BACHELOR OF SCIENCE IN APPLIED MATHEMATICS

The primary aim of applied mathematics is to elucidate scientific concepts and to describe and predict phenomena through the use of mathematics. The applied mathematician is at once a mathematical specialist and a systems analyst whose task is to confront complex real-world problems with mathematical analysis. In business and industry, the applied mathematician has opportunities to utilize both background and training in solving problems of a practical nature. To do so, one must know the mathematical theories involved and have an appreciation for the specific science or technology that provides the source of the problem. CR/NC grades are not acceptable in courses to be counted for a mathematics major or minor program.

Program Learning Outcomes

Upon completion of the Bachelor of Science in Applied Mathematics a student will be able to:

a. develop basic programming skills and use of various software such as Mathematica, Matlab, SAS, and R; apply these skills to solve problems in optimization, applied linear algebra, differential equations, and statistical inference.
b. formulate and analyze mathematical conjectures, construct proofs in sound mathematical English, and use these skills to write proofs of statements in linear algebra, abstract algebra, and analysis.
c. develop practical insights in modeling real-world phenomena using a model toolbox of (partial) differential equations, optimization, applied analysis and linear algebra, and use numerical methods to obtain solutions in probing such models.
d. communicate effectively to a variety of audiences using oral, written, and visual modes.

Applied Mathematics (B.S.) — 55 units minimum

CR/NC grades are not acceptable in courses to be counted for a mathematics major program.

Required Courses (40-44 units)

Code	Title	Units
MATH 226	Calculus I	4
MATH 227	Calculus II	4
MATH 228	Calculus III	4
MATH 301GW	Exploration and Proof - GWAR	3
Select One:		3-7
MATH 209	Mathematical Computing	
CSC 101 & CSC 215	Introduction to Computing and Intermediate Computer Programming	
CSC 309	Computer Programming	
MATH 325	Linear Algebra	4
Select One:		3
MATH 335	Modern Algebra	
MATH 370	Real Analysis I	
MATH 380	Introduction to Complex Analysis	
MATH 376	Ordinary Differential Equations I	3
MATH 400	Numerical Analysis	3
MATH 440	Probability and Statistics I	3
MATH 460	Mathematical Modeling	3
MATH 696 & MATH 697	Applied Mathematics Project I and Applied Mathematics Project II	3

Electives (15 units)

Code	Title	Units
Select six units of the following:		6
MATH 430	Mathematics of Optimization	
MATH 442	Probability Models	
MATH 447	Design and Analysis of Experiments	
MATH 448	Introduction to Statistical Learning and Data Mining	
MATH 449	Categorical Data Analysis	
MATH 471	Fourier Analysis and Applications	
MATH 477	Partial Differential Equations	
MATH 491	Game Theory	
MATH 495	Introduction to Wavelets and Frames with Applications	
A coherent collection of three courses emphasizing applications of mathematics, chosen with the consent of the applied mathematics advisor		9

General Education Requirements

Requirement	Course Level	Units	Area Designation
Oral Communication	LD	3	A1
Written English Communication	LD	3	A2
Critical Thinking	LD	3	A3
Physical Science	LD	3	B1
Life Science	LD	3	B2
Lab Science	LD	1	B3
Mathematics/ Quantitative Reasoning	LD	3	B4
Arts	LD	3	C1
Humanities	LD	3	C2
Arts or Humanities	LD	3	C1 or C2
Social Sciences	LD	3	D1
Social Sciences: US History	LD	3	D2
Lifelong Learning and Self-Development (LLD)	LD	3	E
Ethnic Studies	LD	3	F
Physical and/or Life Science	UD	3	UD-B
Arts and/or Humanities	UD	3	UD-C
Social Sciences	UD	3	UD-D
SF State Studies			

Courses certified as meeting the SF State Studies requirements may be upper or lower division in General Education (GE), a major or minor, or an elective.			
American Ethnic and Racial Minorities	LD or UD	3	AERM
Environmental Sustainability	LD or UD	3	ES
Global Perspectives	LD or UD	3	GP
Social Justice	LD or UD	3	SJ

Note: LD = Lower-Division; UD = Upper-Division.

First-Time Student Roadmap (4 Year)

The roadmaps presented in this Bulletin are intended as suggested plans of study and do not replace meeting with an advisor. For a more personalized roadmap, please use the Degree Planner (https://registrar.sfsu.edu/degreeplanner/) tool found in your Student Center.

First-Time Student Roadmap (http://bulletin.sfsu.edu/colleges/science-engineering/mathematics/bs-applied-mathematics/roadmap-i-ii-eng/)

SF State Scholars Roadmap

The San Francisco State Scholars program provides undergraduate students with an accelerated pathway to a graduate degree. Students in this program pursue a bachelor's and master's degree simultaneously. This program allows students to earn graduate credit while in their junior and/or senior year, reducing the number of semesters required for completion of a master's degree.

Bachelor of Science in Applied Mathematics, Master of Arts in Mathematics Scholars Roadmap (http://bulletin.sfsu.edu/colleges/science-engineering/mathematics/scholars-roadmap-bs-applied-mathematics-ma-mathematics/)

Transfer Student Roadmap (2 Year)

For students with an AS-T in **Mathematics**.
MATH ADT Roadmap (http://bulletin.sfsu.edu/colleges/science-engineering/mathematics/bs-applied-mathematics/adt-roadmap/)

This degree program is an approved pathway ("similar" major) for students earning the ADT in Applied Mathematics

California legislation SB 1440 (2009) mandated the creation of the Associate Degree for Transfer (ADT) to be awarded by the California Community Colleges. Two types of ADTs are awarded: Associate in Arts for Transfer (AA-T) and Associate in Science for Transfer (AS-T).

Note: no specific degree is required for admission as an upper-division student. However, the ADT includes specific guarantees related to admission and graduation and is designed to clarify the transfer process and strengthen lower-division preparation for the major.

An ADT totals 60 units and in most cases includes completion of all lower-division General Education requirements and at least 18 units in a specific major. (The Biology, Chemistry, and Environmental Science AS-T degrees defer 3 units in lower-division GE area C and 3 units in lower-division GE area D until after transfer.) Students pursuing an ADT are guaranteed admission to the CSU if minimum eligibility requirements are met, though not necessarily to the CSU campus of primary choice.

Upon verification that the ADT has been awarded prior to matriculation at SF State, students are guaranteed B.A. or B.S. completion in 60 units if pursuing a "similar" major after transfer. Determinations about "similar" majors at SF State are made by faculty in the discipline.

Degree completion in 60 units cannot be guaranteed when a student simultaneously pursues an additional major, a minor, certificate, or credential.

A sample advising roadmap for students who have earned an ADT and continue in a "similar" major at SF State is available on the Roadmaps tab on the degree requirements page for the major. The roadmap displays:

- How many lower-division units required for the major have been completed upon entry based on the award of a specific ADT;
- Which lower-division requirements are considered complete upon entry based on the award of a specific ADT;
- How to complete the remaining 60 units for the degree in four semesters.

Students who have earned an ADT should seek advising in the major department during the first semester of attendance.

General Advising Information for Transfer Students

a. Before transfer, complete as many lower-division requirements or electives for this major as possible.
b. The following courses are not required for admission but are required for graduation. Students are strongly encouraged to complete these units before transfer; doing so will provide more flexibility in course selection after transfer.
    - a course in U.S. History
    - a course in U.S. & California Government

For information about satisfying the requirements described in (1) and (2) above at a California Community College (CCC), please visit http://www.assist.org (http://assist.org). Check any geographically accessible CCCs; sometimes options include more than one college. Use ASSIST to determine:

- Which courses at a CCC satisfy any lower-division major requirements for this major;
- Which courses at a CCC satisfy CSU GE, US History, and US & CA Government requirements.

Remedial courses are not transferable and do not apply to the minimum 60 semester units/90 quarter units required for admission.

Additional units for courses that are repeated do not apply to the minimum 60 units required for upper-division transfer (for example, if a course was not passed on the first attempt or was taken to earn a better grade).

Before leaving the last California Community College of attendance, obtain a summary of completion of lower-division General Education units (IGETC or CSU GE Breadth). This is often referred to as a GE certification worksheet. SF State does not require delivery of this certification to Admissions, but students should retain this document for verifying degree progress after transfer.

Credit for Advanced Placement, International Baccalaureate, or College-Level Examination Program courses: AP/IB/CLEP credit is not automatically transferred from the previous institution. Units are transferred only when an official score report is delivered to SF State. Credit is based on the academic year during which exams were taken. Refer to the University Bulletin in effect during the year of AP/IB/CLEP examination(s) for details regarding the award of credit for AP/IB/CLEP.

Students pursuing majors in science, technology, engineering, and mathematics (STEM) disciplines often defer 6-9 units of lower-division General Education in Areas C and D until after transfer to focus on preparation courses for the major. This advice does not apply to students pursuing associate degree completion before transfer.

Transferring From Institutions Other Than CCCs or CSUs

Review SF State's lower-division General Education requirements. Note that, as described below, the four basic skills courses required for admission meet A1, A2, A3, and B4 in the SF State GE pattern. Courses that fulfill the remaining areas of SF State's lower-division GE pattern are available at most two-year and four-year colleges and universities.

Of the four required basic skills courses, a course in critical thinking (A3) may not be widely offered outside the CCC and CSU systems. Students should attempt to identify and take an appropriate course no later than the term of application to the CSU. To review more information about the A3 requirement, please visit bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL.

Waiting until after transfer to take a single course at SF State that meets both US and CA/local government requirements may be an appropriate option, particularly if transferring from outside of California.