

MATHEMATICS (BA)

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. Students must have a minimum grade of C- in all courses in the major.

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 college 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 course work may be required. Please note that students will receive only one degree unless the complete 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 we have also had students double major in math and music, English, political science, philosophy, Spanish, psychology, 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

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

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****Option A****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	MAT 381
MAT 321	MAT elective
MAT 380	

Senior

Fall	Spring
MAT 480	Select one of the following ("restricted elective"):
MAT elective	MAT 312
MAT elective	MAT 352 (MAT352 is typically offered in the fall semester.)
	MAT 421
	MAT elective

Option B**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	MAT 381
MAT 321	MAT elective
MAT 380	
Senior	
Fall	Spring
MAT 480	Select one of the following ("restricted elective"):
MAT elective	MAT 312
	MAT 352 (MAT352 is typically offered in the fall semester.)
	MAT 421

Option C

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 351
Junior	
Fall	Spring
MAT 321	MAT 381
MAT 352	Select one of the following statistics electives:
MAT 380	MAT 353
	MAT 354
	MAT 222 (or MAT elective)
Senior	
Fall	Spring
MAT 480	Select one of the following statistics electives:
MAT elective	MAT 353
	MAT 354
	Select one of the following ("restricted elective"):
	MAT 311 (MAT311 is typically offered in the fall semester.)
	MAT 421

Learning Goals & 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	
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.

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 Precalculus for Sciences	3 Credits
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: occasionally.	
MAT 109 Calculus with Review I	4 Credits
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 111 or MAT 115.	
Fulfills College Core: Field 7 (Mathematical Sciences)	
Offered: fall.	

MAT 110 Calculus with Review II	4 Credits
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.	
Prerequisite: MAT 109.	
Offered: 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: fall & spring.	

<p>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: once a year.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>
<p>MAT 191 Introduction to Discrete Mathematics 4 Credits 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. Offered: fall.</p>	<p>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.</p>
<p>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.</p>	<p>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. Offered: spring of even-numbered years.</p>
<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>
<p>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.</p>	<p>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.</p>
<p>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.</p>	

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.

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, Rouché's Theorem.

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.

Mathematics (BA) and Adolescence Education 7-12, Teaching Students with Disabilities Generalist (MSEd)

The dual degree program (<http://catalog.canisius.edu/graduate/school-education-human-services/educator-preparation/dual-degree-content-and-msed-swd/#curriculumtext>) offers a BA in Mathematics as well as a MSEd in Adolescence 7-12 Teaching Students with Disabilities Generalist. This dual degree program leads to Initial Adolescence Certification in History as well as Initial Certification in Adolescence 7-12 SWD Generalist. Since it leads to two teaching certificates, candidates must meet the content requirements for both over the course of their curriculum. In most cases, the content area major covers those requirements. In some instances New York State has additional requirements. Please note, this dual degree program can be completed in as little as 5 years if one summer is included.

Curriculum

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

Undergraduate Courses

Code	Title	Credits
Mathematics Courses		
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 201, PHY 201L, PHY 202, and PHY 202L)		
Any two Economics (ECO) classes		
Education Courses		
EDS 101	Human Growth and Social Development: Adolescence	3
EDS 223	Foundations of Adolescent Literacy	3
EDS 360	Evaluation and Teaching Strategies	3
EDS 403	Methods of Teaching Mathematics: Adolescence	3
EDU 250	Foundations of Education	3
EDU 356	Assessment for Diverse Learners	3
SPE 311	Nature/Needs of Childhood Students with Intellectual Disabilities & Autism Spectrum Disorders	3
SPE 341	Inclusive Strategies	3
Total Credits		79-85

Please note, one math, one science, one English, and one history course are needed for SWD certification.

Graduate Courses

The education curriculum is provided below for the graduate MSeD portion of the dual degree program. Several foundation courses are taken at the undergraduate level listed above with the requirements for the history major. The graduate courses begin at the 500 level and continue until completion. These courses can be taken during a student's senior year. Refer to the roadmap for further details.

Code	Title	Credits
EDU 556	Assessment for Diverse Learners ¹	3
or EDU 356	Assessment for Diverse Learners	
EDU 595	Child Abuse Workshop	0
EDU 596	Prevention of School Violence Workshop	0
EDU 597	Dignity for All Students Workshop	0
EDU 615	Research Methods	3
SPE 580	Classroom Management	3
SPE 631	Reading and Writing Process for Students with Learning and Behavioral Disorders	3
SPE 640	Learning and Behavioral Disabilities (LBD); Etiology and Research Based Interventions	3
SPE 644	Collaborative Practices on a Transdisciplinary Team	3
SPE 649	Transition Issues for Adolescents with Disabilities	3
SPE 650	Intellectual Disabilities and Autism Spectrum Disorders: Etiology & Educational Needs ¹	3

or SPE 311	Nature/Needs of Childhood Students with Intellectual Disabilities & Autism Spectrum Disorders	
SPE 652	Functional Curriculum for Students with Severe Disabilities and ASD	3
SPE 698	Seminar in Teaching and Assessment	3
SPE 693	Student Teaching	9
SPE 697	Student Teaching Seminar	0
Total Credits		39

¹ These courses may be taken at either the undergraduate or graduate level. The graduate level courses are recommended for those students coming into this program during their junior year.