# Mathematics & Statistics - MAT

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
<th>Prerequisites</th>
</tr>
</thead>
<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>
</tr>
<tr>
<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 109 &amp; MAT 110; or MAT 111 or MAT 115.</td>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<td>MAT 141</td>
<td>Inferential Statistics and Computers for Science</td>
<td>3 1/2</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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
<tr>
<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>
</tr>
</tbody>
</table>

### Offered:
- MAT 105: every fall & spring.
- MAT 106: occasionally.
- MAT 109: every fall, spring, & summer.
- MAT 110: occasionally.
- MAT 112: every fall.
- MAT 115: every fall & spring.
- MAT 116: occasionally.
- MAT 117: occasionally.
- MAT 118: occasionally.
- MAT 120: occasionally.
- MAT 121: occasionally.
- MAT 131: occasionally.
- MAT 141: occasionally.
- MAT 150: occasionally.
- MAT 151: occasionally.
- MAT 152: occasionally.
- MAT 153: occasionally.
- MAT 154: occasionally.
- MAT 155: occasionally.
- MAT 156: occasionally.
- MAT 157: occasionally.
- MAT 158: occasionally.
- MAT 159: occasionally.
- MAT 160: occasionally.
- MAT 161: occasionally.
- MAT 162: occasionally.
- MAT 163: occasionally.
- MAT 164: occasionally.
- MAT 165: occasionally.
- MAT 166: occasionally.
- MAT 167: occasionally.
- MAT 168: occasionally.
- MAT 169: occasionally.
- MAT 170: occasionally.
- MAT 171: occasionally.
- MAT 172: occasionally.
- MAT 173: occasionally.
- MAT 174: occasionally.
- MAT 175: occasionally.
- MAT 176: occasionally.
- MAT 177: occasionally.
- MAT 178: occasionally.
- MAT 179: occasionally.
- MAT 180: occasionally.
- MAT 181: occasionally.
- MAT 182: occasionally.
- MAT 183: occasionally.
- MAT 184: occasionally.
- MAT 185: occasionally.
- MAT 186: occasionally.
- MAT 187: occasionally.
- MAT 188: occasionally.
- MAT 189: occasionally.
- MAT 190: occasionally.
- MAT 191: occasionally.
- MAT 192: occasionally.
- MAT 193: occasionally.
- MAT 194: occasionally.
- MAT 195: occasionally.
- MAT 196: occasionally.
- MAT 197: occasionally.
- MAT 198: occasionally.
- MAT 199: occasionally.
MAT 222 Differential Equations 3 Credits
Introduction to the theory and applications of ordinary differential equations.
Prerequisite: minimum grade of C- in MAT 211; or passing grade in MAT112 with permission of instructor.
Offered: spring.

MAT 230 Logic, Set Theory, and Proofs 4 Credits
Transition from calculus to upper division courses: logic and methods of proof; set theory; relations, orders and functions; number systems; cardinality.
Prerequisite: minimum grade of C- in MAT 112 or permission of instructor.
Offered: fall.

MAT 301 History of Mathematics 3 Credits
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.
Prerequisite: MAT 111 & MAT 112.
Offered: occasionally.

MAT 311 Abstract Algebra 4 Credits
Introduction to the basic structures of abstract algebra; groups, rings, fields.
Prerequisite: minimum grade of C- in both MAT 219 and MAT 230.
Offered: fall.

MAT 312 Topics in Algebra 3 Credits
Continuation of MAT 311. Selected topics from groups, rings, integral domains, field extensions and Galois theory.
Prerequisite: MAT 311.
Offered: spring of odd-numbered years.

MAT 321 Real Analysis 4 Credits
Advanced study of limits, continuity, differentiation and integration of functions.
Prerequisite: minimum grade of C- in MAT 211, MAT 219 & MAT 230.
Offered: fall.

MAT 331 Geometry 3 Credits
Prerequisite: MAT 230.
Offered: fall of even-numbered years.

MAT 341 Numerical Analysis 3 Credits
Prerequisite: MAT 219.
Offered: spring of even-numbered years.

MAT 342 Graph Theory 3 Credits
This course covers basic constructions on graphs. Complete graphs, bipartite 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.
Prerequisite: MAT 111 or MAT 115.
Offered: fall of odd-numbered years.

MAT 345 Climate and Sustainability 3 Credits
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.
Prerequisite: MAT 111 or equivalent. Restriction: seniors only.
Fulfills College Core: Core Capstone
Offered: occasionally.

MAT 351 Probability & Statistics I 3 Credits
Introduction to the mathematical aspects of modern probability theory and the theory of statistics.
Prerequisite: MAT 211.
Offered: spring.

MAT 352 Probability & Statistics II 3 Credits
Continuation of MAT 351. Introduction to the mathematical aspects of modern probability theory and the theory of statistics.
Prerequisite: MAT 351.
Offered: fall.

MAT 353 Regression Analysis 3 Credits
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.
Prerequisite: MAT 351 & MAT 352, or permission of instructor.
Offered: spring of odd-numbered years.

MAT 354 Experimental Design and Statistical Computing 3 Credits
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.
Prerequisite: MAT 351 & MAT 352, or permission of instructor.
Offered: spring of even-numbered years.

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: occasionally.

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: occasionally.

MAT 380 Mathematics Seminar 1 Credit
Mathematics seminar for majors. To be taken for three semesters.
Prerequisite: junior standing.
Offered: fall & spring.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Description</th>
<th>Prerequisites</th>
<th>Offered</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAT 381</td>
<td>Mathematics Seminar</td>
<td>1</td>
<td>Mathematics seminar for majors. To be taken for three semesters. Prerequisite: junior standing.</td>
<td></td>
<td>fall &amp; spring</td>
</tr>
<tr>
<td>MAT 421</td>
<td>Complex Analysis</td>
<td>3</td>
<td>Complex numbers, analytic functions and mappings. Cauchy-Riemann equations, harmonic functions, Cauchy's theorem, integral formula and inequalities. Power series, residues, singularities and zeros, Rouche's Theorem.</td>
<td>Prerequisites: MAT 321 or PHY 335.</td>
<td>spring of even-numbered years</td>
</tr>
<tr>
<td>MAT 480</td>
<td>Mathematics Seminar</td>
<td>1</td>
<td>Mathematics seminar for majors. To be taken for three semesters. Prerequisite: junior standing. Fulfills College Core: Oral Communication</td>
<td></td>
<td>fall &amp; spring</td>
</tr>
<tr>
<td>MAT 498</td>
<td>Internship in Mathematics</td>
<td>1-3</td>
<td>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.</td>
<td>Prerequisite: permission of the chair &amp; associate dean.</td>
<td>occasionally</td>
</tr>
<tr>
<td>MAT 499</td>
<td>Independent Study</td>
<td>1-4</td>
<td>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.</td>
<td>Prerequisite: permission of the instructor, department chair, &amp; associate dean</td>
<td>occasionally</td>
</tr>
</tbody>
</table>