applications to daily life. Intended primarily for future elementary-school teachers to provide them with a better understanding of the mathematics they will teach. This course will also be of value for any student who wants a better understanding of these ideas. Focus on understanding and exploring the mathematics behind computation through problem solving, projects, group explorations, use of manipulatives, and some use of technology. Topics include: number systems, measurement, probability, statistics, and geometry. Not open to freshmen.

MA-105   Mathematical Modeling in the Social Sciences   **Credits: 3**
Prerequisite(s): MA-050 passed with a grade of C- or higher or MA-LVL2 or MA-LVL3 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Exploration and aspects of algebra, mathematical modeling, and data analysis, which are important in the social sciences. Topics include: an introduction to data, the use of variables, assorted kinds of graphs to represent data, the concept of function, the problem of fitting functions to data, representing change over time, rates of change, linear functions and linear models, piecewise-linear functions, and an introduction to non-linear functions. Pedagogical methods to be used include: projects using real data, computer explorations, and group work. MA-LVL4 may not take this course.

MA-107   Mathematics in the Arts   **Credits: 3**
Prerequisite(s): MA-050 or MA-LVL2 or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: Spring Term
Course Type(s): None
Study of artistic design in architecture, painting, sculpture, and crafts; math of music.

MA-109   Pre-Calculus Mathematics   **Credits: 4**
Prerequisite(s): MA-101 passed with a grade of C- or higher or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
The real number system, algebraic expressions, exponents, radicals, solution of equations, solutions of inequalities, functions, graphing of functions, and trigonometry. Not open to students who have successfully completed MA-125.

MA-115   Pre-Calculus Modeling for the Biological Sciences   **Credits: 3**
Prerequisite(s): MA-101 passed with a grade of C- or higher or MA-LVL 3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Provides a development of an understanding of linear, exponential, logarithmic, polynomial and trigonometric functions related to biological phenomena. The development is from an algebraic, graphical and modelling perspective. In addition, the solutions of equations and inequalities related to these functions are studied. Use of related technology is included.

MA-116   Calculus for the Biological Sciences   **Credits: 3**
Prerequisite(s): MA-115 or MA-109 passed with a grade of C- or higher or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Introduction to calculus, from a primarily graphical perspective, through applications to biological and ecological phenomena. Topics include: differentiation, integration, and differential equations.

MA-117   Quantitative Analysis for Business I   **Credits: 3**
Prerequisite(s): MA-101 or MA-105 passed with a grade of C- or higher or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Linear equations and models, systems of linear equations and applications, matrices and techniques for solving systems of equations, linear programming and applications, quadratic functions and models, and exponential and logarithmic models. A computer laboratory component is incorporated. Designed for students majoring in Business Administration; other students by permission of the Mathematics Department.

MA-118   Quantitative Analysis for Business II   **Credits: 3**
Prerequisite(s): MA-117 passed with a grade of C- or higher, or permission of the department
Term Offered: All Terms
Course Type(s): None
Functions, limits, continuity, polynomial calculus, including optimization models, anti-derivatives, area and applications to business models; introduction to probability and statistics as applied to business models.

MA-120   Introduction to Mathematical Reasoning   **Credits: 4**
Prerequisite(s): MA-101 passed with a grade of C- or higher or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Introduction to reasoning, proof, and exposition in mathematics. Topics include: Boolean logic, set theory, counting techniques, functions, mathematical induction, permutations, and the proofs of various elementary theorems.

MA-125   Calculus with Analytic Geometry I   **Credits: 4**
Prerequisite(s): MA-109 or MA-115 passed with a grade of C- or higher or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Functions, limits, continuity, and the differential and integral calculus of algebraic, trigonometric, and exponential functions.

MA-126   Calculus with Analytic Geometry II   **Credits: 4**
Prerequisite(s): MA-125 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
Functions, limits, continuity, and the differential and integral calculus of algebraic, trigonometric, exponential functions.

MA-130   Applied Discrete Mathematics   **Credits: 3**
Prerequisite(s): MA-109 or MA-117 passed with a grade of C- or higher or MA-LVL4 passed with a grade of P.
Term Offered: All Terms
Course Type(s): None
Introduction to reasoning, proof, and exposition in mathematics. Topics include: Boolean logic, set theory, counting techniques, functions, mathematical induction, permutations, and the proofs of various elementary theorems.

MA-151   Statistics with Applications   **Credits: 3**
Prerequisite(s): MA-101 or MA-105 passed with a grade of C- or higher or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Analysis of data, probability, random variables, normal distribution, sampling theory, confidence intervals, and statistical inference. Not open to computer science majors or to students required to complete MA-125, except software engineering majors.

MA-198   Special Topics in Mathematics (100 Level)   **Credits: 1-3**
Term Offered: Spring Term
Course Type(s): None
An intensive study of a particular subject or problem in mathematics to be announced prior to registration. The course may be conducted on either a lecture-discussion or a seminar basis. If there is a prerequisite for this course it will be announced in the course schedule.

MA-199   Independent Study in Mathematics   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
Independent study in a topic not substantially treated in a regular mathematics course; for students with superior ability; weekly consultation required. Prior permission of the directing professor and department chair is required to take this course.

MA-203   Foundations of Elementary Mathematics I   **Credits: 3**
Prerequisite(s): MA-050 or MA-LVL2 or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: All Terms
Course Type(s): None
Careful examination of mathematical ideas behind the mathematics taught in grades K-6, their history, and applications to daily life. Intended primarily for future elementary-school teachers to provide them with a better understanding of the mathematics they will teach. This course, along with MA-204, Foundations of Elementary Mathematics II, will also be of value for any student who wants a better understanding of these ideas. Focus on understanding and exploring mathematics through problem solving, projects, group explorations, use of manipulatives, and some use of technology. MA-203 concentrates on problem solving, whole number arithmetic and theory, discrete math, integers, fractions, decimals, and algebraic concepts. MA-203 does not count toward the mathematics major or minor requirements. Students who take MA-203 are not eligible to take MA-205. Prerequisite: MA-050 or MA-LVL2 or MA-LVL3 or MA-LVL4 passed with a grade of P

MA-204   Foundations of Elementary Mathematics II   **Credits: 3**
Prerequisite(s): MA-203 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
Careful examination of mathematical ideas behind the mathematics taught in grades K-6, their history and applications to daily life. Intended primarily for future elementary-school teachers to provide them with a better understanding of the mathematics they will teach. This course, along with MA-203, Foundations of Elementary Mathematics I, will also be of value for any student who wants a better understanding of these ideas. Focus on understanding and exploring mathematics through problem solving, projects, group explorations, use of manipulatives, and some use of technology. Topics in MA-204 include: fractions, ratios and percent, data analysis, counting and probability, geometry of shape, measurement, and measurement geometry (perimeter, area, surface area, volume). MA-204 does not count toward the mathematics major or minor requirements. Students who have taken MA-204 are not eligible to take MA-207.

MA-205   Number Systems   **Credits: 3**
Prerequisite(s): MA-050 or MA-LVL2 or MA-LVL3 or MA-LVL4 passed with a grade of P
Term Offered: Fall Term
Course Type(s): None
Careful examination of mathematical ideas behind the mathematics taught in grades K-6, and their history and applications in daily life. Intended primarily for future elementary school teachers to provide them with a better understanding of the underlying concepts of the mathematics they will teach. MA-205 concentrates on the various number systems of school mathematics: whole numbers, integers, fractions, decimals. It does this by examining, in other number bases, standard algorithms for addition, subtraction, multiplication and division, as well as alternative algorithms in base ten, including student-generated algorithms. The course will focus on developing educators' conceptual understanding and exploring the mathematics through problem solving, projects, group explorations, and use of manipulatives as practices for mathematics instruction. MA-205 does not count towards the mathematics major or minor requirements, except for the mathematics and elementary education major. Students who have taken MA-205 are not eligible to take MA-203.

MA-206   Algebraic Thinking, Probability and Statistics   **Credits: 3**
Prerequisite(s): MA-205 passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): None
Careful examination of mathematical ideas behind the mathematics taught in grades K-6, and their history and applications to daily life. Intended primarily for future elementary school teachers to provide them with a better understanding of the underlying concepts of the mathematics they will teach. MA-206 concentrates on the algebraic thinking, probability and statistics. It develops algebraic thinking by extending concepts from Number Systems (MA-205) via problem-solving, proportional relationships, pattern-recognition, generalization and identities. Probability introduces key concepts from discrete mathematics and applies proportional relationships. Statistics involves systematic organization of data. The course will focus on developing educators' conceptual understanding and exploring the mathematics through problem solving, projects, group explorations, and use of manipulatives as practices for mathematics instruction. MA-206 does not count towards the mathematics major or minor requirements.

MA-207   Elementary Geometry   **Credits: 3**
Prerequisite(s): MA-205 passed with a grade of C- or higher
Term Offered: Fall Term
Course Type(s): None
Careful examination of mathematical ideas behind the mathematics taught in grades K-6, and their history and applications to daily life. Intended primarily for future elementary school teachers to provide them with a better understanding of the mathematics they will teach. This is an activity-centered course. Content will focus on geometric shapes, motions and change, length, area and volume and their measurement. There is an emphasis on understanding a variety of problem solving strategies, conjectures, reasoning, mathematical representations including manipulatives, and communicating. MA-207 does not count toward the mathematics major or minor requirements. Students who take MA-207 are not eligible to take MA-204.

MA-220   Probability and Statistics I   **Credits: 3**
Prerequisite(s): MA-116 or MA-118 or MA-126 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
To provide an axiomatic, calculus-based approach to probability and introductory statistics. The course is built around the process of performing a statistical analysis; posing the question, collecting the data, describing the data, analyzing and modeling the data, and drawing inferences from the data regarding the original question. Specific topics covered include sampling, descriptive analysis of data, probability, random variables, discrete and continuous distributions, expectation, confidence intervals, one sample hypothesis testing, chi-square analyses, correlation and regression.

MA-221   Linear Algebra   **Credits: 3**
Prerequisite(s): MA-120 or MA-130; and MA-125 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
Systems of equations, matrix algebra, linear transformations, Eigenvectors, linear programming, and computational methods.

MA-225   Calculus with Analytic Geometry III   **Credits: 4**
Prerequisite(s): MA-126 passed with a grade of C- or higher
Course Type(s): None
Infinite series, partial differentiation, multiple integration, and associated solid analytic geometry.

MA-237   Programming and Technology in Mathematics   **Credits: 4**
Prerequisite(s): MA-120 and MA-126 both passed with a grade of C- or higher
Co-requisite(s): MA-311 or MA-221 or MA-225
Term Offered: All Terms
Course Type(s): TL
Provides an introduction to the use of technology as it applies to mathematics. A major component of the course will be to build a solid foundation in the skills needed to apply mathematical concepts to programming. In addition, the use of technology in presentations, scholarly searches, and its role and limitations in computer and Internet security will be covered. Students will gain an appreciation of the important ethical and social issues involving the use of technology.

MA-298   Special Topics in Mathematics (200 Level)   **Credits: 1-3**
Term Offered: Spring Term
Course Type(s): None
An intensive study of a particular subject or problem in mathematics to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. If a prerequisite is required it will be announced in the course schedule.

MA-299   Independent Study in Mathematics   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
Independent study in a topic not substantially treated in a regular mathematics course; for students with superior ability; weekly consultation required. Prior permission of the directing professor and department chair is required to take this course.

MA-301   Careers in Mathematics Seminar   **Credits: 1**
Prerequisite(s): MA-220 and MA-221
Term Offered: Fall Term
Course Type(s): None
An orientation to career opportunities and graduate level programs and degrees available to students with a background in mathematics and statistics.

MA-305   Mathematical Problem Solving   **Credits: 3**
Prerequisite(s): MA-205, MA-206, and MA-207 all passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): WT
The final mathematics course in the four- course sequence for future elementary school teachers. Designed to strengthen their mathematical content knowledge, problem solving skills, conceptual understanding and ability to communicate about mathematics, through the investigation of mathematically challenging problems. Problems will require creative thinking and utilization of past content knowledge in new situations. Students will work in groups and individually, and write up their solutions. This course does not count towards the mathematics major or minor requirement.

MA-311   Differential Equations   **Credits: 3**
Prerequisite(s): MA-126 and MA-221 both passed with a grade of C- or higher
Term Offered: Fall Term
Course Type(s): None
Designed to provide students with the fundamentals of differential equations. The topics include elementary methods of solution, nth order linear equations, systems of linear equations, Laplace transform methods, numerical solutions, and initial and boundary value problems.

MA-312   Numerical Analysis   **Credits: 3**
Prerequisite(s): MA-126 and MA-221 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
The main objective of the course is to develop a basic understanding in the construction and analysis of processes used to solve mathematical problems with the aid of a computer. The focus will be on leveraging the mathematical framework to achieve efficient and accurate numerical algorithms. The course also includes exposure to basic programming techniques in the context of implementing several of the algorithms as well as exposure to various applications of mathematics.

MA-314   Number Theory   **Credits: 3**
Prerequisite(s): MA-120 or MA-130 and MA-221 both passed with a grade of C- or higher and EN-101 and EN-102, or permission of the instructor.
Term Offered: All Terms
Course Type(s): RD
Properties of integers, divisibility, prime numbers, congruence, and Diophantine equations.

MA-317   Geometry   **Credits: 3**
Prerequisite(s): MA-120 or MA-130 and either MA-221 or MA-225 passed with a grade of C- or higher.
Term Offered: All Terms
Course Type(s): None
Study of Euclid's axioms, fifth postulate and its substitutes, absolute geometry, projective geometry, constructions, and convexity.

MA-318   Combinatorics and Graph Theory   **Credits: 3**
Prerequisite(s): MA-120 or MA-130 or CS-202 passed with a grade of C- or higher, and MA-221 passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): None
Combinatorics is the study of countable discrete mathematical structures. Graph theory is the study of mathematical structures involving a collection of objects, known as the vertex set, along with a collection of pairs of vertices, known as the edge set. These two inseparable areas of mathematics are ripe with beautiful theory and endless applications. Students will learn the techniques required to answer questions in these fields, as well as appropriate applications.

MA-320   Probability and Statistics II   **Credits: 3**
Prerequisite(s): MA-116 or MA-118 or MA-126 passed with a grade of C- or higher, MA-151 or BE-251 or MA-220 passed with a grade of C- or higher, EN-101 and EN-102
Term Offered: Spring Term
Course Type(s): WT
A continuation of MA-220, including sample distributions, exploratory data analysis, estimation methods, regression and correlation, as well as applications to quality control.

MA-321   Statistical Consulting   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
Gives students a working knowledge of statistical consulting in the world outside of the classroom by working with real clients. Students will interview clients, translate client needs into statistical language, design statistical experiments, generate data collection plans, assist in data collection, analyze data, interpret their analyses, and present their finding to the client. Throughout the process students will interact with their clients regarding ongoing questions that occur. By the end of the course, students will be able to choose and apply appropriate statistical design and analysis methodologies. They will also be able to interpret, evaluate, and present their conclusions in oral and written form. Topics covered will depend upon client needs and may include designing experiments with power and sample size considerations, multiple and logistic regression, survival analyses, t- and chi-square tests, ANOVA/MANOVA/ANCOVA, and principal component analysis. This course may be repeated once for additional credit to either continue work on a long-term project, or to take part in a new statistical consulting project.

MA-325   History of Mathematics   **Credits: 3**
Prerequisite(s): MA-314 or MA-317 or MA-318 passed with a grade of C- or higher, and EN-101 and EN-102
Term Offered: Spring Term
Course Type(s): GU, WT
Surveys historical milestones in the development of mathematics from ancient times to the Nineteenth century, with modern topics as time permits.

MA-327   Design and Analysis of Biological Experiments   **Credits: 3**
Prerequisite(s): MA-151 or MA-220 or BE-251 passed with a grade of C or higher or permission of the instructors.
Term Offered: Spring Term
Course Type(s): MEBP
The purpose of this course is to learn about the statistical design & analysis of biological experiments. After learning mathematical techniques of designing experiments, and statistical analyses customized to them, students will be presented with a broad research question by the instructors. Literature surveys will be a critical part of the course to allow students to find pertinent, relevant, potentially publishable biological questions that address a specific aspect of the larger question posed by the instructors. Students will design their own experiment addressing their question, generate their own data collection plan, collect their data, and then analyze their data using statistical techniques taught in class. This course will involve field/lab work for data collection and computer work in the statistical analysis of the final data. Students will defend their question, design and analysis from both a statistical and biological perspective. At the end of the semester students will complete a formal manuscript in journal format. This course can be used to fulfill the Mathematics or Statistics minor and the Bio/MEBP elective. This course is a research based course and students must have demonstrated a strong interest in and potential for research. Also listed as BY-327.

MA-334   Problem Solving Seminar   **Credits: 3**
Prerequisite(s): MA-120 or MA-130; and MA-126 all passed with a minimum grade of C- or higher, and permission of the instructor
Course Type(s): None
Problem solving techniques and the ability to use them in applications lie at the core of learning and applying mathematics. The course covers important strategies for solving mathematical problems, most of which are only tangentially studied in the usual mathematics curriculum. The strategies are an assortment of both overarching themes and particular techniques of more limited applicability. Each strategy is covered in a theoretical context followed by implementation to specific problems. Polya's classic framework for the problem solving processes will be referenced and used throughout the course. This course is repeatable for credit.

MA-350   Computation and Statistics   **Credits: 3**
Prerequisite(s): MA-116 or MA-118 or MA-126 passed with a grade of C- or higher, and either MA-151 or BE-251 or MA-220 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
Covers topics related to computational statistics, including obtaining large, realistic, real-time datasets, calculation and visualization of basic statistical features, regression, empirical distributions, and time-series features. Also covered will be principal components analysis (PCA), analysis of variance (ANOVA), correlation, prediction, and stochastic volatility estimation (GARCH). Portfolio theory will also be covered.

MA-380   Research in Mathematics   **Credits: 1-3**
Term Offered: All Terms
Course Type(s): None
Mathematical or statistical research work carried out under the mentorship of a faculty research advisor. Research conducted by the students will be submitted for presentation, publication or review. The number of credits will be determined by arrangement with the advisor. Three hours/week per credit. This class is repeatable up to six credits total.

MA-388   Cooperative Education: Mathematics   **Credits: 3**
Prerequisite(s): MA-311 and MA-220, both passed with a grade of C- or higher if a Mathematics major; or MA-120 and MA-126, both passed with a grade of C- or higher if other major, a cumulative G.P.A. of 2.00 and Junior or Senior standing
Term Offered: Spring Term
Course Type(s): EX2
Affords the student an opportunity to apply mathematical theory to practical work-related experience. Includes both academic and experiential components. Involves ten hours per week of work experience. The academic aspect includes a reflective journal and a written report; repeatable for credit.

MA-389   Internship in Mathematics   **Credits: 1-3**
Course Type(s): EX1
Supervised practical experience in math; repeatable for credit. Student must have at least Junior status. Departmental approval is required to take this course.

MA-398   Special Topics in Mathematics (300 Level)   **Credits: 1-3**
Term Offered: Spring Term
Course Type(s): None
An intensive study of a particular subject or problem in mathematics to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. If a prerequisite is required it will be announced in the course schedule.

MA-399   Independent Study in Mathematics   **Credits: 3**
Term Offered: All Terms
Course Type(s): None
Independent study in a topic not substantially treated in a regular mathematics course; for students with superior ability; weekly consultation required. If a prerequisite is required it will be announced in the course schedule.

MA-407   Topology   **Credits: 3**
Prerequisite(s): MA-221 and MA-225, both passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): None
Topology is the study of the structure of space and is one of the major theoretical areas in modern mathematics. The course serves as both a rigorous foundation for advanced study in the field and as a survey of important techniques established since its inception. After building the necessary framework of point-set topology, the course will move on to selected topics such as the classification of surfaces, knot theory, and algebraic topology.

MA-410   Modern Algebra   **Credits: 3**
Prerequisite(s): MA-221, and either MA-314 or MA-317 or MA-318 or MA-407 passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): None
Beginning with the natural numbers, the integers and rational numbers are developed. Complex numbers and roots of unity are followed by groups, rings, and polynomials.

MA-411   Group Theory   Credits: 3
Prerequisite(s): MA-221, and MA-314 or MA-317 or MA-318 or MA-407, both passed with a grade of C- or higher
Course Type(s): None
Group Theory is the study of symmetry, and is one of the core branches of abstract algebra. The course will explore the theory and applications of groups. In addition to covering many examples of groups, course topics will include subgroups, group homomorphisms and isomorphisms, permutations, quotient groups, Sylow Theorems, and the structure of finitely generated abelian groups.

MA-413   Complex Analysis   Credits: 3
Prerequisite(s): MA-225 and either MA-314 or MA-317 or MA-318 or MA-407 passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): None
Complex numbers and plane, functions, derivatives, line integrals, and Cauchy integral theorem. Cauchy's formula, series, applications.

MA-415   Real Analysis   Credits: 3
Prerequisite(s): MA-225 and either MA-314 or MA-317 or MA-318 or MA-407 passed with a grade of C- or higher and EN-101 and EN-102, or permission of the instructor
Term Offered: All Terms
Course Type(s): WT
Metric spaces, real number system, limits, functions, continuity, differentiation and integration, and counter-examples.

MA-419   Introduction to Mathematical Modeling   Credits: 3
Prerequisite(s): MA-220, MA-311, MA-221 all passed with a grade of C- or higher; Junior standing, and EN-101 and EN-102, or permission of the instructor
Term Offered: Spring Term
Course Type(s): EX5, WT
Introduction to mathematical modeling, which is a process in which a real-world situation is studied, simplified, and abstracted to the point that mathematical tools can be applied to gain understanding. Introduction to the process, first via a text and mini-projects, then in teams investigating problems from local industries or organizations.

MA-421   Design of Experiments and ANOVA   Credits: 3
Prerequisite(s): MA-116 or MA-118 or MA-126 passed with a grade of C- or higher and either MA-151 or BE-251 or MA-220 passed with a grade of C- or higher
Term Offered: Fall Term
Course Type(s): None
Provides a working knowledge of multivariate regression and ANOVA methods balanced with the theory underlying these techniques. Intended for students considering a career in statistics, including but not limited to biostatistics, financial mathematics and theoretical statistics. Topics include: an introduction to experimental design, power and effect size calculations, data screening and transformation to meet assumptions of the analyses, multivariate regression, multinomial logistic regression, multivariate survival analysis, ANOVA/ANCOVA/MANOVA/MANCOVA, and time permitting, an introduction to time series analysis. Extensive use is made of real- world case data from business/finance, health/biology, and education/psychology.

MA-440   Regression and Time Series Analysis   Credits: 3
Prerequisite(s): MA-116 or MA-118 or MA-126 passed with a grade of C- or higher and either MA-151 or MA-220 or BE-251 passed with a grade of C- or higher
Term Offered: All Terms
Course Type(s): None
Covers topics related to multiple regression techniques, including testing the assumptions required for each to be valid. This includes applications to yield curve smoothing, pricing, and investment models, and the use of principal component analysis. Also covered are techniques for the analysis and modeling of time series data and forecasting.

MA-460   Multivariate and Categorical Statistics   Credits: 3
Prerequisite(s): MA-116 or MA-118 or MA-126 passed with a grade of C- or higher and MA-151 or MA-220 or BE-251 passed with a grade of C- or higher
Term Offered: Spring Term
Course Type(s): None
This advanced statistics course provides students with skills in advanced multivariate analysis and its applications. Students will learn the material through projects using data from business, finance, and biology. Topics include MANOVA, discriminant analysis, cluster analysis, multidimensional scaling, and factor analysis. Topics may also include conjoint analysis, canonical correlation and structural equation modeling.

MA-488   Cooperative Education: Mathematics   Credits: 3
Prerequisite(s): MA-220 and MA-311 passed with a grade of C- or higher if a Math major
Term Offered: Spring Term
Course Type(s): EX2
Affords the student an opportunity to apply mathematical theory to practical work-related experience. Includes both academic and experiential components. Involves ten hours per week of work experience. The academic aspect includes a reflective journal and a written report; repeatable for credit. Departmental approval is required to take this course. MA-311 and MA-320, both passed with a grade of C- or higher are required, if a mathematics major; or MA-120 and MA-126, passed with a grade of C- or higher, if another major; a cumulative GPA of 2.00 and Junior or Senior standing.

MA-489   Internship in Mathematics   Credits: 1-3
Course Type(s): EX1
Supervised practical experience in math; repeatable for credit. Departmental approval and Junior standing are required to take this course.

MA-498   Special Topics in Mathematics (400 Level)   Credits: 1-3
Prerequisite(s): MA-126 and MA-221 both passed with a grade of C- or higher and Junior standing
Term Offered: Spring Term
Course Type(s): None
An intensive study of a particular subject or problem in mathematics to be announced prior to registration. May be conducted on either a lecture-discussion or a seminar basis. If a prerequisite is required it will be announced in the course schedule.

MA-499   Independent Study in Mathematics   Credits: 3
Term Offered: All Terms
Course Type(s): None
Independent study in a topic not substantially treated in a regular mathematics course; for students with superior ability; weekly consultation required. Prior permission of the directing professor and department chair is required to take this course.