BACHELOR OF SCIENCE IN MATHEMATICS OR BACHELOR OF ARTS IN MATHEMATICS

Program Director: Byung-Jay Kahng, PhD (kahngb@canisius.edu)

Introduction

The Department of Mathematics and Statistics strives to transmit an understanding and appreciation of mathematics: its substance, its applicability, its literature, its current directions and problems, its historical development, its human worth and values; and to promote the development of skill in the practice of mathematics.

Qualifications

Students must maintain a 2.0 GPA in their major and a 2.0 overall average to graduate with a degree in Mathematics and Statistics.

Advisement

All students should have an advisor in the major and should contact the department directly to have an advisor assigned if they do not already have one. Meetings with academic advisors are required prior to students receiving their PIN for course registration each semester. All majors should work closely with their advisor in discussing career expectations, choosing their major electives, developing their entire academic program and planning their co-curricular or supplemental academic experiences.

Double Majors

Students who wish to expand their educational opportunities may decide to declare a double major. This decision may be based on career goals, planned graduate studies, and/or other student interests. Before a student declares a double major, it is important to meet with the appropriate academic departments for advisement. In order to declare a double major, the student must complete the Major/Minor Declaration form. This form will be submitted electronically and reviewed and approved by each department chairperson as well as the appropriate associate dean.

Per university policy, each additional major requires a minimum of 15 credits that do not apply to the student's first or subsequent major. Some double major combinations can be completed within the minimum 120 credit hour degree requirement, but in other cases, additional coursework may be required. Please note that students will only receive **one** degree unless completing the dual degree (https://catalog.canisius.edu/undergraduate/academics/curricular-information/) requirement, including at least 150 undergraduate credit hours, regardless of the number of majors they complete. Both (all) majors appear on a student's transcript.

Popular double majors with Mathematics are Economics, Computer Science, Education, and Physics, but there have been also mathematics students double major in Philosophy, Psychology, Music, English, Spanish, Political science, Pre-medicine, and other fields.

Minors in Other Disciplines

Minors provide students the opportunity to pursue additional interests but generally do not require as many courses as a major. Minors generally range from five to eight required courses. To receive a minor, the student must complete at least 9 credit hours of coursework distinct from their other credentials (i.e., majors, other minors). The complete list of minors is available on the Canisius website (https://www.canisius.edu/academics/programs/undergraduate/?type%5B%5D=17) and in the catalog (https://catalog.canisius.edu/undergraduate/minors/) and provides links to each minor. Some majors and minors can be completed within the minimum 120 credit hour degree requirement, but in some cases additional coursework may be required. Students must complete the appropriate minor request form.

Curriculum

Please note that students who matriculated in Fall 2022 or before were enrolled in the BA degree, students matriculating in Fall 2023 or later will be enrolled in the BS degree. Students may change to to the BS degree by submitting a change of major form.

An Ignatian Foundation

All undergraduate students must complete either the Canisius Core Curriculum (http://catalog.canisius.edu/undergraduate/academics/curricular-information/core-curriculum/) or the All-College Honors Curriculum (http://catalog.canisius.edu/undergraduate/academics/curricular-information/all-college-honors-program/). Many schools refer to their college-wide undergraduate requirements as "general education" requirements. We believe that the core curriculum and the honors curriculum are more than a series of required classes; they provide the basis for a Jesuit education both with content and with required knowledge and skills attributes that are central to our mission.

Free Electives

Students may graduate with a bachelor's degree with more but not less than 120 credit hours. Free electives are courses in addition to the Canisius Core Curriculum or All-College Honors Curriculum and major requirements sufficient to reach the minimum number of credits required for graduation. The number of credits required to complete a bachelor's degree may vary depending on the student's major(s) and minor(s).

Major Requirements

Bachelor of Science in Mathematics

MATHEMATICS MAJOR

Code	Title	Credits
MAT 111	Calculus I	4
MAT 112	Calculus II	4
MAT 211	Calculus III [1]	4
MAT 219	Linear Algebra [1]	4
MAT 222	Differential Equations	3
or DAT 211	Advanced Statistics with R	
MAT 230	Logic, Set Theory, and Proofs	4
MAT 311	Abstract Algebra	4
MAT 321	Real Analysis	4
MAT 380	Mathematics Seminar	1
MAT 381	Mathematics Seminar	1
MAT 480	Mathematics Seminar	1
Select one of the following:		3
MAT 312	Topics in Algebra	
MAT 352	Probability & Statistics II	
MAT 421	Complex Analysis	

CSC 111 & 111L	Introduction to Programming and Introduction to Programming Laboratory [1]	4
Choose one of the following:		3-4
PHY 223 & 223L	General Physics for Physical Science Majors I and General Physics for Physical Science Majors I Laboratory	
Any one Economics (ECO) class		
Electives: Any four additional 300 or 400-level mathematics courses [2]		12-16
Total Credits		**56-61**

[1] For students enrolled in the Mathematic BS/Data Analytics 4+1 Program:
- Taking MAT 211 and MAT 219 automatically waives MAT 500
- CSC 111 & CSC 111L waives CSC 511 & CSC 511L

[2] For those with concentration in another area (double majors or MAT major with a minor in another area), up to two courses may be waived from the four-elective requirement.

Bachelor of Arts in Mathematics (before Fall 2023)

Option A (Mathematics Major)

Code	Title	Credits
MAT 111	Calculus I	4
MAT 112	Calculus II	4
MAT 211	Calculus III	4
MAT 219	Linear Algebra	4
MAT 222	Differential Equations	3
or MAT 351	Probability & Statistics I	
MAT 230	Logic, Set Theory, and Proofs	4
MAT 311	Abstract Algebra	4
MAT 321	Real Analysis	4
MAT 380	Mathematics Seminar	1
MAT 381	Mathematics Seminar	1
MAT 480	Mathematics Seminar	1
Select one of the following:		3
MAT 312	Topics in Algebra	
MAT 352	Probability & Statistics II	
MAT 421	Complex Analysis	
Select four courses from the following:		12-16
Any additional 300 or 400-level mathematics courses		
PHY 335	Mathematical Analysis for Physicists	
PHY 446	Quantum Mechanics I	
Choose one of the following two sequences:		6-8
General Physics for Physical Science Majors (PHY 223, PHY 223L, PHY 224, and PHY 224L)		
Any two Economics (ECO) classes		
Total Credits		**55-61**

Option B (Mathematics with a Concentration in Another Area)

Code	Title	Credits
MAT 111	Calculus I	4
MAT 112	Calculus II	4
MAT 211	Calculus III	4
MAT 219	Linear Algebra	4
MAT 222	Differential Equations	3
or MAT 351	Probability & Statistics I	
MAT 230	Logic, Set Theory, and Proofs	4
MAT 311	Abstract Algebra	4
MAT 321	Real Analysis	4
MAT 380	Mathematics Seminar	1
MAT 381	Mathematics Seminar	1
MAT 480	Mathematics Seminar	1
Select one of the following:		3
MAT 312	Topics in Algebra	
MAT 352	Probability & Statistics II	
MAT 421	Complex Analysis	
Select two of the following:		6-8
any additional 300 or 400-level mathematics courses		
PHY 335	Mathematical Analysis for Physicists	
PHY 446	Quantum Mechanics I	
Choose one of the following two sequences:		6-8
Any two Economics (ECO) classes		
General Physics for Physical Science Majors (PHY 223, PHY 223L, PHY 224, and PHY 224L)		
Four courses in another area approved by the Department of Mathematics and Statistics		12
Total Credits		**61-65**

Option C (Statistics)

Code	Title	Credits
MAT 111	Calculus I	4
MAT 112	Calculus II	4
MAT 211	Calculus III	4
MAT 219	Linear Algebra	4
MAT 222	Differential Equations	3
Or any upper level MAT course		
MAT 230	Logic, Set Theory, and Proofs	4
MAT 321	Real Analysis	4
MAT 351	Probability & Statistics I	3
MAT 352	Probability & Statistics II	3
MAT 380	Mathematics Seminar	1
MAT 381	Mathematics Seminar	1
MAT 480	Mathematics Seminar	1
Select one of the following:		3
MAT 311	Abstract Algebra	
MAT 421	Complex Analysis	
MAT 353	Regression Analysis	3
MAT 354	Experimental Design and Statistical Computing	3
Select one of the following:		6-8
any additional 300 or 400-level mathematics courses		
PHY 335	Mathematical Analysis for Physicists	
PHY 446	Quantum Mechanics I	
Choose one of the following two sequences:		6-8
Any two Economics (ECO) classes		

General Physics for Physical Science Majors (PHY 223, PHY 223L, PHY 224, and PHY 224L)	
Total Credits	**57-61**

Additional Course Considerations

Option A is designed to prepare the student for positions in which mathematical competence is sought, as well as for advanced study in graduate school.

Option B allows the student to develop expertise in another area besides mathematics. Many students combine this option with a major or minor in another department. Students interested in education can get a dual major to give them a strong background in mathematics while fulfilling the requirements of the School of Education.

Option C prepares the student for advanced work or graduate study and the many careers which utilize statistical thinking. This option, together with appropriate courses in business, constitutes a good preparation for a career in actuarial science.

Roadmap

Recommended Semester Schedule for Major Courses

Bachelor of Science in Mathematics

Freshman	
Fall	**Spring**
MAT 111	MAT 112
PHY 223 & 223L (or ECO Course)	CSC 111 & 111L
Sophomore	
Fall	**Spring**
MAT 211	MAT 219
MAT 230	MAT 222 or DAT 211[2]
Junior	
Fall	**Spring**
MAT 321	MAT 380
MAT elective	MAT elective
	MAT elective
Senior	
Fall	**Spring**
MAT 311	MAT 480
MAT 381	MAT restricted elective [1]
MAT elective	

[1] Select one of the following:
MAT 312 (odd year spring)
MAT 352 (even year fall)
MAT 421 (even year spring)

[2] DAT 211 is typically offered in the Fall semester

Bachelor of Arts in Mathematics Option

Freshman	
Fall	**Spring**
MAT 111	MAT 112
PHY 223 (or ECO course)	PHY 224 (or ECO course)
Sophomore	
Fall	**Spring**
MAT 211	MAT 219
MAT 230	MAT 222 or 351
Junior	
Fall	**Spring**
MAT 311 (Options A & B)	MAT 381
MAT 352 (Option C)	**Options A & B:**
MAT 321	MAT elective
MAT 380	**Option C:**
	MAT 222
	MAT 353 or 354
Senior	
Fall	**Spring**
MAT 480	MAT restricted elective[1]
MAT elective	**Option C:**
	MAT 354 or 353

[1] Select one of the following:
MAT 311(Option C)
MAT 312(Options A & B)
MAT 352(Options A& B)
MAT 421

Learning Goals and Objectives

Student Learning Goal 1:

Mathematics majors will perform tasks requiring logical reasoning.

Students will:

- **Objective A:** Understand the different types of mathematical statements and how they are used, including definitions, axioms, hypotheses, conclusions, theorems, corollaries, lemmata, and conjectures;
- **Objective B:** Understand methods of proof.

Student Learning Goal 2

Mathematics majors will know the content of the fundamental fields of mathematics and can perform tasks requiring complex reasoning.

Students will:

- **Objective A:** Use basic skills to manipulate expressions;
- **Objective B:** Know the basic definitions and theorems of mathematics;
- **Objective C:** Be able to perform tasks requiring complex reasoning.

Student Learning Goal 3

Mathematics majors will advance their understanding and knowledge of mathematics and their ability to convey mathematical concepts through currently available technology.

Students will:

- **Objective A** (Information Literacy): Use the internet and/or library resources to obtain relevant information concerning historical information or mathematical content in regards to current course or project. Students will be expected to both look up sources and learn to search for their own sources;
- **Objective B** (Computation): Use computers or graphing calculators to perform labor-intensive calculations and/or create graphical displays.

Programs include, but are not limited to, *Excel*, *Minitab* (or other statistical software), *and Mathematica* (or other software);

- **Objective C** (Presentation): Use technology for the purpose of elegantly presenting mathematical ideas, theories or results. Technologies include PowerPoint, Prezzi, Jing, Beamer, Latex, Word, and graphical tools.

Student Learning Goal 4

Mathematics majors will communicate mathematical ideas with precision and clarity.

Students will:

- **Objective A:** Present mathematical material in writing;
- **Objective B:** Present mathematical material orally.

Minor

Code	Title	Credits
Required Courses		
MAT 111	Calculus I	4
or MAT 115	Calculus for Business	
MAT 112	Calculus II	4
MAT 211	Calculus III	4
MAT 219	Linear Algebra	4
MAT 230	Logic, Set Theory, and Proofs	4
Restricted Electives		
Select one of the following tracks and take two of the courses in that track:		6-8
Probability and Statistics:		
MAT 351	Probability & Statistics I	
MAT 352	Probability & Statistics II	
MAT 353	Regression Analysis	
Applied Mathematics:		
MAT 222	Differential Equations	
MAT 341	Numerical Analysis	
MAT 342	Graph Theory	
MAT 345	Climate and Sustainability	
PHY 335	Mathematical Analysis for Physicists	
Theoretical Mathematics:		
MAT 311	Abstract Algebra	
MAT 312	Topics in Algebra	
MAT 321	Real Analysis	
MAT 421	Complex Analysis	
Mathematics and Culture:		
MAT 301	History of Mathematics	
MAT 331	Geometry	
MAT 345	Climate and Sustainability	
Total Credits		**26-28**

Minors are an important part of the undergraduate curriculum. If students declare a minor by sophomore year, they can usually complete it in a timely manner. Students should work with their advisor to determine if it is possible that the minor can be completed by graduation.

To receive a minor, a student must complete at least 9 credit hours of coursework distinct from their major(s) and from other minors, and students must complete more than 50% of the coursework required for the minor at Canisius. Please note that "ancillary/supporting" courses required for a major may still count as distinct courses as long as the remaining coursework still meets the 30 credit-hours required for a major. For more information about minor policies, please see the Declaring Majors and Minors (http://catalog.canisius.edu/undergraduate/academics/student-records/declaring-majors-minors/) page in the catalog.

Combined Degree Programs

- 4+1 Mathematics BS/ Adolescence 7-12, Teaching Students with Disabilities(All Grades) MSEd (http://catalog.canisius.edu/undergraduate/division-business-communication-health-studies/school-data-computing-mathematics/mathematics-statistics/mathematics-adolescence-ed-swd-all-grades/)
- 4+1 Mathematics BS/Data Analytics MS (http://catalog.canisius.edu/undergraduate/division-business-communication-health-studies/school-data-computing-mathematics/mathematics-statistics/4-1-mathematics-data-analytics/)

Courses

MAT 105 Finite Mathematics **3 Credits**
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.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: every fall & spring.

MAT 106 Calculus for the Non-Sciences **3 Credits**
Fundamentals of calculus for students in business, or social or behavioral sciences. Credit not allowed if student already has credit for MAT 109 & MAT 110; or MAT 111 or MAT 115.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: every fall, spring, & summer.

MAT 108 College Precalculus **4 Credits**
Basic science skills. Ratios. 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.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: every fall & spring.

MAT 111 Calculus I **4 Credits**
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.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: fall & spring.

MAT 112 Calculus II **4 Credits**
Applications of integration, integration techniques, improper integrals, sequences, series, convergence tests, Taylor's series, applications; parametric and polar curves.
Prerequisite: minimum grade of C- in one of the following MAT 109 & MAT 110, MAT 111 or MAT 115.
Offered: fall & spring.

MAT 115 Calculus for Business **4 Credits**
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.
Prerequisite: 3 1/2 years of high school mathematics.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: fall.

MAT 121 Mathematics through History **3 Credits**
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.
Prerequisite: 3 years of high school math or equivalent; sophomore standing or higher.
Fulfills College Core: Field 7 (Mathematical Sciences), Global Awareness
Offered: occasionally.

MAT 131 Statistics for Social Sciences **3 Credits**
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.
Prerequisite: 3 years of high school mathematics or equivalent.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: fall & spring.

MAT 141 Inferential Statistics and Computers for Science **4 Credits**
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.
Prerequisite: 3 1/2 years of high school mathematics.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: every spring.

MAT 150 Mathematics and Politics **3 Credits**
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.
Prerequisite: 3 years of high school mathematics or equivalent.
Fulfills College Core: Field 7 (Mathematical Sciences), Justice
Offered: occasionally.

MAT 161 Mathematics for Elementary Teachers **3 Credits**
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.
Prerequisite: 3 years of high school mathematics or equivalent.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: occasionally.

MAT 162 Mathematics for Middle and High School Teachers **3 Credits**
Designed to provide a solid foundation for the mathematical topics encountered in middle and high schools. The primary goal is to develop a deep understanding of these mathematical concepts to allow future teachers to teach with knowledge and confidence.
Prerequisite: 3 yrs. high school mathematics or equivalent.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: every spring.

MAT 171 Business Mathematics **3 Credits**
Learn mathematical principles and procedures relevant to making business/finance decisions. Topics include: Simple and compound interests; Annuities and amortized loans; Trade and cash discounts; Markups and markdowns. Learn and use the financial calculator.
Prerequisite: High school level mathematics or equivalent.
Fulfills College Core: Field 7 (Mathematical Sciences)
Offered: occasionally.

MAT 191 Discrete Mathematics I **4 Credits**
Fundamental topics with computer science applications. Topics include integer properties, sets, propositional and predicate logic, elements of combinatorics and counting, elementary discrete probability, and functions and relations.
Offered: every fall.

MAT 192 Discrete Mathematics II **4 Credits**
Advanced topics with computer science applications. Topics include proofs, graphs, trees, recursion, and a deeper exploration into some of the MAT 191 topics.
Prerequisite: minimum grade of C in MAT 191.
Offered: occasionally.

MAT 211 Calculus III **4 Credits**
Continuation of MAT 111 and MAT 112. Analytic geometry of 3-dimensional space and calculus of functions of several variables.
Prerequisite: minimum grade of C- in MAT 112.
Offered: every fall.

MAT 219 Linear Algebra **4 Credits**
Vector spaces and inner product spaces. Linear transformations and matrices. Eigenvectors, eigenvalues, and applications. Orthogonal transformations. Quadratic forms and quadric surfaces.
Prerequisite: MAT 112 or permission of instructor.
Offered: spring.

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: occasionally.

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 of odd-numbered years.

MAT 331 Geometry **3 Credits**
Axioms for geometry and their consequences: independence of the parallel postulate. Rudiments of hyperbolic geometry. Geometric transformations.
Prerequisite: MAT 230 (can be taken concurrently).
Offered: fall of even-numbered years.

MAT 341 Numerical Analysis **3 Credits**
The methods used to obtain numerical solutions of functional and differential equations. Polynomial interpolation. Various approximation algorithms.
Prerequisite: MAT 219 and CSC 111 & CSC 111L.
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, MAT 115, 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: MAT351.
Offered: fall of even-numbered years.

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.
Prerequisites: MAT 131, or MAT 141, DAT 211, or or MAT 351, or MAT 352, or permission by the 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: occasionally.

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 421 Complex Analysis **3 Credits**
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.
Prerequisites: MAT 211 and MAT 219, 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; MAT 112.
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.