APPLIED MATHEMATICS - BACHELOR OF SCIENCE (BSAM)

The Department of Applied Mathematics in the College of Arts and Sciences offers a Bachelor of Science degree in applied mathematics through the College of Engineering and Applied Science. The BS degree is designed to prepare graduates for exciting and diverse professional careers, and for graduate study in a wide variety of disciplines.

Courses at the undergraduate level provide training in a broad range of mathematical techniques and problem--solving strategies. These courses teach the concepts and methods central to applications of linear algebra, ordinary and partial differential equations, numerical analysis, probability, statistics and data science, complex variables and nonlinear dynamics. Since applied mathematicians often are involved in interdisciplinary work, the BS degree requires an in-depth knowledge of some area of science or engineering where mathematics is used. This knowledge prepares graduates to successfully communicate and cooperate with engineers and scientists. The BS degree also requires knowledge of a programming language and skill in using the computer.

For more information, visit the department's Prospective Students (https://www.colorado.edu/amath/prospective-students/undergraduate/) webpage.

Research Opportunities

The Department of Applied Math offers a broad range of undergraduate research opportunities funded by multiple agencies including the National Science Foundation. Working with faculty, applied math students have developed solutions to a variety of problems in fluids, dynamical systems, data analysis, networks, signal processing, math biology, math education and numerics. Students can do both theoretical and experimental work in the Dispersive Hydrodynamics Lab (https://www.colorado.edu/amath/research/dispersive-hydrodynamics-lab/), gain practical experience in statistics and data science through LISA, the Laboratory for Interdisciplinary Statistical Analysis (https://www.colorado.edu/lab/lisa/) or work on individual research projects with departmental and affiliated faculty.

Students can gain professional exposure through the student chapter of the Society of Industrial and Applied Mathematics (SIAM) or through the Data Buffs, the student chapter of the American Statistical Association. Applied Math also has a local chapter of AWM, the Association for Women in Mathematics.

Requirements

Required Courses and Credits

The BS degree in applied mathematics requires the satisfactory completion of a minimum of 128 credit hours as follows. All prerequisite courses must be passed with a C- or better.

Code	Title	Credit Hours
Calculus		
APPM 1350	Calculus 1 for Engineers	4
or APPM 1345	Calculus 1 with Algebra, Part B	
or MATH 1300	Calculus 1	
APPM 1360	Calculus 2 for Engineers	4
or MATH 2300	Calculus 2	
APPM 2350	Calculus 3 for Engineers	4
or MATH 2400	Calculus 3	
Computing Experience		
APPM 1650	Python for Math and Data Science Applications	4
or ASEN 1320	Aerospace Computing and Engineering Applications	
or CSCI 1300	Computer Science 1: Starting Computing	
or CSCI 2275	Programming and Data Structures	
or CHEN 1310	Introduction to Engineering Computing	
or ECEN 1310	C Programming for ECE	
Science Requirement		
PHYS 1110	General Physics 1	4
or PHYS 1115	General Physics 1 for Majors	
PHYS 1120	General Physics 2	4
or PHYS 1125	General Physics 2 for Majors	
PHYS 1140	Experimental Physics 1	1
Select at least 4 additional credits of chemistry or biology (including 1 credit of laboratory science) from one of the following:		4-8
CHEN 1201 & CHEM 1114	General Chemistry for Engineers 1 and Laboratory in General Chemistry 1	
CHEN 1211 & CHEM 1221	Accelerated Chemistry for Engineers and Engineering General Chemistry Lab	
CHEM 1113 & CHEM 1114	General Chemistry 1 and Laboratory in General Chemistry 1	
EBIO 1210 & EBIO 1220 & EBIO 1230 & EBIO 1240	General Biology 1 and General Biology 2 and General Biology Laboratory 1 and General Biology Laboratory 2	
MCDB 1150 & MCDB 2150	Introduction to Cellular and Molecular Biology and Principles of Genetics (and one 2-credit lab) [1]	
PHYS 2130 & PHYS 2150	Introduction to Quantum Mechanics and Its Applications and Experimental Physics 2	
PHYS 2170 & PHYS 2150	Foundations of Modern Physics and Experimental Physics 2	
APPM Courses		
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
or MATH 2130 & MATH 3430	Introduction to Linear Algebra for Non-Mathematics Majors and Ordinary Differential Equations	
APPM 3310	Matrix Methods and Applications	3
APPM 4350	Methods in Applied Mathematics: Fourier Series and Boundary Value Problems	3
APPM 4360	Methods in Applied Mathematics: Complex Variables and Applications	3
APPM 4600	Numerical Methods and Scientific Computing	4
Select one of the following:		3

APPM 4440	Undergraduate Applied Analysis 1	
MATH 3001	Analysis 1	
MATH 3140	Abstract Algebra 1	
APPM or STAT Courses Numbered 4000 or Above		
A two-semester course sequence of applied mathematics or statistics courses numbered 4000 or above in addition to APPM 4350 and APPM 4360. For example:		6-7
APPM 4380 & APPM 4390	Modeling in Applied Mathematics and Modeling in Mathematical Biology	
APPM 4440 & APPM 4450	Undergraduate Applied Analysis 1 and Undergraduate Applied Analysis 2	
APPM 4600 & APPM 4610	Numerical Methods and Scientific Computing and Numerical Differential Equations	
APPM 3570 & STAT 4520	Applied Probability and Introduction to Mathematical Statistics [2]	
APPM 3570 & APPM 4560	Applied Probability and Markov Processes, Queues, and Monte Carlo Simulations [2]	
APPM 4560 & STAT 4520	Markov Processes, Queues, and Monte Carlo Simulations and Introduction to Mathematical Statistics	
STAT 4000 & STAT 4010	Statistical Methods and Application I and Statistical Methods and Applications II	
APPM or STAT Courses Numbered 3000 or Above		
A minimum of 25 credit hours in APPM and/or STAT courses numbered 3000 or above (including the required courses). [3]		25
Area of Application		
A minimum of 24 credit hours in engineering or approved courses with significant mathematical content in Arts & Sciences or Business (see "Recommended Options For Applied Math Majors")		24
General Bachelor's Degree Requirements		
Humanities & social sciences electives [4]		15
Writing [5]		3
Free Electives		
Free electives should be chosen to bring the total credit hours to a minimum of 128.		6
Total Credit Hours		**128-133**

1 Plus one MCDB lab course for 2 credits, chosen from MCDB 1161, MCDB 1171, MCDB 1181, or MCDB 2171.

2 APPM 3570 is the only 3000-level course that can be used to satisfy this requirement.

3 No more than 3 credit hours of APPM 4840 may count toward these 24. No more than 6 credit hours of independent study are allowed for credit toward the BS degree in applied mathematics.

4 Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives (http://www.colorado.edu/engineering/academics/policies/hss/).

5 Students may choose a course from the list of college-approved writing courses (http://www.colorado.edu/engineering/academics/policies/hss/).

Recommended Areas of Application

In order to fulfill their degree requirements, applied mathematics majors are required to take 24 credit hours in engineering or approved courses with significant mathematical content in A&S or business courses, with at least 6 credit hours in courses numbered 3000 or above, and at least 15 credit hours in courses numbered 2000 or above. Here are several possible options. It should be stressed that the listed courses and options are *suggestions* and not *requirements*. Students may formulate their own option to meet their educational and career goals. Final course selection should be made in consultation with an applied math advisor.

These 24 credit hours are in addition to those required credit hours listed in "Computing Experience" and "Science Requirement" (mentioned in the Requirements section). In general, ENES courses may not be used to fulfill this requirement, although they may be used as humanities and social sciences electives. Several possible pre-approved ENES course options are listed below.

I. Actuarial

BCOR 1025 is a prerequisite for BCOR 2203 and BCOR 2204. Students are advised to substitute an applied math prob/stats course for this prerequisite.

Students are required to take APPM 3570[3], STAT 4520[2] and STAT 4540[2,5] for the actuarial option. Students are strongly advised to take STAT 3400, STAT 4400[5] and APPM 4560.[5] Additional courses that may be useful include ACCT 3220 or ACCT 3230. BCOR, FNCE and ACCT courses listed are only available for students enrolled in the Actuarial and Quantitative Finance Certificate Program (https://www.colorado.edu/program/asqf/).

Code	Title	Credit Hours
BCOR 2203	Principles of Accounting I (prerequisites for this course are waived for Actuarial Certificate students)	1.5
BCOR 2204	Principles of Financial Management	1.5
ECON 2010	Principles of Microeconomics [1]	4
ECON 2020	Principles of Macroeconomics [1]	4
ECON 3070	Intermediate Microeconomic Theory [2,4]	4
ECON 4070	Topics in Microeconomics	3
FNCE 3010	Corporate Finance [2,4]	3
Some (or all) of the following courses should be taken:		3-9
FNCE 3030	Investment and Portfolio Management	
FNCE 4040	Derivative Securities	
ECON 4818	Introduction to Econometrics	
Total Credit Hours		**24-30**

1 ECON 2010 and ECON 2020 may not count toward the 24 credit hours of the option requirement; however, they can be used to meet the 18-credit-hour social science/humanities requirement of the College of Engineering.

2 These courses satisfy the Society of Actuaries requirement that students take certain college courses to earn the Validation by Education Experiences (VEE) credit, provided a grade of B- or better is obtained. These courses are also required for students completing the Actuarial Certificate Program. VEE credit is granted for BCOR 2203, BCOR 2204 and FNCE 3010.

[3] The first actuarial examination, Exam P/1, can be taken after completing this course.

[4] The second actuarial examination, Exam FM/2, can be taken after completing these courses, as well as a self-study in interest theory.

[5] The third and fourth actuarial exams, Statistics for Risk Modeling and Fundamentals of Actuarial Mathematics, require several statistics courses and independent study. Students should consult the website for the Society of Actuaries (https://soa.org/) for details.

II. Aerospace Engineering Sciences

Students who pursue this option are usually double majors. Students who wish to enroll in ASEN courses without being a double major should see their applied mathematics advisor for next steps.

III. Chemical Engineering

Students choosing this option must take CHEN 1310 as part of their applied math major. CHEN 1310 is a prerequisite for CHEN 2120.

Code	Title	Credit Hours
CHEN 1211 & CHEM 1221	Accelerated Chemistry for Engineers and Engineering General Chemistry Lab	5
Recommended courses:		20
CHEN 2120	Chemical Engineering Material and Energy Balances	
CHEN 3200	Chemical Engineering Fluid Mechanics	
CHEN 3210	Chemical Engineering Heat and Mass Transfer	
CHEN 3220	Chemical Engineering Separations	
CHEN 3320	Chemical Engineering Thermodynamics	
CHEN 4521	Physical Chemistry for Engineers	
CHEN 4330	Kinetics and Reactor Design	
CHEM 3311	Organic Chemistry 1	
Total Credit Hours		**25**

IV. Civil, Environmental and Architectural Engineering

Students wishing to enroll in CVEN courses that are restricted to majors only must do so through the departmental course request form (https://www.colorado.edu/engineering-advising/departmental-course-request-forms/).

Code	Title	Credit Hours
Recommended Basic Courses		
CVEN 2121	Analytical Mechanics 1	3
AREN 2110	Thermodynamics	3
CVEN 3161	Mechanics of Materials 1	3
CVEN 3313	Theoretical Fluid Mechanics	3
or AREN 2120	Fluid Mechanics and Heat Transfer	
Additional Courses		
Select two courses from any one of the following groups plus additional courses to bring the total credit hours to 24:		12
Group A		
CVEN 3414	Fundamentals of Environmental Engineering	
CVEN 4333	Engineering Hydrology	
Group B		
CVEN 3525	Structural Analysis	
CVEN 3708	Geotechnical Engineering 1	
CVEN 4545	Steel Design	
CVEN 4555	Reinforced Concrete Design	
Group C		
AREN 2050	Building Materials and Systems	
AREN 3010	Energy Efficient Buildings	
AREN 3540	Illumination I	
Total Credit Hours		**24**

V. Computational Biology and Bioinformatics

The following concentration of selected courses from computer science, biology and chemistry provide the foundation for work in mathematical biology, computational biology and/or bioinformatics.

Students selecting this option are advised to take APPM 3570, STAT 4520, STAT 4540 and APPM 4390 as part of their applied math coursework. Other recommended courses include CSCI 3287.

Code	Title	Credit Hours
CSCI 2270	Computer Science 2: Data Structures	4
CHEM 3311 & CHEM 3321	Organic Chemistry 1 and Laboratory in Organic Chemistry 1	5
MCDB 1150 & MCDB 1152	Introduction to Cellular and Molecular Biology and Problem Solving Co-Seminar for Introduction to Molecular and Cellular Biology	4
MCDB 2150 & MCDB 2152	Principles of Genetics and Problem Solving Co-Seminars for Genetics	4
MCDB 3135 & MCDB 3140	Molecular Biology and Cell Biology Laboratory	5
CSCI 3104	Algorithms	4
CSCI 4314	Dynamic Models in Biology	3
Total Credit Hours		**29**

VI. Computer Science

Students completing the computer science option should have a minor in computer science (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/computer-science-minor/). Check with the Computer Science Department (https://www.colorado.edu/cs/).

Code	Title	Credit Hours
Required Course		
CSCI 2270	Computer Science 2: Data Structures	4
Additional Courses		
At least two of these must be at the 3000 level. Possible choices include:		20
CSCI 2400	Computer Systems	
CSCI 3104	Algorithms	
CSCI 3155	Principles of Programming Languages	

CSCI 3287	Design and Analysis of Database Systems	
CSCI 3308	Software Development Methods and Tools	
CSCI 3753	Design and Analysis of Operating Systems	
Additional CSCI courses to bring the total number of credit hours to at least 24		
Total Credit Hours		**24**

VII. Creative Technology and Design

Students are advised to take APPM 3570, APPM 4560 and APPM 4610 as part of their applied math coursework.

Students may wish to consider the creative technology and design minor (https://www.colorado.edu/atlas/academics/undergraduate/ctd-minor/).

Code	Title	Credit Hours
Required Courses		
ATLS 2000	The Meaning of Information Technology [1]	3
ATLS 2100	Image	3
ATLS 2200	Web	3
ATLS 2300	Text	3
ATLS 1300	Computational Foundations 1	4
CSCI 2270	Computer Science 2: Data Structures	4
CSCI 3104	Algorithms	4
CSCI 4229	Computer Graphics	3
Additional Courses		
Recommended additional courses to bring the total to at least 24 credit hours:		4
Advisor-approved technical electives to complete the ATLAS/TAM Certificate in Digital Media		
CSCI 3202	Introduction to Artificial Intelligence	
CSCI 4448	Object-Oriented Analysis and Design	
Total Credit Hours		**31**

[1] This course may be used to satisfy either 3 credit hours of H&SS requirement or the applied math area of application, but not both.

VIII. Electrical, Computer & Energy Engineering

Students interested in this option should consult with an advisor in the Department of Electrical and Computer Engineering as several areas are available (computer engineering, electrical engineering, quantum computing and signals, and systems) and can lead to one of that department's minors. A minimum of 24 credits is required.

IX. Engineering Physics/Physics

Students completing the physics option should have a minor in physics (https://catalog.colorado.edu/undergraduate/colleges-schools/arts-sciences/programs-study/physics/physics-minor/). Check with the Physics Department (https://www.colorado.edu/physics/).

Code	Title	Credit Hours
Recommended courses after first-year Physics: [1]		
PHYS 2130	Introduction to Quantum Mechanics and Its Applications	3
or PHYS 2170	Foundations of Modern Physics	
PHYS 2150	Experimental Physics 2	1
PHYS 2210	Classical Mechanics and Mathematical Methods 1	3
PHYS 3210	Classical Mechanics and Mathematical Methods 2	3
PHYS 3220	Quantum Mechanics 1	3
PHYS 3310	Principles of Electricity and Magnetism 1	3
PHYS 3320	Principles of Electricity and Magnetism 2	3
PHYS 3330	Electronics for the Physical Sciences	2
or PHYS 4230	Thermodynamics and Statistical Mechanics	
Additional Physics courses to total at least 24 credits		3
Total Credit Hours		**24**

[1] Students choosing this option are advised to take APPM 3570 (Applied Probability – 3 cr.).
MATH 3140 (Abstract Algebra 1 – 3 cr.) may also be useful for students interested in theoretical physics.

X. Finance

Students wishing to take College of Business courses must apply for admittance to the Actuarial Studies and Quantitative Finance Certificate Program (http://www.colorado.edu/asqf/.html). Students accepted into this program receive preferential treatment with respect to other non-business students when registering for business courses. For more information, please see your applied math advisor.

Students doing the Finance Option are required to take APPM 3570 and STAT 4520 as part of the major's required 24 upper-division credits. Students are advised to take APPM 4560 and STAT 4540 if time permits.

Code	Title	Credit Hours
The Following courses should be taken as part of the 24 credits required in the option:		
BCOR 2203	Principles of Accounting I	1.5
BCOR 2204	Principles of Financial Management	1.5
FNCE 3010	Corporate Finance	3
ECON 2010	Principles of Microeconomics [1]	4
ECON 2020	Principles of Macroeconomics [1]	4
ECON 3070	Intermediate Microeconomic Theory	4
ECON 4818	Introduction to Econometrics	3
A minimum of two of the following courses must be taken in order to meet the 24 credit requirements of the option. All of them must be taken to complete the requirements of the Quantitative Finance Program		6
ACCT 3220	Corporate Financial Reporting 1	
FNCE 3030	Investment and Portfolio Management	
FNCE 4040	Derivative Securities	
FNCE 4820	Topics in Finance	
FNCE 4070	Financial Markets and Institutions	
Additional courses that may be taken as time permits		

ACCT 3230	Corporate Financial Reporting 2	
FNCE 4000	Financial Institutions Management	
FNCE 4050	Capital Investment Analysis	
FNCE 4060	Special Topics in Finance	
Total Credit Hours		**27**

[1] ECON 2010, ECON 2020 may not count toward the 24 credits of the option requirement; however, they can be used to meet the 18-credit social science/ humanities requirement of the College of Engineering.

Additional courses that may be taken as time permits:

Code	Title	Credit Hours
ACCT 3230	Corporate Financial Reporting 2	3
FNCE 4000	Financial Institutions Management	3
FNCE 4050	Capital Investment Analysis	3
FNCE 4060	Special Topics in Finance	1-6

XI. Geographic Information Science (GIS)

Students completing the geographic information science option should qualify to receive a certificate in GIS and computational science. Check with the faculty contacts for the GIS Certificate Program (https://www.colorado.edu/geography/undergraduate-certificate-gis-and-computational-science/).

Code	Title	Credit Hours
GEOG 3023	Statistics and Geographic Data	4
CSCI 2270	Computer Science 2: Data Structures	4
GEOG 3053	Geographic Information Science: Mapping	4
GEOG 4103	Geographic Information Science: Spatial Analytics	4
Additional Courses		
Additional courses to bring the total number of credits to 24. Possible choices include:		8
GEOG 4023	Advanced Quantitative Methods for Spatial Data	
GEOG 4303	Geographic Information Science: Spatial Programming	
GEOG 4403	Geographic Information Science: Space Time Analytics	
GEOG 4503	Geographic Information Science: Project Management	
GEOL 3050	GIS for Geologists	
Total Credit Hours		**24**

XII. Geological Sciences

Students completing the geological sciences option should have a minor in geology (https://catalog.colorado.edu/undergraduate/colleges-schools/arts-sciences/programs-study/geological-sciences/geology-minor/). Check with the Geological Sciences Department (https://www.colorado.edu/geologicalsciences/).

Code	Title	Credit Hours
Required Courses		
One of the following introductory sequences:		6
GEOL 1010 & GEOL 1020	Exploring Earth and Dodos, Dinos, and Deinococcus: The History of a Habitable Planet	
GEOL 1040 & GEOL 1010	Geology of Colorado and Exploring Earth	
GEOL 1060 & GEOL 1010	Global Change: An Earth Science Perspective and Exploring Earth	
Required Lab Course:		
GEOL 1030	Introduction to Geology Laboratory 1	1
Additional Courses		
Additional courses to bring the total number of credits to 24; at least two of these must be at the 3000 level		17
GEOL 2700	Introduction to Field Geology	
GEOL 3010	Introduction to Mineralogy	
GEOL 3023	Statistics and Geographic Data	
GEOL 3120	Structural Geology	
GEOL 3410	Paleobiology	
GEOL 3430	Sedimentology and Stratigraphy	
GEOL 4093	Remote Sensing of the Environment	
GEOL 4241	Earth Surface Processes	
Total Credit Hours		**24**

XIII. Mechanical Engineering

Students choosing this option are advised to take STAT 4000 or APPM 3570 and STAT 4520 as part of their applied math major.

Students wishing to enroll in MCEN courses that are restricted to majors only must do so through the departmental course request form (https://www.colorado.edu/engineering-advising/departmental-course-request-forms/).

Code	Title	Credit Hours
Recommended Courses		
MCEN 2023	Statics and Structures	3
MCEN 2043	Dynamics	3
MCEN 2063	Mechanics of Solids	3
MCEN 3012	Thermodynamics	3
MCEN 3021	Fluid Mechanics	3
MCEN 3022	Heat Transfer	3
MCEN 3025	Component Design	3
MCEN 4043	System Dynamics	3
Total Credit Hours		**24**

XIV. Statistics and Data Science

Students will take the courses in statistics for the APPM Statistics Minor (https://catalog.colorado.edu/undergraduate/colleges-schools/arts-sciences/programs-study/applied-mathematics/statistics-minor/) plus additional coursework chosen from Computer Science (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/computer-science/), College of Media, Communication and Information, (https://catalog.colorado.edu/undergraduate/colleges-schools/media-communication-information/) Technology, Arts and Media (https://catalog.colorado.edu/undergraduate/colleges-schools/engineering-applied-science/programs-study/technology-arts-media/) or another relevant area as approved by the advisor.

Students choosing this option must complete STAT 2600 as part of the statistics minor; APPM 1650 and APPM 3650 are strongly recommended.

Students completing the statistics & data science option may qualify for an applied mathematics minor in statistics (https://catalog.colorado.edu/undergraduate/colleges-schools/arts-sciences/programs-study/applied-mathematics/statistics-minor/) and should check with their advisor for confirmation. Students may earn a BS in applied mathematics and a minor in statistics. The 12 upper-division statistics credits required for the minor may not be counted toward the 25 credits of upper-division math courses for the bachelor's degree.

XV. Advisor Approved Option

Students may formulate their own option to meet their educational and career goals. In order to fulfill their degree requirements, applied mathematics majors are required to take 24 credit hours in engineering or advisor-approved courses with significant mathematical content in A&S or business courses, with at least 6 credit hours in courses numbered 3000 or above and at least 15 credit hours in courses numbered 2000 or above. These 24 credit hours are in addition to those required credit hours listed in "Computing Experience" and "Science Requirement" (mentioned in the Requirements section). In general, ENES courses may not be used to fulfill this requirement, although they may be used as humanities and social sciences electives.

Final course selection should be made in consultation with an applied math advisor.

Recommended Four-Year Plan of Study

Students must complete 128 hours for graduation.

Year One		
Fall Semester		**Credit Hours**
APPM 1350	Calculus 1 for Engineers	4
CHEN 1201	General Chemistry for Engineers 1	4
CHEM 1114	Laboratory in General Chemistry 1	1
APPM 1650	Python for Math and Data Science Applications	4
COEN 1830	Special Topics (First-Year Engineering Seminar)	1
Humanities or Social Sciences Elective [1]		2
	Credit Hours	**16**
Spring Semester		
APPM 1360	Calculus 2 for Engineers	4
PHYS 1110	General Physics 1	4
Free Electives		3
Tech Elective (Area of Emphasis)		3
Humanities or Social Sciences Elective [1]		3
	Credit Hours	**17**
Year Two		
Fall Semester		
APPM 2350	Calculus 3 for Engineers	4
PHYS 1120	General Physics 2	4
PHYS 1140	Experimental Physics 1	1
APPM 3170	Discrete Applied Mathematics	3
Humanities or Social Sciences Elective [1]		3
	Credit Hours	**15**
Spring Semester		
APPM 2360	Introduction to Differential Equations with Linear Algebra	4
APPM 2460	Differential Equations Computer Lab (Recommended, but not required)	1
APPM 3310	Matrix Methods and Applications	3
Technical Electives (Area of Emphasis)		3
Free Electives		3
Humanities or Social Sciences Elective [1]		3
	Credit Hours	**17**
Year Three		
Fall Semester		
APPM 4350	Methods in Applied Mathematics: Fourier Series and Boundary Value Problems	3
APPM 4440	Undergraduate Applied Analysis 1	3
Technical Electives (Area of Emphasis)		6
College-approved writing course [2]		3
	Credit Hours	**15**
Spring Semester		
APPM 3XXX		3
APPM 4360	Methods in Applied Mathematics: Complex Variables and Applications	3
Technical Electives (Area of Emphasis)		3
Free Electives		4
Humanities or Social Sciences Elective [1]		3
	Credit Hours	**16**
Year Four		
Fall Semester		
APPM 4600	Numerical Methods and Scientific Computing	4
APPM 4XXX		3
Technical Electives (Area of Emphasis)		6
Free Electives		3
	Credit Hours	**16**
Spring Semester		
APPM 4610	Numerical Differential Equations (or other course to complete senior sequence)	3
APPM 4XXX		3
Technical Electives (Area of Emphasis)		3
Free Electives		7
	Credit Hours	**16**
	Total Credit Hours	**128**

[1] Students may choose courses from the list of college-approved humanities and social sciences (HSS) electives (http://www.colorado.edu/engineering/academics/policies/hss/).

[2] Students may choose a course from the list of college-approved writing courses (http://www.colorado.edu/engineering/academics/policies/hss/).

Learning Outcomes

Content Knowledge

Students completing the undergraduate degree in Applied Mathematics will be broadly knowledgeable in a number of mathematical areas including:

- Differential and integral calculus in one and several variables.
- Vector spaces and matrix algebra.
- Ordinary and partial differential equations.
- At least one programming language.
- At least one application software package in either mathematics or statistics.
- Methods of complex variables as used in applications.
- Numerical solutions of linear and nonlinear problems.
- An in-depth knowledge of an area of application (statistics, an engineering discipline, a natural science field, or one of the quantitative areas of business and economics).

Student Outcomes

Upon graduation, students will:

- Acquire foundational knowledge in calculus, ordinary and partial differential equations, vector spaces and matrix methods, analysis, numerical analysis, complex variables, and probability and statistics.
- Develop proficiency in at least one programming language.
- Acquire an in-depth knowledge of an area of application (statistics, an engineering or natural science field, or one of the quantitative areas of finance and economics).
- Acquire problem-solving and modeling skills that allow them to formulate a real-world problem in a mathematical setting and implement a numerical solution.
- The ability to clearly and concisely, in oral and in written forms, communicate analytic arguments.

Bachelor's–Accelerated Master's Degree Program(s)

The bachelor's–accelerated master's (BAM) degree program options offer currently enrolled CU Boulder undergraduate students the opportunity to receive a bachelor's and master's degree in a shorter period of time. Students receive the bachelor's degree first but begin taking graduate coursework as undergraduates (typically in their senior year).

Because some courses are allowed to double count for both the bachelor's and the master's degrees, students receive a master's degree in less time and at a lower cost than if they were to enroll in a stand-alone master's degree program after completion of their baccalaureate degree. In addition, staying at CU Boulder to pursue a bachelor's–accelerated master's program enables students to continue working with their established faculty mentors.

BS and MS in Applied Mathematics

Admissions Requirements

In order to gain admission to the BAM program named above, a student must meet the following criteria:

- Have a cumulative GPA of 3.40 or higher.
- Have a minimum GPA of 3.40 in APPM and MATH courses.
- Have at least junior class standing.
- Completion of all MAPS requirements and no deficiencies remaining (students admitted to CU Boulder prior to Summer 2023 only).
- Satisfactory completion of at least two APPM courses numbered 3000 or higher.
- Two letters of recommendation from CU Boulder Department of Applied Mathematics faculty.

Program Requirements

Students may take up to and including 12 graduate credit hours while in the undergraduate program which can later be used toward the master's degree. However, only six credits may be double counted toward the bachelor's degree and the master's degree. Students must apply to graduate with the bachelor's degree, and apply to continue with the master's degree, early in the semester in which the undergraduate requirements will be completed.

Please see the Applied Mathematics/Applied Mathematics BAM degree program (https://www.colorado.edu/amath/academics/bs-ms-program/) webpage for more information.