COLLEGE OF SCIENCE
MATHEMATICS
VIRGINIA TECH

Undergraduate Handbook for Mathematics Majors

Department of Mathematics, Virginia Tech

Revised June 2024

INTRODUCTION

The purpose of this handbook is to advise you, the mathematics student, about the Mathematics Department and the curriculum for the Bachelor of Science degree in Mathematics. There are four different degree options (paths) that you may follow towards a B.S. degree in Mathematics:

1. Traditional Option (technically, the "no option" option)
2. Applied Computational Mathematics Option (ACM)
3. Applied Discrete Mathematics Option (ADM)
4. Mathematics Education Option (Math Ed or MSTR)

The curriculum of each of the four degree options is designed to give you a solid foundation in the basic areas of mathematics with supporting background in applied areas. A coherent program of courses in fields other than mathematics, but in which mathematics is used significantly, is valuable as part of a general education in mathematics and is extremely valuable for employment opportunities.

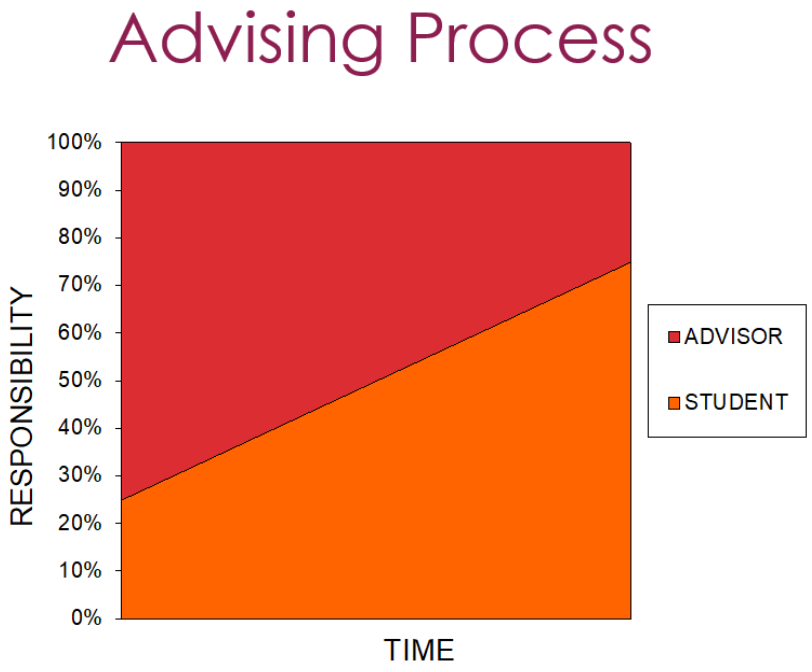
The Traditional Option, as its name implies, yields a broad and flexible background in mathematics, while the other three options are more specialized. The ACM Option is designed for students who want to have an applied mathematics career in an area closely associated with physics, some form of engineering, etc. The Traditional and ACM options require that you work with your advisor to create a plan of study for an Interdisciplinary Application of Mathematics. This plan consists of courses in an applied area of your choosing that will support your post-graduation goals.

The ADM Option is designed for students who want to have an applied mathematics career in an area closely associated with computer science. The Education Option is designed for students who want to teach high-school or middle-school mathematics. The ADM and Math Ed options

have the Interdisciplinary Application of Mathematics and associated required courses already determined -- computer science courses for ADM and teaching-focused courses for Math Ed. More details and specific requirements can be found in the Program Requirements listed in the Academic Catalog and in the Degree Options section below.

Though each of the degree options has different graduation requirements, and each is intended to support various post-graduation goals, all four degree options yield the same degree -- a B.S. in Mathematics. The first two years of coursework are nearly identical among the degree options, making it easy to change degree options early in your undergraduate mathematical career. It is critical that you discuss your mathematical interests and post-graduation goals with your advisor early and often in order to determine the degree option that will be best suited for you. If you are interested in graduate study, seek advice early and often about the degree option, coursework, and research experience(s) that provide the best preparation for graduate work in your mathematical area of interest.

ACADEMIC ADVISING



Advising at Virginia Tech is a collaborative process between student and advisor leading to the exchange of information that encourages the individual student to make responsible academic and career decisions. Math Department academic advisors are also faculty members who can discuss details of course and career advice throughout your undergraduate career, in addition to many other aspects of undergraduate educational life. Advising information and resources can be found at: **math.vt.edu/advising**.

In addition to your assigned academic advisor, the Mathematics Department has designated Career Advisors. The Career Advisors will work with your academic advisor to provide information that will aid you in planning a career-oriented program. Information about career opportunities and career fairs will be sent to students periodically. In addition, you can explore the career resources and information posted on the Math Department's Career Advising website: **math.vt.edu/careers**. Also see the section: **Preparation for Post-Graduation Endeavors**.

DEGREE REQUIREMENTS

The B.S. in Mathematics requires a total of 120 credits, comprised of the following:

- Pathways General Education Requirements: 45 credits
- Math Major Requirements: 60-75 credits*
- Free Electives: 9-21 credits*

*Range depends on degree option. More free electives may be possible by satisfying multiple requirements with a single course. Some math major requirements satisfy Pathways General Education requirements, and those credits are counted twice above, leaving every student with some free electives.

Exercise care in choosing your Pathways General Education classes and free electives. At a university you have opportunities that exist nowhere else. You may want to consider a Pathways Minor as a way to make Pathways General Education courses feel more cohesive. Pathways Minors are thematic, cross-disciplinary programs that allow students to examine important topics from a variety of perspectives while completing general education requirements along the way. Choosing free electives is another way for you to tailor your formal education individually. The ability to choose your own Interdisciplinary Application of Mathematics and free electives makes this degree both strong and flexible.

PROGRESS TOWARD DEGREE

Students are expected to understand the Progress Toward Degree requirements and monitor their progress. You will be notified by the Math Department Advising Team if you fall out of compliance with Progress to Degree rules. In most cases, a probationary semester will be allowed, in which terms required to remain in the major are agreed upon between the student and the Math Department Advising Team. Failure to meet those terms generally results in removal from the mathematics major.

MATH COURSE REQUIREMENTS – ALL DEGREE OPTIONS

NOTE: The years listed below are estimates and represent the scheduling by which many math majors complete these requirements. Each student's coursework and ordering of classes is unique, especially at the 3000 and 4000-levels. Always work with your academic advisor to determine individual course plans and timing that best supports your goals and sets you up for success.

Year 1

MATH 1225: Calculus of a Single Variable
MATH 1226: Calculus of a Single Variable

MATH 1225 and MATH 1226 are the standard mathematics courses for your first year. These courses introduce you to the language, techniques and applications of single-variable calculus.

Most students also take MATH 1454 - Intro to Math Programming. This course satisfies the 3-credit programming course requirement for all math majors. MATH 1454 is intended for students who have no previous programming experience and is taught using Matlab. All students, especially those pursuing the ADM degree option, should discuss the choice of a first programming course with their advisor.

First-year students should also take MATH 1004 (fall only) and MATH 1044 (spring only), Discovering Mathematics I & II. These courses will introduce you to the scope and applicability of mathematics and its many sub-disciplines. You will be introduced to the process of thinking, learning, and writing as a mathematician through topics such as logic systems, recreational mathematics, LaTeX programming, history, ethics, open problems, and research in mathematics. The course has embedded upper-class peer mentors and also includes advising topics that will help you learn the tools and tips for success throughout your college career.

Year 2

MATH 2204: Multivariable Calculus
MATH 2114: Intro to Linear Algebra
MATH 2214: Intro to Differential Equations
MATH 3034: Intro to Proofs

In your second year, you will take introductory courses in Multivariable Calculus (essentially calc 3), linear algebra, and differential equations. In addition, MATH 3034, an introduction to creating logical proofs, should be taken in your second year. This course bridges the gap between the largely calculation-based nature of the calculus sequence and the fundamental-reasoning nature of the junior-level courses. Math Ed students will also take MATH 2644: Mathematics Tutoring.

Paralleling the standard versions of MATH 2214, MATH 2114, and MATH 2204 are honors sections of the same material (MATH 2214H, MATH 2114H, and MATH 2204H). Honors sections cover the material in more depth than standard courses and may include a few extra topics beyond what is covered in the non-honors sections. If you are interested in honors classes and you are not in the Honors College, you will need departmental approval. More information is available at **math.vt.edu/honors**.

The Math Department also offers the sequence MATH 2405H-2406H, Mathematics in a Computational Context. The yearlong honors sequence (5 credits fall, 5 credits spring) includes all topics taught in MATH 2114, MATH 2214, and MATH 2204, motivated by applications and taught with attention to algorithmic implementation. More information is available at **math.vt.edu/honors**.

Year 3

MATH 3124: Modern Algebra (not required for ACM students entering 2024 or earlier)
MATH 3144: Linear Algebra
MATH 3214: Calculus of Several Variables (not required for Math Ed entering 2024 or earlier)
MATH 3224: Advanced Calculus

MATH 3224 is a proof-based perspective on single-variable calculus and MATH 3144 is an advanced treatment of the linear algebra topics covered in MATH 2114. The Year 3 3000-level courses should not be viewed as applied courses but rather as courses that build mathematical foundations necessary for most senior-level courses. Exceptional students may substitute MATH 4124 for MATH 3124, MATH 4225 for MATH 3224, and/or MATH 4226 for MATH 3214. Consult with an advisor about this process.

ADM students will also take MATH 3134: Applied Combinatorics and Graph Theory.
ACM students will also take the 4000-level Numerical Analysis.

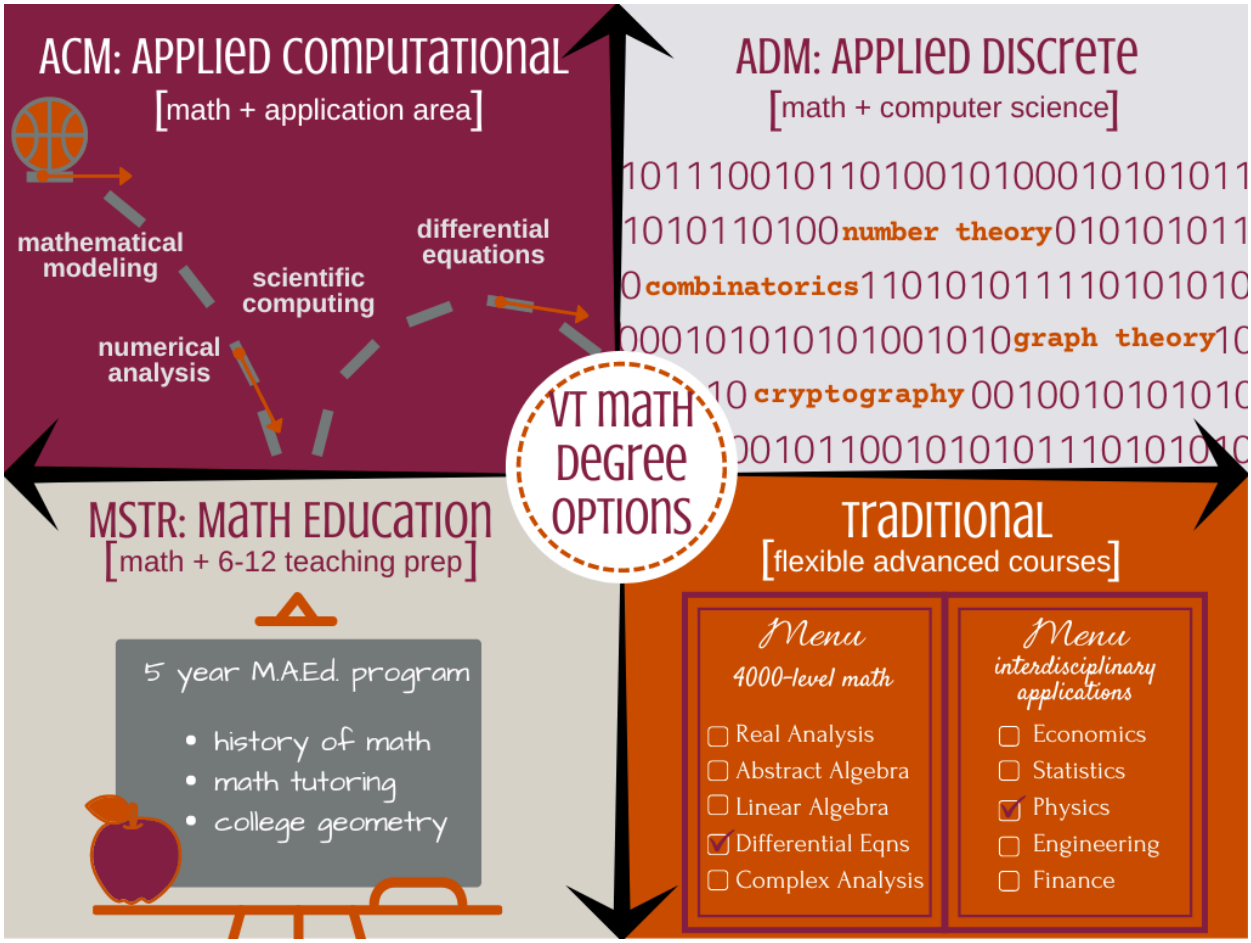
Year 4

At least four 4000-level MATH classes

There are a wide variety of 4000-level courses. Among these, students may decide to augment a chosen application area or study fundamental extensions of junior-level courses in preparation for graduate school. With departmental permission, advanced students are also allowed to take graduate courses. The requirements for the 4000-level MATH courses differ by degree option. Refer to the Program Requirements in the Academic Catalog for details.

DEGREE OPTIONS

The curriculum of each of the four degree options is designed to give you a solid foundation in the basic areas of mathematics with supporting background in an interdisciplinary application of mathematics. A coherent program of courses in fields other than mathematics, but in which mathematics is used significantly, is valuable as part of a general education in mathematics and is extremely valuable for employment opportunities.



Traditional Option

Overview: The Traditional Option, as its name implies, yields a broad and flexible background in mathematics. It ensures a comprehensive, well-rounded curriculum of foundational courses in analysis and algebra, while allowing the largest range of choices at the advanced level. One can acquire many aspects of the ACM and ADM options by appropriate choices of advanced and math-related courses.

Interdisciplinary Application of Mathematics: Students in the Traditional degree option are required to work with their advisor to complete an Interdisciplinary Application of Mathematics Course Plan (IAMCP). The IAMCP should be submitted by the time the 2000-level MATH courses are completed (generally, by the end of the second year). When submitting plans for departmental review, students will be asked to address the intellectual rigor of the IAMCP courses and the overall IAMCP, the degree to which mathematics is used, and the relevance to their career and/or future studies.

Interdisciplinary Application of Mathematics Course Plan (IAMCP) Requirements:

1. Contain at least 12 credits of coursework from a department(s) other than Mathematics.
2. The courses in the IAMCP must be in an area to which mathematics can be applied.
3. The IAMCP must exhibit depth in at least one application area. Typically depth means courses at the 3000 level or higher, often together with some 2000-level prerequisites for the higher-level courses. Some exceptions apply, but the plan generally should not include 1000-level courses and should include at least one course at the 3000-level or higher.

Popular concentrations recently have been in Computational Modeling and Data Analytics (CMDA), Statistics, Actuarial Science, Economics, Finance, and Physics.

Click here for a sample list of courses that might be considered for an IAMCP.

The IAMCP form can be found on the Forms page linked from the Math Department Advising Website: **math.vt.edu/advising**.

4000-level MATH: Twelve credits are required. Six of these credits must come from a sequence or cluster. See the Traditional Option Program Requirements in the Academic Catalog for details.

Applied Computational Mathematics Option (ACM)

Overview: The ACM option is designed to train students for successful entry into jobs in laboratories and industrial organizations, as well as to prepare students for graduate study in applied mathematics, mathematics, and the sciences. It has four components, each of which plays a crucial role in the career of a working applied mathematician.

- Area of Applications: see next section

- Scientific Computing: Since computational hardware has become faster, cheaper, and more common, most applied mathematicians (especially those who work in laboratories) require the skills necessary to analyze, employ, and evaluate large-scale algorithms for solving multidisciplinary problems. The ACM option emphasizes these skills through courses in programming, scientific computing, and numerical analysis as well as an applications area.

- Technical Tools of Applied Mathematics: Applied mathematics employs a broad spectrum of theory, methods and tools in attacking real-world problems. Students in the ACM program will develop skills in ordinary differential equations, partial differential equations, numerical analysis, and scientific computation.

- Mathematical Rigor: Students in the ACM option will receive a firm background in rigorous mathematics through courses such as Calculus of Several Variables, Advanced Calculus, Linear Algebra, and Numerical Analysis. Courses such as Partial Differential Equations and Scientific Computing will provide links between mathematical rigor and applied problems.

Interdisciplinary Application of Mathematics: One of the main components of the ACM program is the requirement that all students taking the option acquire substantial knowledge in some area of applications. Each ACM student is required to work with their advisor to complete an Interdisciplinary Application of Mathematics Course Plan (IAMCP). The IAMCP should be submitted by the time the 2000-level MATH courses are completed (generally, by the end of the second year). When submitting plans for departmental review, students will be asked to address the intellectual rigor of the IAMCP courses and the overall IAMCP, the degree to which mathematics is used, and the relevance to their career and/or future studies.

Interdisciplinary Application of Mathematics Course Plan (IAMCP) Requirements:

1. Contain at least 12 credits of coursework from a department(s) other than Mathematics.
2. The courses in the IAMCP must be in an area to which mathematics can be applied.

3. The IAMCP must exhibit depth in at least one application area. Typically depth means courses at the 3000 level or higher, often together with some 2000-level prerequisites for the higher-level courses. Some exceptions apply, but the plan generally should not include 1000-level courses and should include at least one course at the 3000-level or higher.

Popular concentrations recently have been in Computational Modeling and Data Analytics (CMDA), Statistics, Actuarial Science, Economics, Finance, and Physics.

Click here for a sample list of courses that might be considered for an IAMCP.

The IAMCP form can be found on the Forms page linked from the Math Department Advising Website: **math.vt.edu/advising**.

4000-level MATH: 21 credits are required, 6 of which are chosen electives. See the ACM Program Requirements in the Academic Catalog for details.

Applied Discrete Mathematics Option (ADM)

Overview: As computer power and applications have evolved, the importance of combinatorics and discrete mathematics has grown tremendously. Techniques that employ combinatorics and discrete mathematics are being used in almost every area where mathematical computations are found. In response to this area's increased importance and utility, the Math Department developed the ADM Option, in which students are given exposure to fundamental ideas and techniques in discrete mathematics and combinatorics. Because computers are central in these applications, ADM students are required to develop a strong foundation in Computer Science.

The ADM Option is designed to allow students either to enter the job market after their undergraduate years or to continue their studies at a graduate-degree level. Those students who wish to begin work after their undergraduate degree will have training in combinatorial techniques, including graph theory (used in electrical circuits, optimization problems among many other areas), number theory (basic to coding theory and algorithm development), counting techniques (employed in almost every area where mathematics is applied), and general algebraic theories (providing the student with a strong abstract mathematical foundation). ADM students will be employable in many different capacities. For example, our students would be prepared to work for the National Security Agency (which employs many mathematicians and is interested in applications of coding theory), software development companies, engineering companies that need software development, and research laboratories such as Bell Laboratories and IBM Laboratories. ADM students will have both the mathematical sophistication to handle abstractions and a firm grounding in applicable techniques. These skills will be enhanced by a strong background in computer science.

Interdisciplinary Application of Mathematics – Computer Science: ADM students are required to develop a strong foundation in computer science. By adding three additional credits in computer science, students can obtain a CS minor, and possibly continue on to graduate school in Computer Science. ADM students are required to take 12 credits of CS courses beyond the 3-credit programming requirement for all mathematics majors, and are also required to take one statistics course, chosen from a given list. See the ADM Program Requirements in the Academic Catalog for details.

4000-level MATH: Twelve credits are required. Six of these credits must come from a given list in the ADM Program Requirements.

Mathematics Education Option (MSTR)

Overview: The Mathematics Education option is designed to help prepare students to become future secondary mathematics teachers (grades 6-12) and leads to a B.S. in Mathematics at the end of four years. Students may apply to an optional fifth year to earn an M.A.Ed. in Curriculum & Instruction with a specialization in Mathematics Education in the Virginia Tech School of Education.. The 5-year program is designed to satisfy Virginia's licensure requirements for teaching mathematics in secondary schools.

Interdisciplinary Application of Mathematics – Secondary Teaching in Grades 6-12: Math Ed students are required to take 21 credits of coursework in education, curriculum, and instruction. One statistics course, chosen from a given list, is also required. See the Math Ed option checksheet for details.

Professional Studies Component: EDCI 2004 is typically taken during the spring of a student's third year. It is recommended that students in the math ed degree option take EDCI 2004 after completing MATH 2644.

The early field experience part of EDCI 2004 requires 50 hours spent serving as a teacher aide in a middle school or high school. Students are expected to provide their own transportation to and from the field experience placement. Upon completion of EDCI 2004, students will be evaluated by their cooperating teacher and EDCI 2004 instructor regarding the quality of their field experience.

4000-level MATH: Twelve credits of 4000-level courses specified in the Math Education Program Requirements are required. In addition, Math Ed students must choose one MATH elective course at the 3000-level or higher.

5000-level Courses: Nine credits of graduate-level education courses specified in the Program Requirements are required. Students who apply and are accepted into the School of Education's M.A.Ed. program take the remaining graduate-level education courses once they are enrolled as graduated students.

[Not part of the undergraduate degree] **Information on application to the M.A.Ed. Program:** Students apply for admittance to the M.A.Ed. degree program in either the spring or fall of their fourth year of the B.S. degree. A 3.0 overall GPA is required. (Students with a lower GPA might be admitted on provisional status). Typically, students begin their coursework as graduate students in the summer after their fourth year. To begin then, the application deadline is February 15. Students who wish to dual enroll (take courses towards their B.S. and courses towards their M.A.Ed. during the same semester) or wish to be accelerated (take courses that count towards both their B.S. and M.A.Ed. degrees) will typically apply for the M.A.Ed. by the October 15 deadline. Application for the dual enrollment or accelerated undergrad/grad program is completed after admittance into the graduate program.

The M.A.Ed. program works with students to complete any remaining licensure requirements set by the Virginia Department of Education. More information about the program can be found at **https://liberalarts.vt.edu/departments-and-schools/school-of-education/academic-programs/mathematics-education/master-mathematics-education.html**

SPECIAL OPPORTUNITIES FOR ALL MATHEMATICS MAJORS

Scholarships

In a typical year the Math Department awards more than $60,000 to 30+ students with the majority going to continuing students. To be considered for a Mathematics Department awarded scholarship, complete the following steps by mid January:

STEP 1 (required): Login to Scholarship Central (found at **https://vt.academicworks.com**) and complete the general application.

STEP 2 (preferred): Provide additional information to the Mathematics Department Scholarship Committee to assist with scholarship decisions by filling out the **Math Department 2025-2026 Scholarship Permission Form**.

STEP 3 (optional): Fill out the FAFSA at **https://studentaid.gov/h/apply-for-aid/fafsa**
This form is only required for eligibility to certain scholarships based on financial need.

Decisions will be made either at the end of the spring semester or at the beginning of the fall semester. The Math Department has several scholarship programs including the Carl A. Persinger Scholarship/Fellowship for Mathematics, Daniel S. Kim Memorial Scholarship, David P. Roselle Scholarship, Lee R. and Regina Aultice Steeneck Endowed Scholarship, Marion V. Eckert and Charlotte H. Eckert Scholarship in Mathematics, Math Department Award, Patricia A. Caldwell Endowed Scholarship in Mathematics, Ray A. Gaskins Scholarship in Mathematics, Richard L. and Georgia W. Kimball - Norfolk Southern Scholarship, T.W. Hatcher Math Scholarship, The Kathleen Wampler & Forrest Dryden Rollins Scholarship in Mathematics, and the Wilbur Francis Wells Memorial Scholarship. Some have more than one recipient.

Undergraduate Research

The Mathematics Department at Virginia Tech emphasizes and features activity in undergraduate research. Numerous institutions, including the National Science Foundation, the American Mathematical Society, and the Society for Industrial & Applied Mathematics, also emphasize the importance of developing research opportunities for undergraduates. Undergraduate research experiences serve to prepare students for life after the B.S. degree, both in the industrial world and in graduate school.

There are several ways to participate in mathematics undergraduate research. Some students participate in projects with stipend support, some earn course credit as MATH 4994, and others participate purely for the experience. Undergraduate research projects are typically directed by faculty members. To find an undergrad research project to participate in, students are encouraged to reach out to any faculty member about potential research interests and/or to reach out to our faculty members who serve as the coordinators of our undergraduate research program.

More information, including contact information for the Math Department Undergraduate Research Coordinators, research competitions and prizes, forms, and more can be found at:
https://math.vt.edu/undergrad-math/undergraduate-research.html

Accelerated 5-Year Undergraduate/Graduate Degree Program in Mathematics

The Accelerated Undergraduate/Graduate Degree Program is intended to allow undergraduate students who are prepared to take graduate courses to complete M.S. requirements one year after completing B.S. requirements.. The principal feature of the program is that it allows the students to use 12 credits of graduate work simultaneously toward the completion of their bachelor's degree and a program of study leading to a master's degree. It is this ability to complete the final year of undergraduate work with the same courses that comprise much of the first year of graduate work that makes it possible to finish both degrees in five years. For more information, students should contact the Math Department Graduate Program Director and consult:
https://www.math.vt.edu/content/dam/math_vt_edu/documents/accel-u-g-degree.pdf

Double Majors, Second Degrees (Dual Degrees), and Minors

Double majors, second degrees (also known as dual degrees), and minors often satisfy Interdisciplinary Application of Mathematics Course Plan requirements for students in the traditional and ACM degree options. The same holds for students in the ADM degree option if the additional major or minor is in Computer Science.

Double majors and second degrees in Computer Science, Engineering, Statistics, Computational Modeling and Data Analytics (CMDA), or Physics are popular choices that yield excellent degrees. Students who pursue a double major receive a diploma in the primary major and a double major certificate in the second major. Students who pursue a second degree obtain two diplomas by taking an additional 30 credits of coursework at VT beyond the requirements of the primary major. If interested, discuss this with your academic advisor. More information about double majors and dual degrees can be found at:
https://www.registrar.vt.edu/graduation-multi-brief/faq.html

Students typically have space within the mathematics undergraduate degree requirements to obtain a minor if desired. Students can explore minors, including Pathways Minors, offered by VT at **https://vt.edu/academics/minors.html**

Activities

Undergraduate and graduate students in mathematics are invited to join the Virginia Tech student chapters of the Mathematical Association of America (MAA) – also known as the Math Club, Association for Women in Mathematics (AWM), and the Society for Industrial and Applied Mathematics (SIAM). The activities of these chapters include talks on mathematics used in government and industry, as well as social, recreational, and charitable activities. More information can be found on our undergraduate website in the section titled Opportunities for VT Math Students: **math.vt.edu/undergrad-math**

Virginia Tech has a chapter of Pi Mu Epsilon, a national organization whose purpose is the promotion of scholarly activity in mathematics. Outstanding math majors may be nominated for membership in this organization in their junior or senior years.

Matecharlas provides students with the opportunity for informal discussions about 1000-level MATH courses with instructors fluent in Spanish. Brush up your Spanish and/or math skills with Matercharlas! Organized by Math Department faculty member and academic advisor Dr. Fanny Jasso, with support from El Centro (the Hispanic and Latinx Cultural and Community Center), Matecharlas meets weekly at El Centro -- 309 Squires Student Center. Members of the group also talk about careers, academics, experiences, or any combination that includes mathematics. All interested students are welcome. Contact: Dr. Fanny Jasso: **efjasso@vt.edu**

Paid On-Campus Jobs Opportunities in Math

The Mathematics Department and other offices around campus employ both undergraduate and graduate students in a variety of positions that require a background in mathematics. Positions are generally focused in grading for 1000-level or 2000-level MATH classes or tutoring. More information is available at: **https://math.vt.edu/undergrad-math/Jobs.html**

Study Abroad

Global Education Office: **globaleducation.vt.edu**

Students who wish to study abroad should meet with an advisor in the Global Education Office. Together with the Global Education Office, we have created a document outlining some **study abroad opportunities for math majors**.

Mathematical Contests and Competitions

The Putnam Competition: Each December, a nation-wide mathematics examination called the William Lowell Putnam Competition, is given. The examination is graded for individual performances and carries a considerable amount of prestige. In addition, each participating school selects three students whose composite score represents the school.

The Putnam Competition only covers material from undergraduate mathematics, including concepts from analysis, linear algebra, and number theory. In this regard, the problems are "elementary", but often quite tricky. The best way to prepare for the examination is to practice on previous examinations or similar problems.

Mathematical Contest in Modeling: In the Mathematical Contest in Modeling (MCM), three-person teams are given 96 hours to develop mathematical models to solve a real-world problem, evaluate their solution, and write a paper describing the results. These papers are generally around thirty pages long. The questions are open-ended and over a broad range of topics. Past problems include fingerprint identification, submarine tracking, air traffic control, and velociraptor hunting strategies. The following handbook provides detailed information on this prestigious competition, in which Virginia Tech teams have done very well in recent years: **https://www.math.vt.edu/content/dam/math_vt_edu/documents/mcmguide.pdf**

Senior Awards

In each of the four degree options, one student is selected each year as the Outstanding Senior. An overall Outstanding Senior is also selected. All awardees are recognized at an awards

reception in the spring semester. The College of Science has awards for one Outstanding Senior and one Outstanding Researcher among all students in the college, and the Math Department puts forward a nominee for each of these awards.

PREPARATION FOR POST-GRADUATION ENDEAVORS

Career and Professional Development: **career.vt.edu**
Handshake at Virginia Tech: **career.vt.edu/job-search/Handshake**
Math Department Career Advising Website: **math.vt.edu/careers**

Whether you plan to seek employment immediately upon graduation or attend graduate school, you need to start investigating and planning early in your undergraduate career. There is great value in attending career fairs and having summer internships, particularly internships that take place the summer prior to graduation. You should consult with an advisor in the Career and Professional Development office for resume reviews and help with the Handshake platform. In addition, consult with a Mathematics Department Career Advisor and review the many job and internship opportunities that are posted on the Math Department career advising website throughout the year: **math.vt.edu/careers**

In the present economic climate, many jobs are found from past internships or by directly contacting companies, even ones who are not interviewing on campus or ones who do not say they will interview mathematics majors. Talk to a career advisor in the Career and Professional Development office about the best ways to make these contacts. Always be informed about a company/agency and its work before attending an interview.

If you plan to go to graduate school, you should make preliminary inquiries about graduate schools early in your academic career. Talk regularly to your academic advisor and also talk to professors that may have attended the graduate school(s) in which you are interested or whose area of mathematical interest aligns with yours. Many graduate schools require the Graduate Record Examination (GRE). Plan to take it in October of your senior year. Finally, allow enough time for professors to write your letters of reference.

You may wish to consider graduate work in a field other than mathematics; probably in the area of your applied concentration. One need not have a B.S. in a discipline in order to do graduate work in that area. There will, of course, be certain basic courses that you will be expected to have had. Talk with an academic advisor in the other discipline about such courses.

EMPLOYMENT AREAS FOR MATHEMATICS MAJORS AND RELATED SAMPLE COURSES FOR INTERDISCIPLINARY APPLICATION OF MATHEMATICS COURSE PLANS (TRADITIONAL & ACM OPTIONS)

Some general areas where mathematics majors find employment are listed below. After each title, some courses which should help you in the area are listed. These lists are simply examples, though, and many other course options are possible. **Prerequisites are not explicitly noted.**

Not all courses are offered every term. Check the relevant Timetable of Classes to determine the availability of particular classes and prerequisites. Some of the courses listed below might be restricted to majors within that discipline, so enrollment may require a permission from the department offering the course. This permission is decided upon by the offering department, not the Mathematics Department.

Business, Actuarial Science, Finance, or Statistics

ECON	2005-2006	Principles of Economics
FIN	3104	Introduction to Finance
FIN	3134	Financial Analytics
FIN	4114	Financial Planning Technology and Modeling
FIN	4144	International Financial Management

STAT	3005-3006	Statistical Methods
STAT	3104	Probability and Distributions
STAT	4004	Methods of Statistical Computing
STAT	4105-4106	Theoretical Statistics
STAT	4204	Experimental Designs
STAT	4214	Methods of Regression Analysis
STAT	4514	Contingency Table Analysis
STAT	4524	Sample Survey Methods
STAT	4534	Applied Statistical Time Series Analysis
STAT	4604	Statistical Methods for Engineers
STAT	4705-4706	Probability and Statistics for Engineers

NOTE: STAT 2004 is generally not an appropriate course for an IAMCP. Begin statistics courses with STAT 3005-3006.

FIN 3104 is a prerequisite to many advanced courses in finance. Consult the course catalog and **http://www.stat.vt.edu/academics/courses.html** for statistics course duplications.

The Statistics Department offers a minor in actuarial science that includes courses in probability and statistics, economics, and finance. More information can be found at:
https://www.stat.vt.edu/academics/undergraduate/actuarial-science.html

Business Information Technology

BIT	2405-2406	Intro to Business Statistics, Analytics, and Modeling
BIT	3424	Intro to Business Analytics Modeling
BIT	3434	Advanced Modeling for Business Analytics
BIT	3444	Advanced Business Computing and Applications
BIT	4434	Computer Simulation in Business

Computer Science, such as Software Engineering

CS	1114	Intro to Software Design

See the CS course requirements for the ADM option for further suggestions.

Data Analytics

CS	1114	Intro to Software Design

STAT	3005-3006	Statistical Methods

(or CMDA 2005-2006 Integrated Quantitative Sciences)

CMDA 3634	Computer Science Foundations for CMDA
CMDA 3654	Introductory Data Analytics and Visualization
CMDA 4654	Intermediate Data Analytics and Machine Learning
CMDA 4664	Computational Stochastic Modeling

To avoid having credits disallowed due to content duplication, **consult with your advisor before taking any CMDA classes.** Some Math degree requirements can be satisfied by either a MATH class or CMDA class, but a student cannot earn credit for both of those classes. Some IAMCP requirements can be satisfied by either a STAT class or a CMDA class, but not by both. Some CMDA classes do not satisfy the IAMCP requirement.

CMDA double-majors may have taken CMDA 2005-2006 instead of STAT 3005-3006. Successfully completing and earning credit for CMDA 2005 will count as 3 credits toward the IAMCP (considered equivalent to STAT 3005). Successfully completing and earning credit for CMDA 2005 and CMDA 2006 will count for 6 IAMCP credits (considered equivalent to taking STAT 3005 and STAT 3006). A student can earn credit for at most one of MATH 2204 and CMDA 2005. A student can earn credit for at most one of MATH 2214 and CMDA 2006.

Some CMDA courses, such as CMDA 3605, 3606, and 4604 are essentially MATH courses and therefore are not considered "interdisciplinary" or "applications". These courses will not be approved as part of an IAMCP. Students should not include CMDA 2014 as part of an IAMCP; this course is intended for a non-technical audience.

Economics

ECON 2005-2006	Principles of Economics
ECON 3104	Microeconomic Theory
ECON 3204	Macroeconomic Theory
ECON 4124	Growth and Development
ECON 4304	Intro to Econometric Methods
ECON 4424	Theory of Games and Economic Behavior

Engineering - Aerospace Engineering

ESM	2104	Statics
ESM	2204	Mechanics of Deformable Bodies
ESM	2304	Dynamics
AOE	3014	Fluid Dynamics for AOE
AOE	3034	System Dynamics and Control
AOE	3114	Aerodynamics & Compressibility
ME	3134	Fundamentals of Thermodynamics

Engineering - Electrical and Computer Engineering

ECE	2004	Electric Circuit Analysis
ECE	2204	Electronics
ECE	2504	Intro to Computer Engineering
ECE	3054	Electrical Theory
ECE	3105 – 3106	Electromagnetic Fields
ECE	3204	Analog Electronics
ECE	3514	Data Structures and Algorithms
ECE	4134	Photonics

Operations Research

CS	1114	Intro to Software Design
ISE	2404	Deterministic Operations Research I
ISE	3414	Probabilistic Operations Research
ISE	3424	Discrete-Event Computer Simulation
ISE	3434	Deterministic Operations Research II
ISE	3614	Human Factors Engineering and Ergonomics
ISE	4404	Statistical Quality Control
STAT	4105-4106	Theoretical Statistics
STAT	4705-4706	Probability and Statistics for Engineers

MATH 4445-4446 are 4000-level MATH course choices that support this career area.

Physics

PHYS	2305-2306	Foundations of Physics
PHYS	3324	Modern Physics
PHYS	3355-3356	Intermediate Mechanics
PHYS	3405-3406	Intermediate Electricity & Magnetism
PHYS	4614	Optics
PHYS	4714	Intro to Biophysics

NOTE: Students should take PHYS 2305-2306, the calculus-based physics sequence. The non-calculus-based physics sequence, PHYS 2205-2206 will not be approved as part of a math-related or applications area course plan.