

## **Applied and Computational Mathematics B.S. and Minor**



### **Contact Information**

#### **Dr. Kyle Riley**

Department of Mathematics  
and Computer Science  
McLaury 308  
(605) 394-2471  
E-mail: [Kyle.Riley@sdsmt.edu](mailto:Kyle.Riley@sdsmt.edu)

### **Faculty**

Professors Corwin, Johnson, Logar, and Teets;  
Associate Professors Braman, Burgoyne,  
McGough, Kowalski and Riley; Assistant  
Professors Dahl, Fleming, and Geary; Instructors  
Lofberg and Trimble; Emeritus Faculty, Benson,  
Carda, Grimm, and Opp.

### **General Information**

Mathematics is a broad field of study that is foundational to many areas of Science and Engineering. The Department of Mathematics and Computer Science offers a bachelor of science degree in applied and computational mathematics. This degree program emphasizes computational methods and the use of technology applied to the mathematical problems in industry and the sciences. Students who desire to major in this program should announce their intention to the Department of Mathematics and Computer

Science as early as possible and should consult advisors in the department at each registration period before selecting electives to round out the courses of study outlined in the departmental curriculum. Any student who is pursuing a double major and whose designated advisor is in another department should consult an advisor in the mathematics and computer science department at each registration to ensure that reasonable progress is being made and that conflicts are avoided.

### **Prerequisite and Placement Information**

Before registering for any course in mathematics, a student must either have met all prerequisites and be enrolled in all co-requisites, passed the appropriate placement examinations, or have obtained permission from the head of the mathematics and computer science department. Placement examinations, however, may only be used for initial mathematics course placement (exception — students successfully completing Math 021 may skip Math 101 and proceed to Math 102 if they have obtained the written permission of the Vice President for Academic Affairs and earned a successful Algebra Placement Examination score.) Please see the course descriptions in this catalog for all information related to prerequisites and placement. Again, placement exams (with the exception noted above) may only be used for initial placement. For example, a student enrolled in (MATH 120: Trigonometry), must pass this course with at least a “C” before being allowed to enroll in MATH 125; a student receiving below a “C” in trigonometry may not use a placement examination to skip a repeat of Trigonometry before enrolling in MATH 125. Placement examinations are given prior to registration each semester.

Students transferring from other institutions or returning to the School of Mines after interrupting studies for a period of one year or more should consult the head of the Department of Mathematics and Computer Science to discuss proper placement.

## **Departmental Courses**

MATH 021 and 101 may not be used for credit toward any bachelor's degree at School of Mines. College algebra, trigonometry, and pre-calculus courses may not be counted toward any mathematics, computer science, or engineering degree. Other majors should consult their departments on policies regarding these courses.

In an attempt to help students plan their future semesters, the following information is presented. This reflects the best available knowledge at the time of the preparation of this document. This is not meant as a guarantee of when classes will be offered. Students concerned about when classes will be offered should contact the department head for any changes to the following. Courses not listed below have no defined rotation and will be offered contingent upon demand and staff availability. Summer offerings are highly dependent on staffing. An attempt will be made to offer MATH 102, MATH 120, MATH 123, MATH 125, MATH 225, and MATH 321 during the summer session.

Classes that are typically offered every semester include MATH 101, MATH 102, MATH 120, MATH 123, MATH 125, MATH 225, MATH 321, MATH 373, and MATH 381.

Classes that are typically offered every fall semester include MATH 281, and MATH 486.

Classes that are typically offered every spring semester include MATH 315, MATH 382, MATH 441, and MATH 353.

Classes that are typically offered in the fall semester of even numbered years, for example fall 2010, include MATH 413 and MATH 431.

Classes that are typically offered in the spring semester of odd numbered years, for example spring 2011, include MATH 421, and MATH 463.

Classes that are typically offered in the fall semester of odd numbered years, for example fall 2009, include MATH 432 and MATH 423.

Classes that are typically offered in the spring semester of even numbered years, for example spring 2010, include MATH 424, MATH 451, and MATH 447.

## **Applied and Computational Mathematics Major**

Students majoring in mathematics will use the accompanying applied and computational mathematics curriculum. The curriculum includes 56 credits of mathematics courses, 11 credits of computer science, 10 credits of sciences, and at least 9 credits of additional science and engineering courses that fall in a specific field (see emphasis area below). Any student majoring in mathematics who desires a minor in another field should consult his or her advisor in the Department of Mathematics and Computer Science as early in the program of study as possible. In addition, the student must contact the Office of the Registrar and Academic Services in order to declare a minor. Departmental majors contemplating a career in actuarial science should prepare for the examinations given by the Society of Actuaries. It is recommended that this preparation be attained, in part, by electing courses from: MATH 353, MATH 381, MATH 382, MATH 463, MATH 447, IENG 362, and IENG 301 or IENG 302. Information concerning these examinations can be obtained from the Department of Mathematics and Computer Science.

The primary goal of the applied and computational mathematics program is to give graduates a firm understanding of mathematics and its applications to science and engineering. Graduates are expected to develop a strong foundation of knowledge and skill in the core areas of analysis, differential equations, numerical methods, and modeling. They are also expected to attain a basic understanding of probability, statistics, and algebra. Because applied mathematicians are problem solvers, graduates must develop the ability to formulate and solve problems arising from scientific and engineering applications. This entails acquiring fundamental knowledge in the basic sciences, which School of Mines students accomplish by taking courses in an emphasis area. The student will take three courses in an external discipline that will provide exposure and depth in an application area of mathematics. Information on emphasis areas and

the associated courses is available from the department or advisor.

Graduates must be prepared to continue learning throughout their careers. In the two-course sequence of MATH 498 and MATH 402, students will have the opportunity to work with individual faculty members on research and develop their communication skills. This work will result in a technical paper and an oral presentation.

Upon graduation, some graduates pursue careers in fields such as computer software development, actuarial science, applied statistics, data analysis, and operations research. Others go on to pursue advanced degrees in mathematics or seek certification to teach mathematics at the elementary or secondary levels.

An applied and computational mathematics major must complete a minimum of 16 credit hours in humanities and social sciences with at least 6 credit hours in humanities and at least 6 credit hours in social sciences. Refer to the humanities and social sciences section of this catalog for a list of courses satisfying these requirements. It is also important to refer to the general education core requirements under bachelor of science graduation requirements for further information. Students must complete the general education core requirements within the first 64 credits.

The accompanying sample schedule lists all required classes for the degree in their proper prerequisite sequence. Students should consult course listings for prerequisites and should consult their advisors at each registration.

### **Minor in Mathematics**

The core requirements for a minor in mathematics are MATH 123, MATH 125, MATH 225, and the completion of CSC 251 or MATH 221. In addition, students must also successfully complete MATH 423 or MATH 413 plus the completion of at least 6 credit hours from: MATH 315, MATH 381, MATH 382, or any MATH course 400-level and above, excluding Special Topics and Independent Studies courses. Thus, a total of at least 23 semester credit hours is needed

for a Math minor. MATH 423 and MATH 413 are offered in alternate years so plans for a minor should be made early.

A minor in the Department of Mathematics and Computer Science must be approved by the student's major department. A form for declaring a minor is available at the Office of the Registrar and Academic Services. The form must be completed and signed by the department heads from both departments involved in this minor.

### **Double Major with Mathematics**

Due to the large number of courses that many majors have in common with the mathematics major, many students find it attractive to pursue a double major. Students are encouraged to pursue the double major and should contact their advisor for details.

### **Applied and Computational Mathematics Curriculum**

For the bachelor of science in mathematics, a student must:

1. Take all of the courses listed in the applied and computational mathematics curriculum checklist;
2. Take 3 emphasis area courses (information about emphasis areas and supporting courses is available from the department); and
3. Have a departmental grade point average of at least 2.00 in all mathematics courses 300 level or higher. (Courses taken more than once will have only the higher grade counted for computing the departmental grade point average.)

### **Applied and Computational Mathematics Curriculum/Checklist**

It is the student's responsibility to check with his or her advisor for any program modifications that may occur after the publication of this catalog. Additional information about the program may be found at: [www.mcs.sdsmt.edu/](http://www.mcs.sdsmt.edu/).

### Freshman Year

#### **First Semester**

ENGL 101	Composition I	3
IS 110	Explorations	2
MATH 123	Calculus I	4
CSC 150	Computer Science I	3
Elective <sup>2</sup>		3
PE <sup>4</sup>	Physical Education	1
<b>TOTAL</b>		<b>16</b>

#### **Second Semester**

MATH 125	Calculus II	4
Science Elective/Science Lab <sup>1</sup>		4
CSC 250	Computer Science II	4
Elective <sup>2</sup>		3
PE <sup>4</sup>	Physical Education	1
<b>TOTAL</b>		<b>16</b>

### Sophomore Year

#### **First Semester**

ENGL 279	Technical Comm I	3
MATH 225	Calculus III	4
MATH 321	Differential Equations	4
PHYS 211	University Physics I	3
Elective <sup>2</sup>		3
<b>TOTAL</b>		<b>17</b>

#### **Second Semester**

MATH 315	Linear Algebra	3
CSC 251	Finite Structures	4
ENGL 289	Technical Comm II	3
PHYS 213	University Physics II	3
Elective <sup>2</sup>		3
<b>TOTAL</b>		<b>16</b>

### Junior Year

#### **First Semester**

MATH 413	Abstract Algebra	3
MATH 381	Probability and Statistics	3
MATH 431	Dynamical Systems	3
MATH 373	Intro to Numerical Analysis	3
Elective/Emphasis <sup>3</sup>		3
<b>TOTAL</b>		<b>15</b>

#### **Second Semester**

MATH 382	Probability and Statistics II	3
MATH 463	Scientific Computing	3

MATH 421	Complex Analysis	3
Elective/Emphasis <sup>3</sup>		7
<b>TOTAL</b>		<b>16</b>

### Senior Year

#### **First Semester**

MATH 423	Advanced Calculus I	4
MATH 432	Partial Differential Equations	3
MATH 498	Undergraduate Research I	1
Elective/Emphasis <sup>3</sup>		8
<b>TOTAL</b>		<b>16</b>

#### **Second Semester**

MATH 424	Advanced Calculus II	4
MATH 451	Math Modeling	3
MATH 402	Communicating Mathematics I	1
Elective/Emphasis <sup>3</sup>		8
<b>TOTAL</b>		<b>16</b>

### **128 credits required for graduation**

#### **Curriculum Notes**

<sup>1</sup>The science requirement for this major consists of PHYS 211, PHYS 213, one course from among BIOL 151, CHEM 112, GEOL 201, plus a lab associated with one of the science courses taken – either BIOL 151L, CHEM 112L, GEOL 201L, or PHYS 213L.

<sup>2</sup>Students should consult the “General Education Requirements” section of this catalog for a complete listing of all general education requirements. It is important to note that all general education requirements must be completed within the first 64 credits taken. Math majors are additionally required to take a total of at least 16 semester hours of electives in humanities and social sciences.

<sup>3</sup>Math majors must complete 3 courses in a science or engineering emphasis area. Any double major automatically satisfies this emphasis area requirement with their other major. Further information about possible emphasis areas is available from the department.

<sup>4</sup>MUEN 101, 121, 122 can be used to substitute for one or two of the required two physical education credits.