# Mathematics & Statistics - MAT

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Description</th>
<th>Prerequisite</th>
<th>Offered</th>
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<tbody>
<tr>
<td>MAT 105</td>
<td>Finite Mathematics</td>
<td>3</td>
<td>Introduction to finite (non-calculus) mathematics and its applications: linear, quadratic, exponential and logarithmic functions and equations; systems of linear equations and linear programming; compound interest problems and annuities.</td>
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<td>Fulfills College Core: Field 7 (Mathematical Sciences)</td>
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<td>every fall &amp; spring.</td>
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<tr>
<td>MAT 106</td>
<td>Calculus for the Non-Sciences</td>
<td>3</td>
<td>Fundamentals of calculus for students in business, or social or behavioral sciences. Credit not allowed if student already has credit for MAT 109 &amp; MAT 110; or MAT 111 or MAT 115.</td>
<td>Minimum grade of C- in MAT 109 or MAT 110.</td>
<td>every fall, spring, &amp; summer.</td>
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<tr>
<td>MAT 108</td>
<td>Precalculus for Sciences</td>
<td>3</td>
<td>Polynomials and rational, exponential, logarithmic, and trigonometric functions. Solving equations. Graphing functions. Trigonometric identities. Credit not allowed if student already has credit for MAT 109, MAT 111, or MAT 115.</td>
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<td>MAT 109</td>
<td>Calculus with Review I</td>
<td>4</td>
<td>For science and mathematics majors. Calculus, with topics from pre-calculus. Logarithmic and exponential functions, trigonometric functions, limits, differentiation. Credit not allowed if student already has credit for MAT 110 or MAT 115.</td>
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<td>MAT 110</td>
<td>Calculus with Review II</td>
<td>4</td>
<td>Continuation of MAT 109. Differentiation, related rates, optimization problems, anti-differentiation, definite integral. Credit not allowed if student already has credit for MAT 111 or MAT 115.</td>
<td>Prerequisite: MAT 109</td>
<td>fall &amp; spring.</td>
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<td>MAT 111</td>
<td>Calculus I</td>
<td>4</td>
<td>For science and mathematics majors. Calculus of functions of single variable. Functions, limits, differentiation, continuity, graphing, logarithm, exponential and inverse trigonometric functions, related rates, optimization problems, mean value theorem, l'Hospital's rule, anti-differentiation, definite integral. Credit not allowed if student already has credit for MAT 109 and MAT 110 or for MAT 115.</td>
<td>Prerequisite: MAT 109</td>
<td>fall &amp; spring.</td>
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<td>MAT 112</td>
<td>Calculus II</td>
<td>4</td>
<td>Applications of integration, integration techniques, improper integrals, sequences, series, convergence tests, Taylor's series, applications; parametric and polar curves.</td>
<td>Prerequisite: minimum grade of C- in one of the following MAT 109 &amp; MAT 110, MAT 111 or MAT 115.</td>
<td>fall &amp; spring.</td>
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<td>MAT 115</td>
<td>Calculus for Business</td>
<td>4</td>
<td>Calculus for business students. Differentiation and integration of functions of one variable. Applications, concepts, examples and problems in economics and business. Credit not allowed if student already has credit for either MAT 109 and MAT 110 or for MAT 111.</td>
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<td>MAT 121</td>
<td>Mathematics through History</td>
<td>3</td>
<td>Liberal arts mathematics course. Tracing the development of mathematical ideas globally and through history, with emphasis on problem solving techniques, quantitative thinking, and deductive reasoning.</td>
<td>3 1/2 years of high school mathematics.</td>
<td>fall &amp; spring.</td>
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<td>Fulfills College Core: Field 7 (Mathematical Sciences), Global Awareness</td>
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<td>MAT 131</td>
<td>Statistics for Social Sciences</td>
<td>3</td>
<td>A first course for majors in social or health sciences. Descriptive statistics, calculators, computer programs and introduction to inferential statistics. Credit not allowed if student already has credit for MAT 141 or MAT 351.</td>
<td>Prerequisite: 3 years of high school mathematics or equivalent.</td>
<td>once a year.</td>
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<td>MAT 141</td>
<td>Inferential Statistics and Computers for Science</td>
<td>4</td>
<td>Elementary probability theory, descriptive statistics, hypothesis testing, estimation, correlation and regression. The computer will be used with one of the standard statistical packages. Credit not allowed if student already has credit for MAT 131 or MAT 351.</td>
<td>Prerequisite: 3 1/2 years of high school mathematics.</td>
<td>fall &amp; spring.</td>
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<td>MAT 150</td>
<td>Mathematics and Politics</td>
<td>3</td>
<td>Liberal arts course emphasizing applications of math in the social sciences. Covers topics such as voting theory, decisions made by groups, measurement of political power.</td>
<td>3 years of high school mathematics or equivalent.</td>
<td>fall &amp; spring.</td>
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<td>Fulfills College Core: Field 7 (Mathematical Sciences), Justice</td>
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<td>MAT 161</td>
<td>Mathematics for Elementary Teachers</td>
<td>3</td>
<td>Designed to provide a solid foundation for the mathematical topics encountered in elementary schools. The primary goal is to develop a deep understanding of mathematical concepts so future teachers can teach with knowledge and confidence. The main topics are: problem solving processes and strategies, elementary set theory, the theory behind basic arithmetic, number systems, basic probability and statistics, elementary geometry.</td>
<td>Prerequisite: 3 years of high school mathematics or equivalent.</td>
<td>fall &amp; spring.</td>
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<td>MAT 191</td>
<td>Introduction to Discrete Mathematics</td>
<td>4</td>
<td>Fundamental topics with computer science applications. Sets and logic, propositional and predicate calculus, elements of combinatorics and counting, elementary discrete probability, functions and relations, and graphs.</td>
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<td>fall.</td>
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<td>MAT 211</td>
<td>Calculus III</td>
<td>4</td>
<td>Continuation of MAT 111 and MAT 112. Analytic geometry of 3-dimensional space and calculus of functions of several variables.</td>
<td>Prerequisite: minimum grade of C- in MAT 112.</td>
<td>fall &amp; spring.</td>
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### MAT 219 Linear Algebra
- **Offered:** spring.
- **Prerequisite:** MAT 112 or permission of instructor.
- **Credit:** 4
- **Description:** Vector spaces and inner product spaces. Linear transformations and matrices. Eigenvectors, eigenvalues, and applications. Orthogonal transformations. Quadratic forms and quadric surfaces.

### MAT 222 Differential Equations
- **Offered:** spring.
- **Prerequisite:** minimum grade of C- in MAT 211 or passing grade in MAT112 with permission of instructor.
- **Credit:** 3
- **Description:** Introduction to the theory and applications of ordinary differential equations.

### MAT 230 Logic, Set Theory, and Proofs
- **Offered:** fall.
- **Prerequisite:** MAT 111 & MAT 112.
- **Credit:** 4
- **Description:** Transition from calculus to upper division courses: logic and methods of proof; set theory; relations, orders and functions; number systems; cardinality.

### MAT 301 History of Mathematics
- **Offered:** occasionally.
- **Prerequisite:** minimum grade of C- in MAT 112 or permission of instructor.
- **Credit:** 3
- **Description:** Development and interrelations of major areas of mathematics, from ancient to modern times. Emphasis on both historical context and mathematical content. Mathematics as cultural heritage.

### MAT 311 Abstract Algebra
- **Offered:** fall.
- **Prerequisite:** minimum grade of C- in both MAT 219 and MAT 230.
- **Credit:** 4
- **Description:** Continuation of MAT 311. Selected topics from groups, rings, integral domains, field extensions and Galois theory.

### MAT 312 Topics in Algebra
- **Offered:** occasionally.
- **Prerequisite:** MAT 311.
- **Credit:** 3
- **Description:** Continuation of MAT 311. Selected topics from groups, rings, integral domains, field extensions and Galois theory.

### MAT 313 Number Theory
- **Offered:** spring of odd-numbered years.
- **Prerequisite:** MAT 311 or permission of instructor.
- **Credit:** 3
- **Description:** Divisibility, prime numbers, numerical functions, congruencies, quadratic reciprocity, Diophantine equations.

### MAT 319 Linear Algebra
- **Offered:** spring.
- **Prerequisite:** minimum grade of C- in MAT 211, MAT 219 & MAT 230.
- **Credit:** 4
- **Description:** Advanced study of limits, continuity, differentiation and integration of functions.

### MAT 322 Topics in Analysis
- **Offered:** occasionally.
- **Prerequisite:** minimum grade of C- in MAT 321.
- **Credit:** 3
- **Description:** Continuation of MAT 321. Selected topics from functions of one or several variables.

### MAT 323 Real Analysis
- **Offered:** fall.
- **Prerequisite:** minimum grade of C- in MAT 211, MAT 219 & MAT 230.
- **Credit:** 4
- **Description:** Advanced study of limits, continuity, differentiation and integration of functions.

### MAT 324 Linear Algebra
- **Offered:** spring of even-numbered years.
- **Prerequisite:** MAT 111 or MAT 115.
- **Credit:** 3
- **Description:** Continuation of MAT 311. Selected topics from groups, rings, integral domains, field extensions and Galois theory.

### MAT 330 Introduction to Probability
- **Offered:** spring.
- **Prerequisite:** MAT 211.
- **Credit:** 3
- **Description:** Introduction to the mathematical aspects of modern probability theory and the theory of statistics.

### MAT 331 Geometry
- **Offered:** fall of even-numbered years.
- **Prerequisite:** MAT 230.
- **Credit:** 3
- **Description:** Axioms for geometry and their consequences: independence of the parallel postulate. Rudiments of hyperbolic geometry. Geometric transformations.

### MAT 332 Topology
- **Offered:** occasionally.
- **Prerequisite:** MAT 311.
- **Credit:** 3
- **Description:** Continuation of MAT 311. Selected topics from groups, rings, integral domains, field extensions and Galois theory.

### MAT 333 Complex Variables
- **Offered:** occasionally.
- **Prerequisite:** MAT 311.
- **Credit:** 3
- **Description:** Continuation of MAT 311. Selected topics from groups, rings, integral domains, field extensions and Galois theory.

### MAT 334 Numerical Analysis
- **Offered:** spring.
- **Prerequisite:** MAT 211.
- **Credit:** 3
- **Description:** The methods used to obtain numerical solutions of functional and differential equations. Polynomial interpolation. Various approximation algorithms.

### MAT 341 Numerical Analysis
- **Offered:** occasionally.
- **Prerequisite:** MAT 219.
- **Credit:** 3
- **Description:** The methods used to obtain numerical solutions of functional and differential equations. Polynomial interpolation. Various approximation algorithms.

### MAT 342 Graph Theory
- **Offered:** spring of even-numbered years.
- **Prerequisite:** MAT 311 & MAT 352, or permission of instructor.
- **Credit:** 3
- **Description:** Continuation of MAT 311. Selected topics from graphs, trees, cycles, and more general graphs are studied along with their combinatorial properties. Euler circuits, Hamilton circuits, spanning trees. Applications of graphs to optimization problems such as the Traveling Salesperson Problem and Construction of the Minimal Spanning Trees.

### MAT 343 Combinatorial Optimization
- **Offered:** occasionally.
- **Prerequisite:** MAT 311.
- **Credit:** 3
- **Description:** Continuation of MAT 311. Selected topics from graphs, trees, cycles, and more general graphs are studied along with their combinatorial properties. Euler circuits, Hamilton circuits, spanning trees. Applications of graphs to optimization problems such as the Traveling Salesperson Problem and Construction of the Minimal Spanning Trees.

### MAT 344 Experimental Design and Statistical Computing
- **Offered:** occasionally.
- **Prerequisite:** MAT 351 & MAT 352, or permission of instructor.
- **Credit:** 3
- **Description:** Statistical computing package; Monte-Carlo simulation-subset selection, analyzing data; one-way/two-way blocking; chi-square, goodness of fit.

### MAT 345 Climate and Sustainability
- **Offered:** occasionally.
- **Prerequisite:** MAT 111 or equivalent.
- **Credit:** 3
- **Description:** This course, for majors from all the sciences, develops the use of conceptual models in understanding complicated situations, while illustrating the role of scientific arguments in societal debates about climate change and sustainability. Topics include: the Earth's energy balance, historical data for ocean and atmosphere and temperature and their circulation and oscillation patterns, the carbon cycle and biological systems, and handling large data. The increasingly sophisticated examples explored in the course will introduce the use of various areas of mathematics: linear models and networks, calculus-based dynamical systems, statistics and data assessment, and analysis of periodic phenomena. Students will learn about these topics by seeing simple examples of their use. The last part of the course will center on sustainability issues, and connections to global awareness, diversity, ethics, and justice.

### MAT 351 Probability & Statistics I
- **Offered:** spring.
- **Prerequisite:** MAT 211.
- **Credit:** 3
- **Description:** Continuation of MAT 351. Introduction to the mathematical aspects of modern probability theory and the theory of statistics.

### MAT 352 Probability & Statistics II
- **Offered:** fall.
- **Prerequisite:** MAT 211.
- **Credit:** 3
- **Description:** Continuation of MAT 351. Introduction to the mathematical aspects of modern probability theory and the theory of statistics.

### MAT 353 Regression Analysis
- **Offered:** fall of odd-numbered years.
- **Prerequisite:** MAT 351 & MAT 352, or permission of instructor.
- **Credit:** 3
- **Description:** Linear regression and correlation. Covariance, residual sum of squares, residual variance, correlation coefficient, tests of significance for correlation coefficient and for regression coefficients. Non-linear regression.

### MAT 354 Experimental Design and Statistical Computing
- **Offered:** spring of odd-numbered years.
- **Prerequisite:** MAT 351 & MAT 352, or permission of instructor.
- **Credit:** 3
- **Description:** Analyzing data; one-way/two-way blocking; chi-square, goodness of fit. Statistical computing package; Monte-Carlo simulation-subset selection, central limit theorem; residual plots.
MAT 361 Probability for Actuaries
1 Credit
This course prepares students to take Exam P of the Society of Actuaries or Exam 1 from the Casualty Actuary Society. Key probability concepts are reviewed and students learn to apply these tools to problems encountered by actuaries. The course will develop a thorough command of calculus and probability topics. Additionally, a very basic knowledge of insurance and risk management is introduced.
Prerequisite: MAT 211 & MAT 351. Corequisite: MAT 352 or permission of instructor.
Offered: fall.

MAT 362 Financial Mathematics for Actuaries
1 Credit
This course prepares students to take Exam FM of the Society of Actuaries or Exam 2 from the Casualty Actuary Society. It covers interest theory (discrete and continuous) and an introduction to derivative securities.
Prerequisite: MAT 111 & MAT 112 or permission of instructor.
Offered: spring.

MAT 380 Mathematics Seminar
1 Credit
Mathematics seminar for majors. To be taken for three semesters.
Prerequisite: junior standing.
Offered: fall & spring.

MAT 381 Mathematics Seminar
1 Credit
Mathematics seminar for majors. To be taken for three semesters.
Prerequisite: junior standing.
Offered: fall & spring.

MAT 411 Topology
3 Credits
An introduction to topology, stressing concrete examples including surfaces. Point-set, geometric and algebraic topology with interconnections and applications.
Prerequisite: MAT 230.
Offered: occasionally.

MAT 421 Complex Analysis
3 Credits
Prerequisites: MAT 321 or PHY 335.
Offered: spring of even-numbered years.

MAT 480 Mathematics Seminar
1 Credit
Mathematics seminar for majors. To be taken for three semesters.
Prerequisite: junior standing.
Fulfills College Core: Oral Communication
Offered: fall & spring.

MAT 498 Internship in Mathematics
1-3 Credits
Internship involving non-routine tasks linking academic concepts to practical experience. May be used for free elective credit only. Internships require an application and approval by the associate dean.
Prerequisite: permission of the chair & associate dean.
Offered: occasionally.

MAT 499 Independent Study
1-4 Credits
Study and work with a faculty supervisor. Project to be determined by faculty agreement. Independent studies require an application and approval by the associate dean.
Prerequisite: permission of the instructor, department chair, & associate dean.
Offered: occasionally.