

## **University Information**

### **SDSM&T Vision, Mission and Strategic Priorities**

Our **vision** for the South Dakota School of Mines and Technology is to be recognized as a world class technological university.

Our **mission** is to prepare students for leadership roles in engineering and science; to advance both knowledge and its application through scholarship and research; and serve the state of South Dakota, our region and the nation through collaborative efforts in education, research, and economic development.

### **Strategic Priorities**

1. Prepare and educate an expanding and increasingly diverse student body.
2. Reinforce and increase our research enterprise to elevate educational outcomes.
3. Invest in human capital to move the institution forward.
4. Dedicate ourselves to continuous quality improvement.
5. Enhance partnerships that yield the critical resources needed to advance the university.

### **2012-13 Academic Year Governance**

The South Dakota School of Mines and Technology is one of six universities operating under the authority assigned by the Constitution of the State of South Dakota to the nine member Board of Regents. The mission of the university is established by the Legislature of the State of South Dakota with programs and organization approved by the Board of Regents. The president is delegated to administer the operation of the university. The traditional collegial process of shared governance for the formation of policies and oversight includes representative organizations to provide recommendations to the president for implementation as appropriate.

### **South Dakota Board of Regents**

Mr. Terry D. Baloun, Seneca

Dr. James O. Hansen, Pierre

Mr. Harvey C. Jewett, Aberdeen

Dr. Kathryn O. Johnson, Hill City

Mr. Dean M. Krogman, Brookings

Mr. Randall K. Morris, Spearfish

Ms. Carole Pagones, Sioux Falls

Mr. Randy Schaefer, Madison

Mr. Patrick Weber, Montrose

### **Officers of the Board**

President: Dr. Kathryn O. Johnson

Vice President: Mr. Dean Krogman

Secretary: Mr. Randy Schaefer

### **Executive Director**

Dr. Jack R. Warner

### **South Dakota Public Higher Education Institutions**

Black Hills State University, Spearfish;

Dakota State University, Madison;

Northern State University, Aberdeen;

South Dakota School of Mines and Technology, Rapid City;

South Dakota State University, Brookings;

University of South Dakota, Vermillion

## **SDSM&T Councils**

### **Executive Council**

The Executive Council is the principal administrative unit at the university. The council members are the president, executive assistant to the president, provost and vice president for academic affairs, vice president for finance and administration, vice president for university relations, vice president for student affairs and dean of students, vice president for research, director of athletics, SDSM&T Foundation president, and director of the Alumni Association.

### **University Cabinet**

The University Cabinet advises the president concerning the development of policy, the governance of the university, strategic planning, and the fiscal operation of the university. The University Cabinet consists of: the president, executive assistant to the president, provost and vice president for academic affairs, vice president for finance and administration, vice president for university relations, vice president for student affairs and dean of students, vice president for research, director of athletics, SDSM&T Foundation president, chair of the faculty senate, director of the Alumni Association, dean of graduate education, chair of the exempt employees council, chair of the career service council, president of the student association, and the director of facility services.

### **Career Service Council**

The Career Service Act employees elect the Career Service Council members.

### **Exempt Employees Council**

The Exempt Employees Advisory Council is elected by the administrative employees who are exempt from the Career Service Act of the state of South Dakota.

### **Faculty Senate**

The Faculty Senate consists of nine voting members, two non-voting (ex-officio) members and is chaired by the chair of the Faculty Senate. The ex-officio members are the vice president for research and the provost and vice president for academic affairs. All faculty members may vote in the election of representatives from their discipline and each is eligible for election as a discipline representative.

### **Student Association**

The Senate of the Student Association is the elected representative council for the formation of recommendations on behalf of enrolled students, including the fees charged to students and the operation of student activities funded through student fees.

### **SDSM&T Executive Council**

**WHARTON, ROBERT A.** (2008) President. B.A., M.A., Humboldt State University; Ph.D., Virginia Polytechnic Institute.

**GUNN, MICHAEL** (2009) Interim Executive Assistant to the President. B.A., Wake Forest University; M.A., University of Nebraska-Lincoln; M.S., National Defense University; M.L.S., Fort Hays State University; Ph.D., Columbia Pacific University.

**HENDERSON, TIMOTHY G.** (1981) Vice President, Finance and Administration. B.S., University of South Dakota.

**HORN, CHRISTY A.** (2011) Vice President for University Relations. B.A., M.A., Ball State University.

**HRNCIR, DUANE C.** (2006) Provost/Vice President, Academic Affairs. B.S., University of Alabama; M.S., University of Massachusetts; Ph.D., Texas A&M University.

**KAISER, RICHARD** (2009) Director of Athletics. B.A., University of Northern Colorado; M.A., South Dakota State University; Ed.D., Brigham Young University.

**MAHON, PATRICIA G.** (2000) Vice President, Student Affairs and Dean of Students. B.S., M.S., Montana State University-Billings; Ph.D., Kansas State University.

**SELZER, MICHAEL** (2011) President, South Dakota School of Mines and Technology Foundation. B.S., South Dakota School of Mines and Technology; M.B.A., Arizona State University.

**VOTTERO, TIMOTHY J.** (1998) Director, Alumni Association. B.S., South Dakota School of Mines and Technology.

**WHITE, RONALD J.** (2009) Vice President, Research. B.S., University of Southwestern Louisiana; Ph.D., University of Wisconsin-Madison.

**Academic departments at South Dakota School of Mines and Technology are organized as follows:**

- Atmospheric Sciences
- Chemical and Biological Engineering
- Chemistry and Applied Biological Sciences
- Civil and Environmental Engineering
- Electrical and Computer Engineering
- Geology and Geological Engineering
- Humanities
- Industrial Engineering and Engineering Management
- Math and Computer Science
- Mechanical Engineering
- Materials and Metallurgical Engineering
- Military Science
- Mining Engineering and Management
- Physical Education
- Physics
- Social Sciences

**Accreditation**

The South Dakota School of Mines and Technology is accredited by the Higher Learning Commission of the North Central Association of Colleges and Secondary Schools, the recognized accrediting agency for the north central states, through the Academic Quality Improvement Program (AQIP) process. For more information call (800) 621-7440 or visit: [www.ncahigherlearningcommission.org](http://www.ncahigherlearningcommission.org).

In addition, the curriculum in chemistry is approved by the American Chemical Society.

All engineering programs are accredited by the by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. The computer science program is accredited by the Computing Accreditation Commission of ABET, Inc., <http://www.abet.org>.

*Mines Matters:* The relationships students make at the School of Mines are as important as the world-class education they receive. Students come from 40 states and 27 countries

**Equal Opportunity Policy**

*South Dakota School of Mines and Technology does not discriminate on the basis of race, color, national origin, military status, gender, religion, age, sexual orientation, political preference, or disability in employment or the provision of service.*

South Dakota School of Mines and Technology is committed to the policy that all persons shall have equal access to its programs, facilities, and employment without regard to race, color, creed, national origin, ancestry, religion, gender, age, sexual orientation, marital status, pregnancy, military/Veteran’s status, or disability. In adhering to this policy, South Dakota School of Mines and Technology abides by all federal and state statutes and regulations for the protection of employees against discrimination. Inquiries regarding compliance may be directed to the Director of Human Resources, South Dakota School of Mines and Technology, 501 East Saint Joseph St., Rapid City, SD 57701, (605) 394-1203.

## Academic Calendar

Institutions of higher education, under control of the South Dakota Board of Regents, shall operate on a common academic calendar with common periods during the summer term and the fall and spring semesters at each institution when classes are not in session. Academic calendars shall be designed a minimum of two years in advance with annual extensions recommended to the Executive Director by the Council of Presidents and Superintendents no later than the May meeting.

### Fall Semester 2012

Registration	August 27
Classes that meet on Mondays with a class start time of 4:00 p.m. or later begin	August 27
All other classes begin	August 28
Labor Day Holiday	September 3
Last day to add or drop a course and to adjust fees	September 5
Last day to submit a graduation application for fall 2011	September 5
Registration shut down (Tentative)	October 1-28
Native American Day Holiday	October 8
Midterm (first half of semester ends)	October 18
Midterm deficiencies grades due by midnight	October 23
Early Registration Weeks (Tentative)	October 29-Nov 16
Last day to drop classes	November 8
Veterans Day Holiday	November 12
Thanksgiving Holiday begins at end of class day	November 20
Classes resume	November 26
Final examinations	December 10-14
Semester ends	December 14
Fall Graduation	December 15
Final grades are due by midnight	December 19

### Spring Semester 2013

Registration	January 9
Classes that meet on Wednesdays with a class start time of 4:00 p.m. or later begin	January 9
All other classes begin	January 10
Last day to add or drop a course and adjust fees	January 18
Last day to submit a graduation application for spring/summer 2012	January 18
Martin Luther King Jr. Day	January 21
Registration shut down (Tentative)	February 15-March 21
Presidents' Day Holiday	February 18
Spring vacation begins at end of class day	March 1
Classes resume	March 11
Midterm (First half of semester ends)	March 11
Midterm deficiencies grades due by midnight	March 14
Early Registration Weeks (Tentative)	March 21-April 12
Easter Break begins at end of class day	March 28
Classes resume	April 2
Last day to drop classes	April 3
Final examinations	April 29-May 3
Semester ends	May 3
Spring Graduation	May 4
Final grades are due by midnight	May 8

This calendar conforms to guidelines established by the Board of Regents but is subject to change at its discretion.

**Holidays**

The schedule of holidays for the institutions of higher education is listed below. Classes shall not be scheduled to meet on holidays.

**New Years Day**

January 1\*.

**Martin Luther King Jr. Day**

Third Monday in January.

**Presidents Day**

Third Monday in February.

**Memorial Day**

Last Monday in May.

**Independence Day**

July 4\*.

**Labor Day**

First Monday in September

**Native American Day**

Second Monday in October.

**Veterans Day**

November 11\*.

**Thanksgiving Day**

Fourth Thursday in November.

**Christmas Day**

December 25\*

\* If January 1, July 4, November 11, or December 25 fall on a Sunday, the Monday following shall be observed as the holiday; if they fall on a Saturday, the previous Friday shall be observed as the holiday.

**Drop and Add Period**

The drop/add period is the time period during which students may adjust their academic schedule for the term without financial or academic consequences. The last day of the drop/add period for a course is designated as the census date for that course and is the official date for enrollment reporting. The end of the drop and add period for standard and non-standard courses offered in a semester shall be the date the first 10 percent of the term ends or the day following the first class meeting, whichever is later. When calculating 10 percent of the term, breaks of five or more days are not included when counting the total number of days but Saturdays, Sundays, and holidays are. Student registrations can only be added to courses after the end of the drop and add period by approval of the chief academic officer of the university.

**Final Exam Schedule for Fall 2012:** <http://registrar.sdsmt.edu/docs/182590.pdf>

**Final Exam Schedule for Spring 2013:** <http://registrar.sdsmt.edu/docs/187881.pdf>

## **Intercollegiate Athletics**

The athletic program has always been considered a major extracurricular activity on the campus of School of Mines. It is believed that a student's participation in athletics fosters well-rounded development. The intercollegiate sports scheduled throughout the year include men's football, cross country, basketball, golf and track, and the women's sports include volleyball, cross country, basketball, track and golf

The university is in its second year of candidacy for membership within the NCAA D-II with an expected full membership to be achieved beginning fall semester 2013. The various Hardrockers teams play a full regional schedule that encompasses teams from a variety of states including South

Dakota, North Dakota, Minnesota, Wisconsin, Nebraska, Colorado, Montana, Iowa and Missouri. The individual athletic sport season schedules are developed each year with an attempt to balance the number of home and away contests evenly thereby providing the loyal fans of the Hardrockers an opportunity to support the teams in Rapid City on a regular basis.

The athletic facilities for South Dakota School of Mines and Technology include

1. the 4000 seat and 260 car drive-up O'Hara Stadium that has a 400 meter championship Mondo track and a state-of-the-art synthetic turf football field, and the King Center which has the 2,200 seat Goodell gymnasium, two weight rooms, a 25 yard 6-lane swimming pool and the spectacular Christiansen Hall of Fame.

## **Eligibility for Intercollegiate Athletics**

To be eligible for intercollegiate competition at the South Dakota School of Mines and Technology

1. Entering freshmen must enroll with the NCAA Eligibility Center and complete the NCAA mandated process to become eligible for their freshman season.
2. All student-athletes wishing to participate in intercollegiate athletics must be continually enrolled as a full-time student in a minimum of 12 semester credit hours at the time of participation. Students become immediately ineligible upon dropping below 12 credit hours of enrollment during a term of participation.
3. All student-athletes must be making normal progress toward a recognized degree and maintain the GPA required to remain in good standing as set forth by this catalog.
4. All student-athletes must pass a minimum of 24 credit hours (or equivalent) in the two terms of attendance immediately preceding their next term of participation. A second-term freshman must pass 6 credit hours (or equivalent) in the first term to be eligible for term two.
5. Transfer students from a four-year institution must have eligibility remaining at the institution they are transferring from and be academically eligible at their previous institution to be able to further intercollegiate competition at SDSM&T.

## **The Apex Gallery**

The Apex gallery was established in 1989 and is housed in the Classroom Building. Open year-round, it offers educational and science exhibitions for the enjoyment and enrichment of people of all ages. The gallery features contemporary works of artists and scientists, many of whom are nationally and internationally recognized. These exhibits are designed to reflect a cross section of cultural expressions and perspectives.

In addition to providing on-campus students and staff with opportunities to view the exhibits, the Apex Gallery offers tours to local middle-schools, features lectures from visiting artists, provides campus and community workshops, and conducts collaborative programming and exhibitions with Rapid City's Dahl Fine-Arts Center. For additional information, visit [apexgallery.sdsmt.edu/](http://apexgallery.sdsmt.edu/)

## **The Music Program**

The Music Program, a division of the Department of Humanities, is housed in the Music Center on the southeast corner of the main quadrangle.

Cultural and educational enrichment opportunities provided by Music Activities include the following:

- Academic offerings — see courses listed under MUS, MUEN, or MUAP in this catalog, on Web Advisor, or on the Music Activities website <http://music.sdsmt.edu>.
- Ensembles — Symphonic Band, Concert Choir, Jazz Band, Master Chorale, Brass Choir, String Ensemble, and other instrumental and vocal ensembles.
- Performance Opportunities

Concerts and recitals are presented throughout the year both on campus in the Music Center and at venues around Rapid City and the Black Hills. Appearances are made throughout South Dakota and neighboring states at various venues such as the music association conventions, alumni gatherings, festivals, and competition.

Music ensembles have traveled to major national and international music events resulting in critical acclaim and recognition through first-place awards such as the New Years Eve Mass in Vienna's Karlskirche (1990), Lindenhofhausen Harmonie-Festival (1993), Florence's Palazzo Vecchio (1996),

Circolo Musica in Venice (2001), the Association of Irish Musical Societies Choral Festival (2006), and the Konstanz (Germany) Münster (1993, 1996, 2003, 2010).

For current concert listings and more information, visit [music.sdsmt.edu](http://music.sdsmt.edu)

**Guidebook for Parents** - <http://resources.sdsmt.edu/documents/parent-guidebook.pdf>

### Course Export to Microsoft Word

A PDF of the **2012-2013 Academic Catalog Course Descriptions** can be found at the following URL: [catalog.sdsmt.edu/docs/200384.pdf](http://catalog.sdsmt.edu/docs/200384.pdf)

### BOR Systemwide General Education Requirements Checklist

For your convenience, below is a link to the *Board of Regents Systemwide General Education Requirements Checklist* which contains a list of courses being offered currently within the system which will meet the individual general education goals. [registrar.sdsmt.edu/docs/202642.pdf](http://registrar.sdsmt.edu/docs/202642.pdf)

### Transfer Equivalency

Official transfer credit evaluation is made by the Registrar and Academic Services Office in consultation with the head of the academic department in which the applicant intends to major or the current student is majoring. However, to get a preliminary estimate of the previous credits you have earned which will transfer to SDSMT or to decide whether taking a course from another university will transfer and apply to your major, we provide an online transfer credit equivalency calculator at the following link: [sdmines.sdsmt.edu/cgi-bin/global/eq\\_search\\_courses.cgi](http://sdmines.sdsmt.edu/cgi-bin/global/eq_search_courses.cgi)

### Faculty and Staff Directories

**Faculty** <http://sdmines.sdsmt.edu/sdsmt/directory/personnel/faculty>

**Personnel** <http://sdmines.sdsmt.edu/sdsmt/directory/personnel/all>

#### Course Abbreviations

Abbreviation	Definition
AES	Atmospheric and Environmental Sciences
ANTH	Anthropology
ART	Art
ARTH	Art History
ATM	Atmospheric Sciences
BIOL	Biology
BME	Biomedical Engineering
CBE	Chemical and Biological Engineering
CEE	Civil and Environmental Engineering
CENG	Computer Engineering
CHEM	Chemistry
CHIN	Chinese
CM	Construction Management
CP	Career Planning
CSC	Computer Science
EE	Electrical Engineering
EM	Engineering Management
ENGL	English
ENGM	Engineering Management
EXCH	Student Exchange - International
EXPL	Study Abroad
GE	General Engineering
GEOE	Geological Engineering
GEOG	Geography
GEOL	Geology
GER	German
GES	General Engineering and Science
GS	General Studies
HIST	History

HUM	Humanities
IENG	Industrial Engineering
IS	Interdisciplinary Sciences
MATH	Mathematics
ME	Mechanical Engineering
MEM	Mining Engineering and Management
MES	Materials Engineering and Science
MET	Metallurgical Engineering
MSL	Military Science
MUAP	Applied Music
MUEN	Music Ensemble
MUS	MUSIC
NANO	Nanoscience and Nanoengineering
PALE	Paleontology
PE	Physical Education
PHIL	Philosophy
PHYS	Physics
POLS	Political Science
PSYC	Psychology
SOC	Sociology
SPAN	Spanish
SPCM	Speech

## Academic Programs

### Associate of Arts

#### General Studies, A.A.

#### Contact Information

##### Dr. Frank Van Nuys

Department of Social Sciences

Classroom Building 319

(605) 394-2481

E-mail: Frank.VanNuys@sdsmt.edu

The Associate of Arts Degree in General Studies is a two-year degree program that provides a student the opportunity to complete a curriculum in traditional fields of study. The curriculum offers a broad and varied background in general education as well as opportunities to explore a number of disciplines as a basis for entrance into a four-year degree program. Completion of the A.A. degree will fulfill the general education requirements for a baccalaureate degree at the state universities of South Dakota. Approved general education courses from other state universities may be used to satisfy the School of Mines general education requirements. The program of studies is as follows:

#### Associate of Arts Degree General Education Requirements

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

#### A. Written and Oral Communication

A minimum of 9 semester hours is required. This requirement can be met by taking one of two sequences of courses.

##### Either:

- ENGL 101 Composition I **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**

##### OR

- ENGL 101 Composition I **Credits: (3-0) 3**
- ENGL 201 Composition II **Credits: (3-0) 3**
- SPCM 101 Fundamentals of Speech **Credits: (3-0) 3**

Note(s):

Students who intend to continue at or return to Mines for a B.S. degree should take the first sequence—ENGL 101, ENGL 279, ENGL 289.

#### B. Humanities

Courses in history, literature, philosophy, religion, non-English languages, art, music, and theatre may be used. A minimum of 6 semester hours in two disciplines (i.e., two different course prefixes or a two-semester sequence in a foreign language), is required.

- ART 111/111A Drawing I **Credits: (3-0) 3**
- ART 112/112A Drawing II **Credits: (3-0) 3**
- ARTH 211 History of World Art I **Credits: (3-0) 3**
- CHIN 101 Introductory Chinese I **Credits: (4-0) 4 AND**
- CHIN 102 Introductory Chinese II **Credits: (4-0) 4**
- ENGL 210 Introduction to Literature **Credits: (3-0) 3**
- ENGL 212 World Literature II **Credits: (3-0) 3**
- ENGL 221 British Literature I **Credits: (3-0) 3**
- ENGL 222 British Literature II **Credits: (3-0) 3**
- ENGL 241 American Literature I **Credits: (3-0) 3**
- ENGL 242 American Literature II **Credits: (3-0) 3**
- ENGL 250 Science Fiction **Credits: (3-0) 3**
- GER 101 Introductory German I **Credits: (4-0) 4 AND**
- GER 102 Introductory German II **Credits: (4-0) 4**

- HIST 121 Western Civilization I **Credits: (3-0) 3**
- HIST 122 Western Civilization II **Credits: (3-0) 3**
- HUM 100 Introduction to Humanities **Credits: (3-0) 3**
- HUM 200 Connections: Humanities & Technology **Credits: (3-0) 3**
- MUS 100 Music Appreciation **Credits: (3-0) 3**
- MUS 110 Basic Music Theory I **Credits: 2 to 4**
- PHIL 100 Introduction to Philosophy **Credits: (3-0) 3**
- PHIL 200 Introduction to Logic **Credits: (3-0) 3**
- PHIL 220 Introduction to Ethics **Credits: (3-0) 3**
- PHIL 233 Philosophy and Literature **Credits: (3-0) 3**
- SPAN 101 Introductory Spanish I **Credits: (4-0) 4 AND**
- SPAN 102 Introductory Spanish II **Credits: (4-0) 4**

**Note(s):**

ART and ARTH are considered the same prefix.

**C. Social Sciences**

Courses in anthropology, economics, geography, history, political science, psychology, and sociology may be used. A minimum of 6 semester hours in two disciplines (i.e., two different course prefixes), is required.

- ANTH 210 Cultural Anthropology **Credits: (3-0) 3**
- GEOG 101 Introduction to Geography **Credits: (3-0) 3**
- GEOG 210 World Regional Geography **Credits: (3-0) 3**
- GEOG 212 Geography of North America **Credits: (3-0) 3**
- HIST 151 United States History I **Credits: (3-0) 3**
- HIST 152 United States History II **Credits: (3-0) 3**
- POLS 100 American Government **Credits: (3-0) 3**
- POLS 250 World Politics **Credits: (3-0) 3**
- PSYC 101 General Psychology **Credits: (3-0) 3**
- SOC 100 Introduction to Sociology **Credits: (3-0) 3**
- SOC 150 Social Problems **Credits: (3-0) 3**
- SOC 250 Courtship and Marriage **Credits: (3-0) 3**

**D. Mathematics**

A minimum of 3 semester hours of college algebra or a math course with college algebra as a prerequisite is required.

- MATH 102 College Algebra **Credits: (3-0) 3**

**E. Natural Sciences**

A minimum of 6 semester hours in the natural sciences is required including one semester hour of laboratory. The following courses in biology, chemistry, earth science, geology, and physics may be used.

- BIOL 151 General Biology I **Credits: (3-0) 3 AND**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- BIOL 153 General Biology II **Credits: (3-0) 3 AND**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**
- CHEM 106 Chemistry Survey **Credits: (3-0) 3 AND**
- CHEM 106L Chemistry Survey Lab **Credits: (0-1) 1**
- CHEM 108 Organic and Biochemistry **Credits: (4-0) 4 AND**
- CHEM 108L Organic and Biochemistry Lab **Credits: (0-1) 1**
- CHEM 112 General Chemistry I **Credits: (3-0) 3 AND**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- CHEM 114 General Chemistry II **Credits: (3-0) 3 AND**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**

- GEOL 201 Physical Geology **Credits: (3-0) 3 AND**
- GEOL 201L Physical Geology Laboratory **Credits: (0-1) 1**
- PHYS 111 Introduction to Physics I **Credits: (3-0) 3 AND**
- PHYS 111L Introduction to Physics I Laboratory **Credits: (0-1) 1**
- PHYS 113 Introduction to Physics II **Credits: (3-0) 3 AND**
- PHYS 113L Introduction to Physics II Laboratory **Credits: (0-1) 1**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3 AND**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**

### **Electives**

Total semester hours required to graduate is 60. The number of elective credits will vary depending on the courses selected in humanities, social sciences, mathematics, and natural sciences. All elective courses must be approved by the student's academic advisor.

### **Other Degree Requirements**

Students are required to pass the CAAP proficiency examination. For additional information on this examination, contact the Office of the Registrar and Academic Services at (605) 394-2400.

Students must have achieved a minimum cumulative grade point average of 2.00 in order to graduate with this degree.

After completion of 45 credit hours, students may register for up to nine hours of 300 level courses.

Students must meet the Institutional Credit Requirements, which include completion of a minimum of 15 credits from School of Mines. In addition, 8 of the last 15 credits counted toward the degree must be taken from School of Mines.

This information and an A.A. worksheet may be found at: <http://is.sdsmt.edu>.

# Bachelor of Science

## Applied and Computational Mathematics, B.S.

### Contact Information

**Dr. Kyle Riley**

Department of Mathematics and Computer Science

McLaury 308

(605) 394-2471

E-mail: Kyle.Riley@sdsmt.edu

### Faculty

Professors Corwin, Johnson, Logar and Teets; Associate Professors Braman, Kowalski, McGough and Riley; Assistant Professors Caudle, Dahl, Deschamp, Fleming and Grieve; Instructor Trimble; Emeritus Professors Carda, Grimm and Opp.

### General Information

The Department of Mathematics and Computer Science offers a bachelor of science degree in computer science and a master of science degree in Robotics and Intelligent Autonomous Systems (RIAS). The bachelor of science degree in computer science is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 – telephone (410) 347-7700. Details on the mission and learning outcomes of the Computer Science program can be found off the department website, [www.mcs.sdsmt.edu/](http://www.mcs.sdsmt.edu/).

Mathematics is a broad field of study that is foundational to many areas of Science and Engineering.

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.

### Laboratories

The School of Mines has a variety of computing platforms available. Resources include an extensive PC network, a Linux lab, a Tablet PC lab, and two robotics labs. The Linux lab is fully equipped with quad-core desktops. Other computing resources may be accessed via the Internet. The institution encourages its students to use the computer facilities in the creative and efficient solution of scientific and engineering problems.

### Computer Science and Mathematics Double Major

Due to the large number of courses common to the computer science major and the mathematics major, many students find it attractive to pursue a double major in these two areas. Students seeking the double major should consult their advisors for details about this option.

### Course Offering Schedule

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 on demand and staff. Most computer science courses are not suitable to offering in an eight-week Summer session. Students should not expect computer science offerings in the summer.

#### Every semester

Classes that are typically offered every semester include

- CSC 105 Introduction to Computers **Credits: (3-0) 3**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- CSC 250 Computer Science II **Credits: (4-0) 4**
- CSC 251 Finite Structures **Credits: (4-0) 4**
- CSC 314/314L Assembly Language/Lab **Credits: (2-1) 3**
- CSC 300 Data Structures **Credits: (4-0) 4**

#### Every fall semester

Classes that are typically offered every fall semester include

- CSC 372 Analysis of Algorithms **Credits: (3-0) 3**
- CSC 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3**

- CSC 421/521 Graphical User Interfaces with Object-Oriented Programming **Credits: (3-0) 3**
- CSC 465 Senior Design I **Credits: (2-0) 2**
- CSC 484 Database Management Systems **Credits: (3-0) 3**

### Every spring semester

Classes that are typically offered every spring semester include

- CSC 317 Computer Organization and Architecture **Credits: (3-0) 3**
- CSC 416/416L/516/516L Introduction to Autonomous Systems/Lab **Credits: (2.5-0.5) 3**
- CSC 461 Programming Languages **Credits: (3-0) 3**
- CSC 456 /456L Operating Systems/Lab **Credits: (3-1) 4**
- CSC 467 Senior Design II **Credits: (2-0) 2**
- CSC 470 Software Engineering **Credits: (3-0) 3**

### 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. 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 [MATH 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 120](#), [MATH 123](#), [MATH 125](#), [MATH 225](#), [MATH 321](#), and [MATH 381](#) during the summer session.

### Every semester

Classes that are typically offered every semester include

- MATH 102 College Algebra **Credits: (3-0) 3**
- MATH 120 Trigonometry **Credits: (3-0) 3**
- MATH 123 Calculus I **Credits: (4-0) 4**
- MATH 125 Calculus II **Credits: (4-0) 4**
- MATH 225 Calculus III **Credits: (4-0) 4**
- MATH 315 Linear Algebra **Credits: (3-0) 3**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- MATH 373 Introduction to Numerical Analysis **Credits: (3-0) 3**
- MATH 381 Introduction to Probability and Statistics **Credits: (3-0) 3**

### Every fall semester

Classes that are typically offered every fall semester include

- MATH 281 Introduction to Statistics **Credits: (3-0) 3**
- MATH 486 Statistical Quality and Process Control **Credits: (3-0) 3**

### Every spring semester

Classes that are typically offered every spring semester include

- MATH 382 Probability Theory and Statistics II **Credits: (3-0) 3**

- MATH 353 Linear Optimization **Credits: (3-0) 3**

### **Fall semester of even numbered years**

Classes that are typically offered in the fall semester of even numbered years, for example fall 2012, include

- MATH 413 Abstract Algebra I **Credits: (3-0) 3**
- MATH 431 Dynamical Systems **Credits: (3-0) 3**

### **Spring semester of odd numbered years**

Classes that are typically offered in the spring semester of odd numbered years, for example spring 2013, include

- MATH 421 Complex Analysis **Credits: (3-0) 3**
- MATH 463 Scientific Computing **Credits: (3-0) 3**

### **Fall semester of odd numbered years**

Classes that are typically offered in the fall semester of odd numbered years, for example fall 2011, include

- MATH 432 Partial Differential Equations **Credits: (3-0) 3**
- MATH 423 Advanced Calculus I **Credits: (4-0) 4**

### **Spring semester of even numbered years**

Classes that are typically offered in the spring semester of even numbered years, for example spring 2012, include

- MATH 424 Advanced Calculus II **Credits: (4-0) 4**
- MATH 451 Math Modeling **Credits: (3-0) 3**
- MATH 447/547 Design of Experiments **Credits: (3-0) 3**

### **Applied and Computational Mathematics Major**

Students majoring in mathematics will use the accompanying applied and computational mathematics curriculum. The curriculum includes 5 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 447/547, 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. B

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 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.

### **Computer Science and Mathematics Double Major**

Due to the large number of courses common to the computer science major and the mathematics major, many students find it attractive to pursue a double major in these two areas. Students seeking the double major should consult their advisors for details about this option.

### **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 **Credits: (3-0) 3**
- IS 110 Explorations **Credits: (2-0) 2**
- MATH 123 Calculus I **Credits: (4-0) 4**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- <sup>2</sup>Humanities/Social Science Elective(s) **Credits: 3**

**Total: 15**

### **Second Semester**

- MATH 125 Calculus II **Credits: (4-0) 4**
- <sup>1</sup>Science Elective/Science Lab **Credits: 4**
- CSC 250 Computer Science II **Credits: (4-0) 4**
- <sup>2</sup>Humanities/Social Science Elective(s) **Credits: 3**

**Total: 15**

## **Sophomore Year**

### **First Semester**

- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- MATH 225 Calculus III **Credits: (4-0) 4**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- <sup>2</sup>Humanities/Social Science Elective(s) **Credits: 3**

**Total: 16**

### **Second Semester**

- MATH 315 Linear Algebra **Credits: (3-0) 3**
- CSC 251 Finite Structures **Credits: (4-0) 4**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- <sup>2</sup>Humanities/Social Science Elective(s) **Credits: 3**

**Total: 16**

## Junior Year

### First Semester

- MATH 413 Abstract Algebra I **Credits: (3-0) 3**
- MATH 381 Introduction to Probability and Statistics **Credits: (3-0) 3**
- MATH 431 Dynamical Systems **Credits: (3-0) 3**
- MATH 373 Introduction to Numerical Analysis **Credits: (3-0) 3**
- <sup>3</sup>Elective/Emphasis **Credits: 3**

**Total: 15**

### Second Semester

- MATH 382 Probability Theory and Statistics II **Credits: (3-0) 3**
- MATH 463 Scientific Computing **Credits: (3-0) 3**
- MATH 421 Complex Analysis **Credits: (3-0) 3**
- <sup>3</sup>Elective/Emphasis **Credits: 6**

**Total: 15**

## Senior Year

### First Semester

- MATH 423 Advanced Calculus I **Credits: (4-0) 4**
- MATH 432 Partial Differential Equations **Credits: (3-0) 3**
- MATH 498 Undergraduate Research/Scholarship **Credits: (0-1) 1**
- <sup>3</sup>Elective/Emphasis **Credits: 5**
- <sup>4</sup>PE Physical Education **Credits: 1**

**Total: 14**

### Second Semester

- MATH 424 Advanced Calculus II **Credits: (4-0) 4**
- MATH 451 Math Modeling **Credits: (3-0) 3**
- MATH 402 Communicating Mathematics **Credits: (1-0) 1**
- <sup>3</sup>Elective/Emphasis **Credits: 5**
- <sup>4</sup>PE Physical Education **Credits: 1**

**Total: 14**

## 120 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 15 semester hours of electives in humanities and social sciences. At least three credits of humanities/social sciences must be at the 300 level or above.

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

## Applied Biological Sciences, B.S. - PENDING

### Contact Information

**Dr. Sookie S. Bang**

Department of Chemical and Biological  
Engineering  
McLaury 102  
(605) 394-2426  
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<http://cbe.sdsmt.edu>

### Faculty

Professor Bang; Assistant Professor Sani; Instructors Coble and Machura.

### Biology

The biological sciences play an increasing role in everyday life and are relevant to numerous career fields including several engineering and technological disciplines. A variety of courses are offered to expose students to major theories and disciplines of biology while completing their primary field of study at SDSM&T. Whether anticipating a career in the health sciences, chemical and environmental engineering, or biological research, students need a working knowledge of biology as part of their background. The biology courses are offered for students in science, engineering, and general studies. Students are advised to take laboratory courses whenever possible.

Minimum enrollments, as established by administration policy, are necessary to teach a course. Although a major or minor in biology is not available, it is recommended that students considering medical, dental, veterinary, or graduate school in a biology field take one of the approved biology sequences.

Record of completion of an approved sequence can be made as part of a student's permanent record. A minimum of 18 credits is recommended with 8 of those credits being BIOL 151/BIOL 151L; BIOL 153/BIOL 153L; or equivalent. At least 6 credits should be at the 300 level or above.

### Recommended Options:

#### A. General Biology Sequence

##### Eight (8) core credits:

- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**

##### Ten (10) additional credits from:

- BIOL 341 Microbial Processes in Engineering and Natural Sciences **Credits: (3-0) 3**
- BIOL 371 Genetics **Credits: (3-0) 3**
- BIOL 431 Industrial Microbiology **Credits: (3-0) 3**
- BIOL 431L Industrial Microbiology Lab **Credits: (0-1) 1**
- BIOL 491 Independent Study **Credits: 1 to 4**

#### B. Health Science Sequence

##### Eight (8) core credits:

- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**

##### Ten (10) additional credits from

- BIOL 121 Basic Anatomy **Credits: (3-0) 3**
- BIOL 121L Basic Anatomy Lab **Credits: (0-1) 1**
- BIOL 123 Basic Physiology **Credits: (3-0) 3**
- BIOL 123L Basic Physiology Lab **Credits: (0-1) 1**

- BIOL 371 Genetics **Credits: (3-0) 3**
- BIOL 423 Pathogenesis **Credits: (3-0) 3**
- BIOL 423L Pathogenesis Lab **Credits: (0-1) 1**
- BIOL 492 Topics **Credits: 1 to 5**

### **C. Environmental Science Sequence**

#### **Eight (8) core credits:**

- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**

#### **Ten (10) additional credits from:**

- BIOL 311 Principles of Ecology **Credits: (3-0) 3**
- BIOL 341 Microbial Processes in Engineering and Natural Sciences **Credits: (3-0) 3**
- BIOL 371 Genetics **Credits: (3-0) 3**
- BIOL 431 Industrial Microbiology **Credits: (3-0) 3**
- BIOL 431L Industrial Microbiology Lab **Credits: (0-1) 1**
- BIOL 406/506 Global Environmental Change **Credits: (3-0) 3**
- BIOL 492 Topics **Credits: 1 to 5**

## **Chemical Engineering, B.S.**

### **Contact Information**

#### **Dr. Robb Winter**

Department of Chemical and Biological  
Engineering Chemistry/Chemical Engineering C220  
(605) 394-2421 (605)-394-1232 (Fax)  
E-mail: Robb.Winter@sdsmt.edu  
Web: <http://cbe.sdsmt.edu/>

### **Faculty**

Professors Bang, Dixon, Puszynski, Salem and Winter; Associate Professors Gilcrease, Menkhaus and Sani; Assistant Professors Benjamin, Hadley and Shende.

### **Director and Emeritus Faculty**

Professor and Composites and Polymer Engineering Laboratory Director Salem and Emeritus Professors Bauer and Munro.

### **Staff**

Chemical and Biological Engineering Secretary, Linda Embrock. Chemical and Instrumentation Specialist, Ivan Filipov.

### **Chemical and Biological Engineering (CBE)**

The Department of Chemical and Biological Engineering (CBE) offers a B.S. degree in Chemical Engineering which is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>. CBE also offers a M.S. degree in Chemical Engineering and a Ph.D. in Chemical and Biological Engineering. Our department name, Chemical and Biological Engineering, reflects the forward-looking integration of chemical engineering, chemical sciences and biological sciences.

### **What is Chemical Engineering?**

Chemical Engineering (ChE) is an optimal combination of the molecular sciences (chemistry and biology), the physical sciences (physical chemistry and physics), the analytical sciences (math and computer programming) and engineering. Chemical Engineering focuses on the description and design of processes that combine engineering principles of heat and fluid flow with chemical reactions and molecular separations to produce high-value products useful to humankind from multiple raw material sources. Chemical Engineers do this while always insuring that the processes they design, build and manage are safe, environmentally benign and economical.

### **Examples of such processes include:**

- Artificial organs and biomedicine
- Bioenergy production
- Biological fermentation
- Biopharmaceuticals
- Ceramic manufacturing
- Energetic materials production
- Food processing
- Microprocessor manufacturing
- Mineral and ore refining
- Oil and natural gas refining
- Paper manufacturing
- Pharmaceutical design and manufacturing
- Polymer production
- Polymer composites production
- Nanomaterials manufacturing

Designing and modeling such processes requires a strong fundamental understanding of the chemical and biological phenomena at work. ChE students develop a wide range of problem solving skills grounded in mathematics and computer analysis techniques. ChE graduates are recruited for their technical engineering knowledge as well as their problem solving, systems analysis, and communication skills.

## What do chemical engineers do?

ChE graduates work in a wide variety of manufacturing, process design, and research fields. The unique combination of molecular sciences and engineering analysis make ChE professionals highly qualified for many career options in chemical, petroleum, mineral processing, pharmaceutical, food processing, biotechnology, semiconductor, defense, and alternative fuel industries, state and federal government and academia. Recent graduates from SDSM&T have gone to work in ChE positions at companies like ADM, Dakota Gasification, Dow Chemical, Dow Corning, Cargill, Caterpillar, Freeport-McMoRan Copper and Gold, Halliburton, Lafarge, Lyondell-Basel, Michelin, POET, Quadra Mining, SD DENR, Solvay Chemicals and many others. CBE alumni also regularly pursue graduate education at many of the country's top research institutions such as Stanford and the University of Wisconsin.

To delve deeper into the board range of exciting careers available to you in chemical engineering go to the American Institute of Chemical Engineers website ([www.aiche.org](http://www.aiche.org)) and pull down Career Resources/Career Facts then click on "Chemical Engineers in Action: Innovation at Work" (<http://www.chemicalengineering.org/>). You will find that if you wish to be engaged in discovering answers to the World's pressing engineering challenges, Chemical Engineering is the field for you (<http://www.engineeringchallenges.org/cms/challenges.aspx>).

Another attribute that sets Chemical Engineering apart from many other engineering career paths is that chemical engineering opens doors to other professions. The problem solving skills and process analysis tools developed in the Chemical Engineering curriculum make ChE grads uniquely suited to pursue careers as doctors, patent lawyers, business managers, financial analysts, marketing directors, environmental stewards, policy makers, and philanthropy directors.

## What will I learn as a ChE student?

ChE students take multiple courses in chemistry and biology to develop a fundamental understanding of the molecular sciences. The program includes physics, math, and computer courses to provide the analytical tools required to design processes. Finally the core Chemical Engineering curriculum includes engineering courses in thermodynamics, heat and mass transport, fluid dynamics, chemical reaction kinetics and reactor design, molecular separations and unit operations, and process design and control. Elective courses are also available to provide specialization in emphasis such as advanced materials (e.g. composites, nanomaterials and polymers), bioprocessing/biochemical engineering, energy technology, environmental engineering, and petroleum engineering.

## Chemical Engineering at the School of Mines

The vision of the CBE Department is: **To provide nationally and internationally recognized chemical and biological engineering education and research.** Through the baccalaureate degree, students are prepared to become practicing chemical engineers, ready to enter the workforce and make immediate contributions. As a graduate of the chemical engineering program you will be able to perform at a level that meets or exceeds industry, government lab, and graduate school expectations. Within a few years of your graduation, you will have the characteristics described by the following

### *Chemical Engineering Program Educational Objectives:*

1. Graduates apply fundamental and practical knowledge of unit operations, thermodynamics, reaction engineering, process control and design of chemical/biological processes.
2. Graduates are successfully employed and advancing in governmental and industrial positions requiring chemical engineering expertise.
3. Graduates are prepared to succeed in graduate and professional programs.

### **At the time of your graduation, you will have the characteristics described by the following *Chemical Engineering Program Outcomes.***

1. Graduates possess fundamental and practical knowledge of unit operations, thermodynamics, reaction engineering, process control and design of safe and economical chemical engineering processes.
  - a. Students will demonstrate their ability to solve technical problems through the application of engineering principles.
  - b. Students will be able to experimentally verify mathematical model predictions and theory in the areas of process measurements and feedback control loops; momentum, heat, and mass transfer; and reaction kinetics.
2. Graduates are able to apply critical thinking skills to the solution of chemical engineering problems
  - a. Students will be able to articulate the concept of critical thinking and practice it at a beginner's level.
  - b. Students will become proficient at applying critical thinking to technical and non-technical problems.
3. Graduates possess effective oral and written communication skills for work in a technical environment.
  - a. Students will be able to write memoranda and reports that effectively communicate technical information to technical and non-technical audiences.
  - b. Students will be able to present professionally to technical and non-technical audiences.
4. Graduates are able to interact effectively as team members and in leadership roles.
  - a. Students will be able to work effectively with others.
  - b. Students will be able to function effectively as team leaders.

5. Graduates are able to apply computer tools effectively in a variety of project situations.
  - a. Students will be able to solve complex problems by formulating and solving numerical solutions.
  - b. Students will be able to apply fundamental programming logic skills across a variety of software program platforms.
6. Graduates are motivated to be professional and continue learning throughout their lives.
  - a. Students will have positive experiences of learning material on their own.
  - b. Students will demonstrate awareness of engineering ethics, global issues and environmental impact.

### **Where do I find more information on Chemical Engineering at SDSM&T?**

Visit our webpage <http://cbe.sdsmt.edu/> to learn more about chemical engineering at the SDSM&T. You will learn more about industries in which you can be employed, the AIChE Safety and Chemical Education Certificate Program, profession development opportunities, scholarship opportunities, CBE laboratories, and co-op, intern, and research employment opportunities while you pursue your degree as well as new initiatives within CBE.

### **Chemical Engineering Curriculum/Checklist**

The courses listed in the curriculum have been chosen to develop a well-rounded education, beginning with the foundations of mathematics, physics, biology, and chemistry, and culminating with a capstone process design course at the senior level. Along the way, students develop competencies in fluid dynamics, heat transfer, mass transfer, thermodynamics, computer solutions to complex engineering problems, process control, kinetics, and reactor design, all while developing their critical thinking, general problem solving and communication skills.

Although a minor in chemical engineering is not available, you can obtain an emphasis in emerging areas such as biochemical engineering, environmental engineering, petroleum engineering, energy technology or advanced materials by tailoring your elective courses.

The chemical engineering faculty at SDSM&T keep the curriculum current and dynamic. As a part of this evolutionary process, the faculty continues to develop innovative approaches to teaching chemical engineering lectures and laboratories. An example of this is the integration of process design and simulation throughout the chemical engineering laboratory experiences. Sophisticated process design simulators (such as the commercial software, AspenPlus and COMSOL), are being co-integrated with process design projects. Major funding for this development came from the National Science Foundation and from industrial sponsors. The chemical engineering faculty is also involved in the university's Tablet PC Program. Tablet PCs have been used to explore new ways to deliver courses and integrate sophisticated process software. In addition, SDSM&T offers the opportunity for students and professors to interact in small groups and individual learning sessions.

*Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.*

## **Freshman Year**

### **First Semester**

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- CBE 111/111L Introduction to Chemical Process Modeling/Lab **Credits: (1-1) 2**
- ENGL 101 Composition I **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 16**

### **Second Semester**

- MATH 125 Calculus II **Credits: (4-0) 4**
- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- CBE 117L Programming for Chemical and Biological Engineering **Credits: (0-1) 1**
- Humanities or Social Sciences Elective(s) **Credits: 6**

**Total: 18**

## Sophomore Year

### First Semester

- CBE 217 Chemical Engineering Material Balances **Credits: (3-0) 3**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- Biology Elective **Credits: 3**
- CHEM 326 Organic Chemistry I **Credits: (3-0) 3**
- CHEM 220L Experimental Organic Chemistry IA **Credits: (0-1) 1**
- PHYS 213 University Physics II **Credits: (3-0) 3**

**Total: 16**

### Second Semester

- CBE 218 Chemical Engineering Fluid Mechanics **Credits: (3-0) 3**
- CBE 222 Chemical Engineering Process Thermodynamics **Credits: (3-0) 3**
- CBE 250 Computer Applications in Chemical Engineering **Credits: (2-0) 2**
- CHEM 328 Organic Chemistry II **Credits: (3-0) 3**
- MATH 225 Calculus III **Credits: (4-0) 4**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**

**Total: 18**

## Junior Year

### First Semester

- CBE 317 Chemical Engineering Heat Transfer **Credits: (3-0) 3**
- CBE 321 Chemical Engineering Equilibrium Thermodynamics **Credits: (3-0) 3**
- CBE 333 Process Measurements and Control **Credits: (1-0) 1**
- CBE 333L Chemical Engineering Process Control Lab **Credits: (0-1) 1**
- CBE 361L Chemical Engineering Fluid Laboratory **Credits: (0-1) 1**
- CHEM 230 Analytical Chemistry for Engineers **Credits: (2-0) 2**
- CHEM 332L Analytical Chemistry Lab **Credits: (0-1) 1**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- CHEM 342 Physical Chemistry I **Credits: 2 to 3**

**Total: 17**

### Second Semester

- CBE 318 Chemical Engineering Mass Transfer **Credits: (3-0) 3**
- CBE 343 Chemical Kinetics and Reactor Design **Credits: (3-0) 3**
- CBE 362L Chemical Engineering Heat Transfer Laboratory **Credits: (0-1) 1**
- CBE 364 Chemical Process Design, Economics, and Safety **Credits: (0-2) 2**
- CHEM 344 Physical Chemistry II **Credits: 2 to 3**
- CHEM 344L Physical Chemistry II Lab **Credits: (0-1) 1**
- Engineering Elective **Credits: 3**
- Humanities or Social Sciences Elective **Credits: 3**

**Total: 18**

## Senior Year

### First Semester

- CBE 417 Chemical Engineering Equilibrium Separations **Credits: (2-0) 2**
- CBE 463 Process Design for Chemical Engineering **Credits: (0-2) 2**
- CBE 465 Advanced Process and Equipment Design **Credits: (0-2) 2**
- Chemical Engineering Elective **Credits: 3**

- Department Approved Elective **Credits: 3**

**Total: 12**

### Second Semester

- CBE 433 Process Control **Credits: (3-0) 3**
- CBE 461L Chemical Engineering Mass Transfer and Reaction Engineering Laboratory **Credits: (0-1) 1**
- CBE 466 Capstone Design for Chemical Engineering **Credits: (0-2) 2**
- CBE 487 Global and Contemporary Issues in Chemical Engineering **Credits: 1-0) 1**
- Chemical Engineering Elective **Credits: 3**
- Chemical Engineering Lab Elective **Credits: 1**
- Department Approved Elective **Credits: 4**

**Total: 15**

**130 credits required for graduation**

**Curriculum Notes (see page 21)**

### Board of Regents General Education Requirements:

Students working in conjunction with their advisor need to ensure General Education Requirements are completed in the required timeframe. Hum/SS electives require 6 credit (cr) hr each from Humanities and Social Sciences.

### Optional emphases in ChE:

The academic advisor recommends and approves courses to take if students are interested in an emphasis in one of these areas: bioprocessing/biochemical engineering, energy technology, environmental engineering, petroleum engineering, or advanced materials (nano materials, polymers, ceramics, materials processing, corrosion, or solid state/semi-conductors).

### BIOL Elective (3 cr hr):

Select from

- BIOL 341 Microbial Processes in Engineering and Natural Sciences **Credits: (3-0) 3** (preferred)
- BIOL 371 Genetics **Credits: (3-0) 3 OR**
- Other approved by advisor.

### CHE Elective (6 cr hr):

Select 6 credits from

- CBE 424/524 Molecular Modeling and Simulation **Credits: (3-0) 3**
- CBE 434 Design of Separation Processes **Credits: (1-0) 1**
- CBE 434L Design of Separation Processes Laboratory **Credits: (0-1) 1**
- CBE 444/544 Reactor Design **Credits: (3-0) 3**
- CBE 450/550 Systems Analysis Applied to Chemical Engineering **Credits: 2 to 3**
- CBE 455/555 Pollution Phenomena and Process Design **Credits: (3-0) 3**
- CBE 474/574 Polymer Technology **Credits: 2 to 3**
- CBE 474L/574L Experimental Polymer Technology **Credits: (0-1) 1**
- CBE 476/576 Organosilicon Polymer Chemistry and Technology **Credits: (1-0) 1**
- CBE 484/584 Fundamentals of Biochemical Engineering **Credits: (3-0) 3**
- CBE 484L/584L Biochemical Engineering Laboratory **Credits: (0-1) 1**
- CBE 488/588 Applied Design of Experiments for the Chemical Industry **Credits: (2-0) 2**
- CBE 491 Independent Study **Credits: 1 to 3**
- CBE 492 Topics **Credits: 1 to 3**
- CBE 498 Undergraduate Research/Scholarship **Credits: Credit to be arranged. OR**
- Others approved by advisor.

**CHE Lab Elective (1 cr hr):**

Select 1 credit from

- CBE 434L Design of Separation Processes Laboratory **Credits: (0-1) 1**
- CBE 474L/574L Experimental Polymer Technology **Credits: (0-1) 1**
- CBE 484L/584L Biochemical Engineering Laboratory **Credits: (0-1) 1**
- CBE 498 Undergraduate Research/Scholarship **Credits: Credit to be arranged. OR**
- Other approved by advisor.

**Engineering Elective (3 cr hr):**

Select 3 credits from engineering courses other than CBE prefix; requires advisor approval. These courses are typically at a 200 level or higher.

**Department Approved Elective (8 cr hr):**

Select from the following: CBE, Chem, or other approved courses to fulfill emphasis electives. These courses are typically at a 120 level or higher. May include up to three (3) credits of advanced military science and up to six (6) credits of cooperative education

- CP 297/397/497 Cooperative Education **Credits: 1 to 3**
- Up to three (3) credits of 300 level or above Humanities, Social Science or Business **Credits: 1 to 3**
- Physical Education (PE) or Music Ensemble (MUEN) **Credits: 1**

## Chemistry B.S.

### Contact Information

#### Dr. Richard Sinden (Department Head)

Department of Chemistry and Applied Biological Sciences

Chemistry/Chemical Engineering 219

(605) 394-1678

E-mail: Richard.Sinden@sdsmt.edu

### Faculty

Professor Bang, Boyles and Sinden; Associate Professors Fong, Heglund, Sani and Zhu; Assistant Professor Smirnova; Senior Lecturer Meyer; Lecturer Filipova; Instructors Christofferson, Coble, Dahl and Marshall.

### Staff

Department of Chemistry and Applied Biological Sciences Secretary, Tara Huber; Chemical and Instrumentation Specialist, Margaret Smallbrock.

### Chemistry

The Department of Chemistry and Applied Biological Sciences offers undergraduate chemistry and biology courses that meet the requirements for the Bachelor of Science Degree in Chemistry and support other programs on campus. **The chemistry program offers an American Chemical Society (ACS) certified degree, meeting the national requirements of the ACS.** The Bachelor of Science in Chemistry requires 120 semester credits. A degree in applied biology is under development and should be available in school year 2013 – 2014. The applied biology degree will also require 120 semester credits.

Upon graduation with a Bachelor of Science in Chemistry, students have knowledge of chemical and physical phenomena at the molecular level. They possess critical thinking skills in chemical problem-solving and have a command of the four major sub-disciplines of Chemistry: Analytical, Inorganic, Organic, and Physical Chemistry, as well as exhibiting a familiarity with chemical literature.

Chemistry graduates of the department distinguish themselves in other disciplines as well. The chemistry curriculum provides students ample opportunity to supplement their chemistry knowledge through the diverse offerings of other departments on campus, including mathematics, engineering, humanities, social and behavioral sciences, biological and physical sciences, art and music, physical education, and more. The distinctive latitude inherent within the chemistry curriculum allows students to develop as well-rounded individuals who are able to face and meet the challenges anticipated in their chosen careers

Many students use their chemistry degree as a solid foundation for graduate study in chemistry or in a closely related field, as well as for further study in medicine, dentistry, pharmacy, veterinary medicine, forensic science, materials science, environmental science, medical technology, physical therapy, patent or environmental law, and education. Likewise, students who opt not to further their education beyond their bachelor of science degree are also prepared for a wide variety of employment opportunities. Former School of Mines chemistry graduates have served in research and quality assurance positions in academic, industrial, governmental, and private sectors.

The Department of Chemistry and Biology also participates in the following SDSM&T graduate programs: M.S. and Ph.D. in Biomedical Engineering, M.S. and Ph.D. in Chemical and Biological Engineering, M.S. and Ph.D. in Materials Engineering and Science, and Ph.D. in Nanoscience and Nanoengineering. Students seeking these degrees may choose to emphasize any of the representative sub-disciplines of chemistry and biology in addition to interdisciplinary research specialties.

The Department of Chemistry and Biology prides itself in having modern laboratory facilities and instrumentation available not only for research but as an integral part of undergraduate education. The instrumentation within the department currently includes FT-IR spectrometers, a 300-MHz superconducting heteronuclear nuclear magnetic resonance spectrometer, a spectrofluorometer, a diode-array spectrophotometer, a voltammograph, an atomic absorption spectrometer, a gas chromatograph-mass spectrometer, and many other instruments.

Advisors work closely with their assigned students in order to ensure each student completes all degree requirements in a timely manner, meets prerequisites for further education (such as medical or other professional school), and is knowledgeable about post-graduation options and employment opportunities.

### Freshman Year

#### First Semester

- CHEM 112 General Chemistry I Credits: (3-0) 3

- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- ENGL 101 Composition I **Credits: (3-0) 3**
- MATH 123 Calculus I **Credits: (4-0) 4**
- General Education Goal 3 or 4 Elective(s) **Credits: 3**
- IS 110 Explorations **Credits: (2-0) 2**
- CHEM 290 Seminar **Credits: (0.5-0) 0.5**

**Total: 16.5**

### **Second Semester**

- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- MATH 125 Calculus II **Credits: (4-0) 4**
- CHEM 290 Seminar **Credits: (0.5-0) 0.5**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- General Education Goal 3 Elective(s) **Credits: 3**
- General Education Goal 4 Elective(s) **Credits: 3**

**Total: 17.5**

### **Sophomore Year**

#### **First Semester**

- CHEM 252 Systematic Inorganic Chemistry **Credits: (3-0) 3**
- CHEM 332 Analytical Chemistry **Credits: (3-0) 3**
- CHEM 332L Analytical Chemistry Lab **Credits: (0-1) 1**
- CHEM 326 Organic Chemistry I **Credits: (3-0) 3**
- CHEM 326L Organic Chemistry I Lab **Credits: (0-2) 2**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- CHEM 290 Seminar **Credits: (0.5-0) 0.5**

**Total: 15.5**

#### **Second Semester**

- CHEM 328 Organic Chemistry II **Credits: (3-0) 3**
- CHEM 328L Organic Chemistry II Lab **Credits: (0-2) 2**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**
- General Education Goal 3 or 4 Elective(s) **Credits: 3**
- CHEM 290 Seminar **Credits: (0.5-0) 0.5**

**Total: 17.5**

### **Junior Year**

#### **First Semester**

- CHEM 342 Physical Chemistry I **Credits: 2 to 3**
- CHEM 342L Physical Chemistry I Lab **Credits: (0-1) 1**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- <sup>1</sup> Elective(s) **Credits: 6**
- <sup>2</sup> Advanced Chemistry Requirement **Credits: 3**
- CHEM 490 Seminar **Credits: (0.5-0) 0.5**

**Total: 16.5**

## Second Semester

- CHEM 344 Physical Chemistry II **Credits: 2 to 3**
- CHEM 344L Physical Chemistry II Lab **Credits: (0-1) 1**
- CHEM 370 Chemical Literature **Credits: (1-0) 1**
- <sup>2</sup>Advanced Chemistry Requirement **Credits: 5**
- <sup>1</sup> Elective(s) **Credits: 3**
- CHEM 490 Seminar **Credits: (0.5-0) 0.5**

**Total: 13.5**

## Senior Year

### First Semester

- <sup>1</sup>Elective(s) **Credits: 9**
- <sup>3</sup>Advanced Chemistry Elective **Credits: 3**
- CHEM 490 Seminar **Credits: (0.5-0) 0.5**

**Total: 12.5**

### Second Semester

- <sup>1</sup>Electives **Credits: 5**
- <sup>2</sup>Advanced Chemistry Requirement **Credits: 7**
- CHEM 490 Seminar **Credits: (0.5-0) 0.5**

**Total: 12.5**

## 120 credits required for graduation

### Curriculum Notes

<sup>1</sup>Twenty-three (23) elective credits are required.

<sup>2</sup>Fifteen credits of advanced chemistry courses are required: CHEM 434, CHEM 434L, CHEM 452/552, CHEM 452L/552L, CHEM 460/560, and CHEM 482/582.

<sup>3</sup>Three credits of advanced chemistry electives are required. Take any one of the following courses: CHEM 420/520, CHEM 421/521, or CHEM 426/526 Polymer Chemistry

## **Civil Engineering, B.S.**

### **Contact Information**

**Dr. Molly M. Gribb**

Head and Professor

Department of Civil and Environmental

Engineering, Civil/Mechanical 122

(605) 394-1697

E-mail: Molly.Gribb@sdsmt.edu

### **Faculty**

Professors Amos, Bang, Fontaine, Gribb, Hansen and Kenner; Associate Professors Christopher, Stone and Surovek; Assistant Professors Arneson-Meyer, Benning, Cetin, Fick, Nam and Robinson; Adjunct Assistant Professor Roberts; Distinguished Professor Emeritus Ramakrishnan; Professors Emeritus Hovey, Iyer and Preber; Associate Professor Emeritus Klasi.

### **Civil and Environmental Engineering**

Civil and environmental engineers are problem solvers, meeting the needs for environmental stewardship, renewable energy, sustainable design solutions, and community planning for a better tomorrow. Civil and environmental engineers serve the public by designing a wide variety of infrastructure systems such as dams and waterways, harbors, bridges, buildings, water supply and wastewater systems, highways and airports, tunnels and pipelines, and renewable energy facilities.

Students interested in a career in civil and environmental engineering follow a curriculum that culminates in a bachelor of science degree in civil engineering that is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

The undergraduate curriculum provides a comprehensive education for students who wish to pursue a professional career directly after graduation. The B.S. program in civil engineering also serves as a preparation for graduate study in any of the specialized branches of civil and environmental engineering, construction management or other professional degrees such as medicine or law.

### **Curriculum**

The civil and environmental engineering curriculum begins with students gaining fundamental understanding of humanities, social sciences, mathematics, and basic sciences. Courses in the engineering sciences begin the transition from theory to creative application. During the junior year, students complete required courses in environmental, geotechnical, structural, water resources, sustainable and construction engineering.

Students interested in environmental engineering may follow a curriculum specifically tailored to this important sub-disciplinary area, and may also pursue a minor in environmental engineering or sustainable engineering. In the senior year, a two-semester capstone design course allows students to work in multi-disciplinary teams to develop alternative solutions, incorporate sustainable design principles, perform feasibility and economic analyses, and create detailed designs. The capstone design experience culminates with a formal final written report and a presentation to the faculty and the students' peers.

Graduate programs in civil engineering or construction management afford opportunities for motivated students to pursue advanced studies. An accelerated Master of Science (BS/MS) degree program is available for qualified seniors enrolled in engineering B.S. programs at the South Dakota School of Mines and Technology. The accelerated master's degree program allows B.S. engineering students to take up to nine (9) graduate-level credits to simultaneously meet undergraduate and graduate degree program requirements. For more information about the accelerated master's degree program, see the Civil Engineering M.S. section of the catalog or contact CEE Graduate Coordinator Dr. Scott Amos ([Scott.Amos@sdsmt.edu](mailto:Scott.Amos@sdsmt.edu)).

### **Department Approved Electives**

The undergraduate curriculum includes 12 credit hours of Department Approved Electives (15 for environmental emphasis students) that students may use to gain knowledge and skills in a specialized area to meet their individual career goals. Students may participate in undergraduate research or scholarship, which may include international design projects, design activities associated with the American Society of Civil Engineers (ASCE) steel bridge or concrete canoe competitions, or cooperative education. Students must apply for the cooperative education program prior to starting work. For more information about the cooperative education program, contact Dr. Scott Amos ([Scott.Amos@sdsmt.edu](mailto:Scott.Amos@sdsmt.edu)).

### **Department Approved Electives include the following:**

- At least 6 credits of CEE 300 or 400 level coursework not applied to another CEE graduation requirement.
- Up to 6 credit hours of CEE 498 (Undergraduate Research/Scholarship), CEE 491 (Independent Study) or CP 497 (Cooperative Education); not more than 3 credits may be CEE 491 or CP 497.

- Up to 6 credit hours of 300 or 400 level courses in engineering, science, math or computer science not applied to another CEE graduation requirement (9 credits for environmental engineering emphasis students).

### **Professionalism**

Students are encouraged to participate in the student chapter of the American Society of Civil Engineers (ASCE), Engineers and Scientists Abroad, CAMP, (Center of Excellence for Advanced Manufacturing and Production that involves designing, building, testing, and competing in a variety of engineering challenges), or any other of the many student organizations on campus. During the senior year, students are strongly encouraged to take the Fundamentals of Engineering (F.E.) examination. Passing the F.E. examination is the first step toward registration as a Professional Engineer (P.E.). The second and final step in the registration process is the successful completion of the Professional Engineering examination, which is normally taken after working under the supervision of a P.E. for at least four years.

### **Minor in Environmental Engineering**

Environmental engineers design systems and solve pressing global problems in all areas related to the environment and public health: sustainable design of drinking water treatment and wastewater treatment, and solid and hazardous waste disposal systems; development of air quality monitoring and pollution prevention programs; design of site remediation and mining reclamation programs; and development of ecosystem protection and restoration efforts, among others. For more information, contact Dr. James Stone (James.Stone@sdsmt.edu).

[Environmental Engineering Minor](#)

### **Minor in Sustainable Engineering**

Sustainable Engineering is a developing field that seeks to move traditional engineering practice toward approaches that can solve complex classes of emerging social problems such as competition for limited supplies of resources and water, land conservation, global climate change, and human exposure to toxic chemicals in air, water, and food. For more information, contact Dr. Jennifer Benning (Jennifer.Benning@sdsmt.edu).

[Sustainable Engineering Minor](#)

### **Minor in Geospatial Technology**

Geospatial technology is a rapidly expanding field that covers the management and analysis of spatial data from many sources, such as satellites, airborne remote sensing, geographic information systems (GIS), global positioning systems (GPS), surveying, and more.

### **Civil Engineering, B.S. Curriculum/Checklist**

Students pursuing a traditional civil engineering education will follow the curriculum below. Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog. Curriculum flowcharts and other advising information are available on the departmental web page: [cee.sdsmt.edu](http://cee.sdsmt.edu)

### **Freshman Year**

#### **First Semester**

- ENGL 101 Composition I **Credits: (3-0) 3**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- MATH 123 Calculus I **Credits: (4-0) 4**
- CEE 130/130L Introduction to Civil and Environmental Engineering/Lab **Credits: (1-1) 2**
- <sup>1</sup> Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 16**

#### **Second Semester**

- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- MATH 125 Calculus II **Credits: (4-0) 4**
- CEE 117/117L Introduction to CADD/Lab **Credits: (1-1) 2**
- <sup>2</sup>EM 214 Statics **Credits: (3-0) 3**
- <sup>1</sup> Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 18**

## Sophomore Year

### First Semester

- MATH 225 Calculus III **Credits: (4-0) 4**
- CEE 206/206L Engineering Surveys I/Lab **Credits: (2-1) 3**
- <sup>1</sup>Humanities or Social Sciences Elective(s) **Credits: 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- EM 331 Fluid Mechanics **Credits: (3-0) 3**

**Total: 16**

### Second Semester

- CEE 326 Environmental Engineering I **Credits: (3-0) 3**
- CEE 284 Applied Numerical Methods **Credits: (3-0) 3**
- <sup>2</sup>MATH 321 Differential Equations **Credits: (3-0) 3**
- ME 221 Dynamics of Mechanisms **Credits: (3-0) 3**
- **OR**
- ME 211 Introduction to Thermodynamics **Credits: (3-0) 3**
- <sup>1</sup>EM 321 Mechanics of Materials **Credits: (3-0) 3**
- <sup>1</sup>Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 18**

## Junior Year

### First Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- CEE 316/316L Engineering and Construction Materials/Lab **Credits: (2-1) 3**
- CEE 336/336L Hydraulic Systems Design/Lab **Credits: (2-1) 3**
- CEE 346/346L Geotechnical Engineering/Lab **Credits: (2-1) 3**
- CEE 353 Structural Theory **Credits: (3-0) 3**

**Total: 15**

### Second Semester

- CEE 325 Introduction to Sustainable Design **Credits: (3-0) 3**

#### Three of the following four courses

- CEE 327/327L Environmental Engineering II **Credits: (2-1) 3**
- CEE 337 Engineering Hydrology **Credits: (3-0) 3**
- CEE 347 Geotechnical Engineering II **Credits: (3-0) 3**
- CEE 357 Theory and Design of Metal Structures I **Credits: (3-0) 3**
- <sup>3</sup> Science Elective **Credits: 3**

**Total: 15**

## Senior Year

### First Semester

- IENG 302 Engineering Economics **Credits: (3-0) 3**
- CEE 474/574 Construction Engineering and Management **Credits: (3-0) 3**
- CEE Department Approved Elective(s) **Credits: 6**
- CEE 464 Civil Engineering Capstone Design I **Credits: (0-1) 1**
- <sup>3</sup>Science Elective **Credits: 3**

**Total: 16**

## **Second Semester**

- CEE 463 Concepts of Professional Practice **Credits: (2-0) 2**
- CEE 465 Civil Engineering Capstone Design II **Credits: (0-2) 2**
- <sup>4</sup> Math/Science Elective **Credits: 3**
- <sup>1</sup> Humanities or Social Sciences Elective **Credits: 3**
- CEE Department Approved Elective(s) **Credits: 6**

**Total: 16**

## **130 credits required for graduation**

### **Curriculum Notes**

<sup>1</sup> Consult the section of the catalog addressing graduation requirements for a description of the combinations of lower level (1xx/2xx) social sciences and humanities courses meeting the SDBOR General Education Goals #3 and #4. Students must complete at least 3 credits at an advanced level (300 or above).

<sup>2</sup> Students must earn a "C" or better in MATH 123 to enroll in EM 214 , and earn a "C" or better in EM 214 to enroll in EM 321.

<sup>3</sup> Science electives may be chosen from physics, chemistry, biology, geology, or atmospheric science with at least 3 credit hours BIO, GEOL, or ATM, or GEOE 221/221L. See departmental webpage for list.

<sup>4</sup> Mathematics/science elective may be chosen from physics, chemistry, biology, geology, mathematics, or atmospheric science. See departmental webpage for list.

## **Civil Engineering, B.S. - Environmental Emphasis**

### **Contact Information**

**Dr. Molly M. Gribb**

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### **Faculty**

Professors Amos, Bang, Fontaine, Gribb, Hansen and Kenner; Associate Professors Christopher, Stone and Surovek; Assistant Professors Arneson-Meyer, Benning, Cetin, Fick, Nam and Robinson; Adjunct Assistant Professor Roberts; Distinguished Professor Emeritus Ramakrishnan; Professors Emeritus Hovey, Iyer and Preber; Associate Professor Emeritus Klasi.

### **Environmental Engineering**

Environmental engineering is an important emphasis area in the broad field of civil engineering. Environmental engineers design systems and solve pressing global problems in all areas related to the environment and public health: sustainable design of drinking water treatment and distribution, wastewater treatment, and solid and hazardous waste disposal systems; development of air quality monitoring and pollution prevention programs; design of site remediation and mining reclamation programs; and development of ecosystem protection and restoration efforts, among others.

Students interested in a career in environmental engineering at the School of Mines follow a curriculum with an emphasis in environmental engineering that culminates in a bachelor of science degree in civil engineering that is accredited by the Engineering Accreditation Commission of ABET, [www.abet.org](http://www.abet.org).

The undergraduate curriculum provides a comprehensive education for students who wish to pursue a professional career directly after graduation. The B.S. program in civil engineering also serves as preparation for graduate study in any of the specialized branches of civil and environmental engineering, construction management or other professional degrees such as medicine or law.

### **Curriculum**

The environmental engineering emphasis curriculum includes courses in the liberal arts, higher mathematics, basic sciences, engineering sciences, and engineering design. Civil and environmental engineers often work on interdisciplinary teams to solve complex system design problems, so a broad background in engineering fundamentals and the natural sciences is essential. Students will take courses in environmental, geotechnical, water resources, construction, and sustainable engineering, as well as related chemical engineering courses, to prepare them for a career and/or additional studies.

In the senior year, a two-semester capstone design course allows students to work in multi-disciplinary teams to develop alternative solutions, incorporate sustainable design principles, perform feasibility and economic analyses, and create detailed designs. The capstone design experience culminates with a formal final written report and a presentation to the faculty and the students' peers. A minor in environmental engineering is also available.

Graduate programs in civil and environmental engineering or construction management afford opportunities for motivated students to pursue advanced studies. An accelerated Master of Science (BS/MS) degree program is available for qualified seniors enrolled in engineering B.S. programs at the South Dakota School of Mines. The accelerated master's degree program allows B.S. engineering students to take up to nine (9) graduate-level credits to simultaneously meet undergraduate and graduate degree program requirements. For more information about the accelerated master's degree program, see the Civil Engineering M.S. section of the catalog or contact the CEE Graduate Coordinator Dr. Scott Amos, [Scott.Amos@sdsmt.edu](mailto:Scott.Amos@sdsmt.edu)

### **Department Approved Electives include the following:**

- At least 6 credits of CEE 300 or 400 level coursework not applied to another CEE graduation requirement.
- Up to 6 credit hours of CEE 498 (Undergraduate Research/Scholarship), CEE 491 (Independent Study) or CP 497 (Cooperative Education); not more than 3 credits may be CEE 491 or CP 497.
- Up to 9 credit hours of 300 or 400 level courses in engineering, science, math or computer science not applied to another CEE graduation requirement.

## Environmental Engineering Emphasis Curriculum/Checklist

### Freshman Year

#### First Semester

- ENGL 101 Composition I **Credits: (3-0) 3**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- MATH 123 Calculus I **Credits: (4-0) 4**
- CEE 130/130L Introduction to Civil and Environmental Engineering/Lab **Credits: (1-1) 2**
- <sup>1</sup>Humanities or Social Science Elective **Credits: 3**

**Total: 16**

#### Second Semester

- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- <sup>2</sup> EM 214 Statics **Credits: (3-0) 3**
- <sup>1</sup>Humanities or Social Science Elective(s) **Credits: 3**

**Total: 17**

### Sophomore Year

#### First Semester

- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- MATH 225 Calculus III **Credits: (4-0) 4**
- CHEM 230 Analytical Chemistry for Engineers **Credits: (2-0) 2**
- EM 331 Fluid Mechanics **Credits: (3-0) 3**
- ENVE 217 Chemical Engineering Material Balances **Credits: (3-0) 3**
- <sup>1</sup>Humanities or Social Science Elective **Credits: 3**

**Total: 18**

#### Second Semester

- CEE 326 Environmental Engineering I **Credits: (3-0) 3**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- CBE 222 Chemical Engineering Process Thermodynamics **Credits: (3-0) 3**
- CEE 284 Applied Numerical Methods **Credits: (3-0) 3**
- <sup>2</sup> EM 321 Mechanics of Materials **Credits: (3-0) 3**
- <sup>1</sup> Humanities or Social Science Elective(s) **Credits: 3**

**Total: 18**

### Junior Year

#### First Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- ENVE 317 Chemical Engineering Heat Transfer **Credits: (3-0) 3**
- CEE 316/316L Engineering and Construction Materials/Lab **Credits: (2-1) 3**
- CEE 336/336L Hydraulic Systems Design/Lab **Credits: (2-1) 3**
- CEE 346/346L Geotechnical Engineering/Lab **Credits: (2-1) 3**

**Total: 15**

## **Second Semester**

- CEE 325 Introduction to Sustainable Design **Credits: (3-0) 3**
- CEE 327/327L Environmental Engineering II **Credits: (2-1) 3**
- CEE 337 Engineering Hydrology **Credits: (3-0) 3**
- <sup>3</sup> Science Elective **Credits: 3**
- ENVE 318 Chemical Engineering Mass Transfer **Credits: (3-0) 3**

**Total: 15**

## **Senior Year**

### **First Semester**

- IENG 301 Basic Engineering Economics **Credits: (2-0) 2**
- CEE 474/574 Construction Engineering and Management **Credits: (3-0) 3**
- CEE Department Approved Elective(s) **Credits: 6**
- CEE 464 Civil Engineering Capstone Design I **Credits: (0-1) 1**
- <sup>3</sup> Science Elective **Credits: 3**

**Total: 15**

### **Second Semester**

- CEE 463 Concepts of Professional Practice **Credits: (2-0) 2**
- CEE 465 Civil Engineering Capstone Design II **Credits: (0-2) 2**
- CEE Department Approved Elective(s) **Credits: 9**
- <sup>1</sup>Humanities or Social Science Elective **Credits: 3**

**Total: 16**

## **130 credits required for graduation**

### **Curriculum Notes**

<sup>1</sup> Consult the section of the catalog addressing graduation requirements for a description of the combinations of lower level (1xx/2xx) social sciences and humanities courses meeting the SDBOR General Education Goals #3 and #4. Students must complete at least 3 credits at an advanced level (300 or above).

<sup>2</sup> Students must earn a "C" or better in MATH 123 to enroll in EM 214, and earn a "C" or better in EM 214 to enroll in EM 321.

<sup>3</sup> Science electives may be chosen from physics, chemistry, biology, geology, or atmospheric science with at least 3 credit hours from BIO, GEOL, or ATM, or GEOE 221/221L.

## **Computer Engineering, B.S.**

### **Contact Information**

#### **Dr. Kazem Sohraby**

Department of Electrical and Computer Engineering

Electrical Engineering/Physics 311

(605) 394-1219

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### **Faculty**

Professors Corwin, Logar, Sohraby and Weiss; Associate Professors McGough and Tolle; Assistant Professor Hoover; Instructors Linde and Grahek; Professors Emeritus Batchelder, Cox, McNeil, Meiners, Opp, Simonson and Oliver.

### **Computer Engineering**

The computer engineering curriculum prepares students for life-long careers by providing them with the engineering and technical education appropriate to meet modern technological challenges. The basic curriculum includes required coursework in mathematics, basic sciences, humanities, social sciences, and fundamental engineering topics in circuit analysis, electronics, electrical systems, digital systems, assembly language, data structures, operating systems, and software engineering. Computer engineering students are required to select three (3) senior elective courses from a wide variety of subject areas to fit their particular interests.

Elective subject areas include digital signal processing, microprocessor-based system design, computer networks, and computer architecture. The bachelor of science program in computer engineering is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012 – telephone (410) 347-7700

### **Mission**

The mission of the computer engineering program, in support of the mission of School of Mines, is to provide computer engineering students with education that is broadly based in the fundamentals of the profession so that graduates will be able to maintain a high degree of adaptability throughout their professional careers. It is also intended that the students will develop a dedication to the profession and an ability to maintain professional competency through a program of life-long learning.

### **Objectives**

1. Graduates will be able to successfully practice computer engineering and related fields regionally, nationally, and globally.
2. Graduates will be well-educated in the fundamental concepts of computer engineering and be able to continue their professional development throughout their careers.
3. Graduates will be skilled in clear communications and teamwork and capable of functioning responsibly in diverse environments.
4. Graduates will be prepared to demonstrate leadership in outreach, innovation and invention.

### **Program Strengths**

A two-semester capstone design experience requires computer engineering students to conduct their own design project in a simulated industrial environment. They are encouraged to work on team projects, which are often multidisciplinary. This foundation provides students with a broad base of understanding that allows them to apply their knowledge of scientific and engineering principles to the practical and innovative solutions of existing and future problems.

Students are required to develop a high level of written and oral communication skills and to work well as a member of a team. They must develop a social and ethical awareness so they understand their responsibility to protect both the occupational and public health and safety and to implement these factors in their professional activities. Students are encouraged to participate in the activities of professional societies, such as the Institute of Electrical and Electronics Engineers and Eta Kappa Nu, to enhance their educational and social life while on campus and to gain professional contacts for their careers. Students have opportunities to participate in cooperative education and summer intern programs whereby they elect to seek employment to experience engineering work before they complete their degree requirements. Students gain insight into future opportunities and are often hired by their intern companies after graduation.

### **Integration of Design Concepts**

One of the key elements of the undergraduate computer engineering education experience is to integrate design throughout the curriculum. Students experience various design concepts in a variety of settings:

- Hands-on laboratory projects (including team projects);
- Effective integration of computer applications;
- Senior elective courses;



## Computer Engineering Curriculum/Checklist

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

### Freshman Year

#### First Semester

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- CENG 244/244L Introduction to Digital Systems/Lab **Credits: (3-1) 4**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 15**

#### Second Semester

- ENGL 101 Composition I **Credits: (3-0) 3**
- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**

**Total: 16**

### Sophomore Year

#### First Semester

- EE 220/220L Circuits I/Lab **Credits: (3-1) 4**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**
- CENG 264/264L Sophomore Design **Credits: (1-1) 2**
- CSC 250 Computer Science II **Credits: (4-0) 4**

**Total: 17**

#### Second Semester

- CSC 251 Finite Structures **Credits: (4-0) 4**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- EE 221/221L Circuits II/Lab **Credits: (3-1) 4**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- CENG 351/351L Mechatronics and Measurement Systems **Credits: (3-1) 4**

**Total: 18**

### Junior Year

#### First Semester

- CENG 314/314L Assembly Language/Lab **Credits: (2-1) 3**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- EE 320/320L Electronics I/Lab **Credits: (3-1) 4**
- CSC 300 Data Structures **Credits: (4-0) 4**
- MATH 225 Calculus III **Credits: (4-0) 4**

**Total: 18**

#### Second Semester

- EE 312/312L Signals/Lab **Credits: (3-0.5) 3.5**
- CENG 447/447L/547/547L Embedded and Real-Time Computer Systems/Lab **Credits: (3-1) 4**

- CENG 342/342L Digital Systems/Lab **Credits: (3-1) 4**
- <sup>2</sup>Approved Math Elective **Credits: 3**
- EM 216 Statics and Dynamics **Credits: (4-0) 4**

**Total: 18.5**

## Senior Year

### First Semester

- EE 311/311L Systems/Lab **Credits: (3-0.5) 3.5**
- CENG 464 Computer Engineering Design I **Credits: (0-2) 2**
- <sup>3</sup>CENG Elective(s) **Credits: 4**
- IENG 301 Basic Engineering Economics **Credits: (2-0) 2**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 14.5**

### Second Semester

- CENG 465 Computer Engineering Design II **Credits: (0-2) 2**
- CENG 442/442L Microprocessor-Based System Design **Credits: (3-1) 4**
- <sup>3</sup>CENG Elective(s) **Credits: 7**

**Total: 13**

**130 credits required for graduation**

## Curriculum Notes

<sup>1</sup> Music ensemble courses, (MUEN 101, MUEN 121, or MUEN 122) may be substituted for physical education courses for qualified students. Any other substitution must be approved in advance by the physical education department head.

<sup>2</sup> MATH 381 and MATH 442 are approved electives

<sup>3</sup> Eleven CENG elective credits are required.

## CENG Electives

A maximum of 4 co-op credits may be used toward the CENG electives requirement if a written request presented by the student is approved by the ECE faculty. The student request must justify that the CENG design requirement is met.

The computer engineering program utilizes the Fundamentals of engineering (FE) exam taken by students prior to graduation for program assessment.

- EE 322/322L Electronics II/Lab **Credits: (3-1) 4**
- EE 421/421L/521/521L Communication Systems/Lab **Credits: (3-1) 4**
- EE 451 Control Systems **Credits: 4**
- CENG 420/420L Design of Digital Signal Processing Systems **Credits: (3-1) 4**
- CENG 440/440L VLSI Design/Lab **Credits: (3-1) 4**
- CENG 444/444L/544/544L Computer Networks/Lab **Credits: (3-1) 4**  
(credit for only one of CENG 444/444L/544/544L or CSC 463/563 may be used)
- CENG 446/446L Advanced Computer Architectures/Lab **Credits: (3-1) 4**  
(credit for only one of CENG 446/446L or CSC 440/440L may be used)
- CSC 410/510 Parallel Computing **Credits: (3-0) 3**
- CSC 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3**
- CSC 416/416L/516/516L Introduction to Autonomous Systems/Lab **Credits: (2.5-0.5) 3**
- CSC 433/533 Computer Graphics **Credits: (3-0) 3**
- CSC 440/440L Advanced Digital Systems/Lab **Credits: (3-1) 4**
- CSC 447/547 Artificial Intelligence **Credits: (3-0) 3**
- CSC 464/564 Introduction to Digital Image Processing and Computer Vision **Credits: (3-0) 3**
- CSC 476 Theory of Compilers **Credits: 3**
- CSC 470 Software Engineering **Credits: (3-0) 3**

## Computer Science B.S.

### Contact Information

#### Dr. Kyle Riley

Department of Mathematics and Computer Science

McLaury 308

(605) 394-2471

E-mail: Kyle.Riley@sdsmt.edu

### Faculty

Professors Corwin, Logar and Weiss; Associate Professor McGough; Assistant Professor Qiao; Instructor Schrader; Emeritus Professors Carda, Opp and Weger.

### Computer Science Major

The primary goal of the computer science program is to prepare graduates to enter a dynamic and rapidly changing field as competent computer scientists. Graduates are expected to be capable in all phases of software development including design, development, and testing. Graduates should also have a firm understanding of hardware technologies. These capabilities require the graduate to possess good communication skills, both oral and written, and the ability to work effectively as a team member. Graduates must be able to read and comprehend the literature of the discipline and be sufficiently well-versed in general theory to allow growth within the discipline as it advances. Most of the graduates will pursue careers as software engineers within the computer industry. Some may choose careers as entrepreneurs and others will pursue advanced degrees and careers in research.

The sample Computer Science Checklist in this section lists all required courses for the bachelor's degree in their proper prerequisite sequence. Students should consult course listings for prerequisites and should consult their advisors at each registration.

A computer science major must complete a minimum of 16 credits in humanities and social science, with at least 6 credit hours in humanities and at least 6 credit hours in social science. 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.

Any computer science major desiring a minor in another field should consult his or her advisor in the Department of Mathematics and Computer Science as early in his or her program of study as possible. The Office of the Registrar and Academic Services has a form that must be signed by the student and the department heads of both departments involved.

### Computer Science and Mathematics Double Major

Due to the large number of courses common to the computer science major and the mathematics major, many students find it attractive to pursue a double major in these two areas. Students seeking the double major should consult their advisors for details about this option.

### Computer Science Curriculum

For the bachelor of science in Computer Science, a student must:

1. Take all of the courses listed in the Computer Science curriculum checklist;
2. Successfully complete a minimum of 4 computer science elective courses numbered 400 or above must be taken. A 3-credit Co-op may be substituted for one computer science elective. Special topics and independent study courses may not be used to satisfy the computer science elective requirement.; and
3. Have a departmental grade point average of at least 2.00 in all CSC courses 300 level or higher. (Courses taken more than once will have only the higher grade counted for computing the departmental grade point average.)

### Computer Science Curriculum/Checklist

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

### Freshman Year

#### First Semester

- ENGL 101 Composition I **Credits: (3-0) 3**
- MATH 123 Calculus I **Credits: (4-0) 4**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- <sup>1</sup>Humanities or Social Sciences Elective(s) **Credits: 3**

- CSC 110 Survey of Computer Science **Credits: (1-0) 1**

**Total: 14**

### Second Semester

- MATH 125 Calculus II **Credits: (4-0) 4**
- <sup>1</sup>Humanities or Social Sciences Elective(s) **Credits: 3**
- CSC 250 Computer Science II **Credits: (4-0) 4**
- CSC 251 Finite Structures **Credits: (4-0) 4**

**Total: 15**

### Sophomore Year

#### First Semester

- CSC 300 Data Structures **Credits: (4-0) 4**
- MATH 225 Calculus III **Credits: (4-0) 4**
- <sup>1</sup>Science Elective **Credits: 3**
- <sup>1</sup>Science Elective Lab **Credits: 1**
- <sup>1</sup>Humanities or Social Science Elective(s) **Credits: 3**

**Total: 15**

#### Second Semester

- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- CSC 314/314L Assembly Language/Lab **Credits: (2-1) 3**
- MATH 315 Linear Algebra **Credits: (3-0) 3**
- <sup>1</sup>Humanities or Social Sciences Elective(s) **Credits: 3**
- <sup>1</sup>Science Elective **Credits: 3**
- <sup>1</sup>Science Elective Lab **Credits: 1**

**Total: 16**

### Junior Year

#### First Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- CSC 372 Analysis of Algorithms **Credits: (3-0) 3**
- <sup>1</sup>Elective or CSC Elective **Credits: 3**
- MATH 381 Introduction to Probability and Statistics **Credits: (3-0) 3**

**Total: 15**

#### Second Semester

- CSC 317 Computer Organization and Architecture **Credits: (3-0) 3**
- CSC 461 Programming Languages **Credits: (3-0) 3**
- CSC 470 Software Engineering **Credits: (3-0) 3**
- <sup>1</sup>Elective or CSC Elective **Credits: 6**

**Total: 15**

### Senior Year

#### First Semester

- CSC 465 Senior Design I **Credits: (0-2) 2**
- CSC 484 Database Management Systems **Credits: (3-0) 3**
- CSC 421/521 Graphical User Interfaces with Object-Oriented Programming **Credits: (3-0) 3**
- <sup>1</sup>Humanities or Social Sciences Elective(s) **Credits: 3**

- <sup>1</sup>Elective or CSC Elective **Credits: 4**

**Total: 15**

### **Second Semester**

- CSC 456 /456L Operating Systems/Lab **Credits: (3-1) 4**
- CSC 467 Senior Design II **Credits: (0-2) 2**
- <sup>1</sup>Elective or CSC Elective **Credits: 6**
- <sup>1</sup>Elective or MATH Elective **Credits: 3**

**Total: 15**

### **120 credits required for graduation**

#### **Curriculum Notes**

- CSC 465/CSC 467 is a two-course sequence in senior design. It is expected that the course sequence will be taken in successive semesters.
- An exit exam, such as the Major Field Achievement Test in Computer Science, will be given as part of CSC 467. The overall results of this exam will be used to assess the computer science program.
- CSC 105 may not be counted toward any mathematics, computer science, or engineering degree. Other majors should consult their departments on policy regarding this course.
- MUEN 101, MUEN 121, MUEN 122 can be used to substitute for one or two of the required two physical education credits.  
<sup>1</sup> Elective courses must be chosen to satisfy all of the following requirements.
- Fifteen semester hours in humanities or social science. At least 6 hours must be in humanities and at least 6 hours must be in social sciences.
- Six credit hours of humanities and 6 credit hours of social science must be completed within the first 64 hours. It is important to refer to the general education requirements under bachelor of science graduation requirements for further information.
- A minimum of 4 lecture based computer science elective courses numbered 400 or above must be taken. A 3-credit Co-op may be substituted for one computer science elective. Special topics and independent study courses may not be used to satisfy the computer science elective requirement.
- Eleven credits of science. The science requirement for this major consists of PHYS 211 and two more lecture courses from among BIOL 121, BIOL 123, BIOL 231 , BIOL 151, BIOL 153, CHEM 112, CHEM 114, GEOL 201, or PHYS 213; plus two labs that accompany the science courses taken, i.e., either BIOL 121L, BIOL 123L, BIOL 231 , BIOL 151L, BIOL 153L, CHEM 112L, CHEM 114L, GEOL 201L, or PHYS 213L. Students must complete science classes from at least two different disciplines.(Note: BIOL 121, BIOL 123, and BIOL 331 do not count towards general education.)
- The math elective consists of at least three credits of a math lecture course that is at the 300 or 400 level course except MATH 373 or MATH 486

## **Electrical Engineering, B.S.**

### **Contact Information**

**Dr. Kazem Sohraby**

Department of Electrical and Computer Engineering

Electrical Engineering/Physics 311

(605) 394-1219

E-mail: Kazem.Sohraby@sdsmt.edu

### **Faculty**

Steven P. Miller Endowed Chair and Professor Whites; Professor Sohraby; Associate Professors Montoya and Tolle; Assistant Professors Anagnostou and Hoover; Instructors Linde and Grahek; Professors Emeritus Batchelder, Cox, McNeil, Meiners, Opp, Simonson and Oliver.

### **Electrical Engineering**

The electrical engineering curriculum prepares students for life-long careers by providing them with the engineering and technical education appropriate to meet modern technological challenges. The basic curriculum includes required coursework in mathematics, basic sciences, humanities, social sciences, and fundamental engineering topics in circuit analysis, electronics, electrical systems, electromagnetics, energy systems, and properties of materials. Electrical engineering students are required to select 3 senior elective courses from a wide variety of subject areas to fit their particular interests. Elective subject areas include communication systems, power systems, control systems, microwave engineering, antenna engineering, and computer systems.

The bachelor of science program in electrical engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### **Mission**

The mission of the electrical engineering program, in support of the mission of School of Mines, is to provide electrical engineering students with education that is broadly based in the fundamentals of the profession so that graduates will be able to maintain a high degree of adaptability throughout their professional careers. It is also intended that the students will develop a dedication to the profession and an ability to maintain professional competency through a program of lifelong learning.

### **Objectives**

1. Graduates will be able to successfully practice electrical engineering and related fields regionally, nationally, and globally.
2. Graduates will be well-educated in the fundamental concepts of electrical engineering and be able to continue their professional development throughout their careers.
3. Graduates will be skilled in clear communications and teamwork and capable of functioning responsibly in diverse environments.
4. Graduates will be prepared to demonstrate leadership in outreach, innovation and invention.

### **Program Strengths**

A two-semester capstone design experience requires electrical engineering students to conduct their own design project in a simulated industrial environment. They are encouraged to work on team projects and often the team projects are multidisciplinary. This foundation provides students with a broad base of understanding that allows them to apply their knowledge of scientific and engineering principles to the practical and innovative solutions of existing and future problems.

Students are required to develop a high level of written and oral communication skills and to work well as members of a team. They must develop a social and ethical awareness so they understand their responsibility to protect both occupational and public health and safety and to implement these factors in their professional activities. Students are encouraged to participate in the activities of professional societies, such as the Institute of Electrical and Electronics Engineers and Eta Kappa Nu, to enhance their educational and social life while on campus and to gain professional contacts for their careers. Students have opportunities to participate in cooperative education and summer intern programs whereby they elect to seek employment to experience engineering work before they complete their degree requirements. Students gain insight into future opportunities and are often hired by their intern companies after graduation.

### **Integration of Design Concepts**

One of the key elements of the undergraduate electrical engineering education experience is to integrate design throughout the curriculum. Students experience various design concepts in a variety of settings:

- Laboratory projects (including team projects);
- Effective integration of computer applications;
- Senior elective courses;
- Senior capstone experience; and

- Participation in competitive team projects such as the Robotics Team, the Alternative Fuel Vehicle Team, the Unmanned Aerial Vehicle Team, Lunar Regolith Mining, and the Formula SAE Mini-Indy Team.

## Laboratories

The Electrical and Computer Engineering Department houses well-equipped laboratories designed to give students easy access to experimental support for their theoretical studies. Junior and senior laboratory projects are conducted on an open laboratory basis that allows students to schedule experimental work at their own convenience. Laboratory facilities are open to students and are supervised until 10 p.m. on most weeknights.

Four general-purpose laboratories are fully equipped to provide facilities for experiments in such diverse areas as communication systems, control systems, electromechanics, energy conversion, digital circuits, computer vision and autonomous systems, and electronics. These laboratories can also be used to provide practical experience under the direct supervision of electrical and computer engineering faculty. In addition, there are special-purpose laboratories serving the fields of power systems, antennas, microwave engineering, analog and digital systems, mechatronics, real-time embedded systems, computer instrumentation, microprocessor development, reconfigurable logic, and parallel processing and cluster computing (in conjunction with the Mathematics and Computer Science Department).

Seniors and graduate students have access to facilities to work on senior design and graduate thesis projects. The work area allows students a convenient place in which to work for the duration of their project.

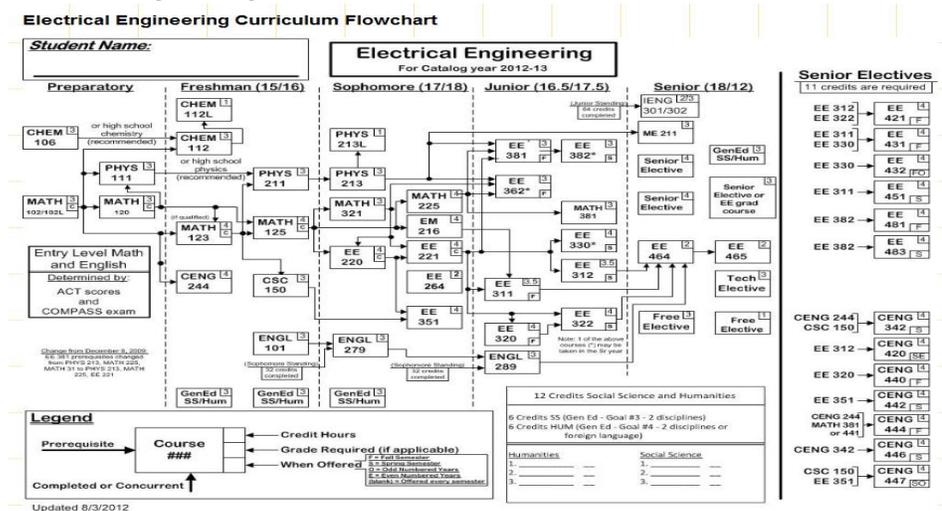
## Notes on Electrical Engineering Courses

Classes that are typically offered every semester include [EE 220/220L](#) , [EE 221/221L](#) , [EE 264/264L](#) , [EE 301/301L](#) , [EE 351/351L](#) , [EE 464](#) , and [EE 465](#) .

## Graduate School Opportunities

The undergraduate curriculum is broadly based to give graduates flexibility in their career paths. Qualified students may study areas of interest in more depth and specialize further by pursuing a graduate program at the School of Mines.

## Electrical Engineering Curriculum Flowchart



## Electrical Engineering Curriculum/Checklist

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

### Freshman Year

#### First Semester

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- CENG 244/244L Introduction to Digital Systems/Lab **Credits: (3-1) 4**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 15**

## Second Semester

- ENGL 101 Composition I **Credits: (3-0) 3**
- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**

**Total: 16**

## Sophomore Year

### First Semester

- EE 220/220L Circuits I/Lab **Credits: (3-1) 4**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 17**

### Second Semester

- EM 216 Statics and Dynamics **Credits: (4-0) 4**
- EE 221/221L Circuits II/Lab **Credits: (3-1) 4**
- MATH 225 Calculus III **Credits: (4-0) 4**
- EE 351/351L Mechatronics and Measurement Sys/Lab **Credits: (3-1) 4**
- EE 264/264L Sophomore Design/Lab **Credits: (1-1) 2**

**Total: 18**

## Junior Year

### First Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- EE 311/311L Systems/Lab **Credits: (3-0.5) 3.5**
- EE 320/320L Electronics I/Lab **Credits: (3-1) 4**
- EE 381 Electric and Magnetic Fields **Credits: (3-0) 3**
- EE 362 Electric and Magnetic Properties of Materials **Credits: (3-0) 3**

**Total: 16.5**

### Second Semester

- EE 312/312L Signals/Lab **Credits: (3-0.5) 3.5**
- EE 322/322L Electronics II/Lab **Credits: (3-1) 4**
- EE 330/330L Energy Systems/Lab **Credits: (3-1) 4**
- EE 382/382L Applied Electromagnetics/Lab **Credits: (2.5-0.5) 3**
- <sup>2</sup>Approved Math Elective **Credits: 3**

**Total: 17.5**

## Senior Year

### First Semester

- IENG 301 Basic Engineering Economics **Credits: (2-0) 2**
- ME 211 Introduction to Thermodynamics **Credits: (3-0) 3**
- EE 464 Senior Design I **Credits: (0-2) 2**
- <sup>3</sup>EE Electrical Engineering Elective(s) **Credits: 8**
- Free Elective **Credits: 3**

**Total: 18**

## Second Semester

- EE 465 Senior Design II **Credits: (0-2) 2**
- <sup>3</sup>EE Electrical Engineering Elective **Credits: 3**
- <sup>5</sup>Technical Elective **Credits: 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- <sup>4</sup>Free Elective **Credits: 1**

**Total: 12**

## 130 credits required for graduation

### Curriculum Notes

<sup>1</sup> Music ensemble courses, (MUEN 101, MUEN 121 or MUEN 122) may be substituted for physical education courses. Any other substitutions must be approved in advance by the physical education department head.

<sup>2</sup> MATH 381 and MATH 442 are approved electives.

<sup>3</sup> Eleven electrical engineering elective credits required.

<sup>4</sup> A free elective is any college level course 100 level or above that is acceptable toward an engineering or science degree. Military science courses, 100 level and above, apply as free electives only; substitution for departmental, technical, humanities, or social science electives is not permitted.

<sup>5</sup> A technical elective is any science or engineering course 200 level or above that does not duplicate the content of any other course required for graduation. Co-op credits may be used for technical elective credit. A maximum of 6 co-op credits may be used for the EE degree.

The Electrical Engineering program utilizes the Fundamentals of Engineering (FE) exam taken by students prior to graduation for program assessment.

### EE Electives

- EE 421/421L/521/521L Communication Systems/Lab **Credits: (3-1) 4**
- EE 431/431L Power Systems/Lab **Credits: (3-1) 4**
- EE 432/432L Power Electronics/Lab **Credits: (3-1) 4**
- EE 451 Control Systems **Credits: 4**
- EE 481/481L Microwave Engineering/Lab **Credits: (3-1) 4**
- EE 483/483L/583/583L Antennas for Wireless Communications/Lab **Credits: (3-1) 4**
- CENG 342/342L Digital Systems/Lab **Credits: (3-1) 4**
- CENG 420/420L Design of Digital Signal Processing Systems **Credits: (3-1) 4**
- CENG 440/440L VLSI Design/Lab **Credits: (3-1) 4**
- CENG 442/442L Microprocessor-Based System Design **Credits: (3-1) 4**
- CENG 444/444L/544/544L Computer Networks/Lab **Credits: (3-1) 4**  
(credit for only one of CENG 444/444L/544/544L or CSC 463/563 may be used)
- CENG 446/446L Advanced Computer Architectures/Lab **Credits: (3-1) 4**  
(credit for only one of CENG 446/446L or CSC 440/440L may be used)
- CENG 447/447L/547/547L Embedded and Real-Time Computer Systems/Lab **Credits: (3-1) 4**

## **Environmental Engineering, B.S.**

### **Contact Information**

**Dr. Molly Gribb**, Program Coordinator  
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### **Management Committee**

Professors Davis (GEOE) and Gribb (CEE); Associate Professors Christopher (CEE), Menkhaus (CBE) and Stone (CEE); Assistant Professors Benning (CEE) and Cross (MET); Instructor Kanth (MEM).

**NOTE: The B.S. in Environmental Engineering degree program is not open to new students. Students wishing to pursue environmental engineering studies are directed to the Civil Engineering, B.S. - Environmental Emphasis degree and the Environmental Engineering Minor.**

### **Environmental Engineering**

Environmental engineers serve our society at the most fundamental level in caring for the air we breathe, the water we drink, and the soil in which we grow our food. Environmental engineers solve existing and prevent future environmental problems. Students in the B.S. Environmental Engineering program will be educated in higher mathematics, basic sciences, engineering sciences, and engineering design. The experience will be augmented by applied laboratory courses at the freshman through senior levels. Students will use computers in virtually all engineering coursework. Fundamental environmental engineering coursework will involve heat and mass transfer, classical and chemical thermodynamics, ground-water and surface-water hydrology, and environmental systems analysis. Each student will participate in a two-semester capstone design experience that will involve work with a multidisciplinary team on the solution to a significant environmental problem. Achieving program educational outcomes will prepare the graduate to work in industry, consulting, or government, and to bring knowledge and principles to bear upon the solution to legacy and current as well as to the prevention of future environmental problems.

In order to develop a technical link with one of five disciplines closely related to environmental engineering, each student will complete a nine-credit elective set delivered by one of five supporting programs. This coursework prepares the student to cooperatively work alongside engineers of the supporting discipline in solution of environmental problems.

### **Supporting programs include**

1. Chemical Engineering — The application of chemical, chemical engineering, and environmental engineering principles to the environmentally safe production of a wide range of products including pharmaceuticals for human consumption, materials for electronic applications, and energy to power our society.
2. Civil Engineering — Engineering our society's infrastructure through treatment of water for potable use, renovation of waste waters generated by domestic and industrial users, safe handling (both disposal and recycling) of solid and hazardous wastes generated by society, clean-up of existing environmental pollution, and general stewardship of the Earth's land and water resources.
3. Geological Engineering — Engineering for the environmentally sound use and conservation of the Earth's natural resources including development of ground-water supplies, cleanup of contaminated aquifers, isolation of hazardous wastes, and exploration for and development of mineral or petroleum resources.
4. Materials and Metallurgical Engineering — development and implementation of environmentally sound processes for producing the metals, ceramics, and composite materials used by our society, and leadership in the area of recycling of materials for re-use by society.
5. Mining Engineering — The development of mining and reclamation plans that ensure environmentally sound mining operations and that the Earth and oceans are returned to environmentally acceptable conditions upon the completion of mining activities.

The objective of the environmental engineering program is to provide graduates with an educational foundation that will enable them to engage in the professional practice of environmental engineering within the public or private sector, or complete advanced studies in either environmental engineering or a related professional discipline.

The bachelor of science program in environmental engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### **Graduates of this program are expected to:**

1. Ethically apply, as appropriate in applicable global and contemporary societal contexts, principles from mathematics, the natural sciences, engineering, humanities, and social sciences, to the definition, formulation, and solution of both existing and potential environmental problems.
2. Develop, interpret, and utilize appropriate laboratory process data; think critically; and use modern engineering skills, techniques, and tools in the iterative decision-making process associated with environmental engineering design.

3. Work and learn, on a lifelong basis, both independently and cooperatively with peers.
4. Communicate the results of their work and their ideas effectively, both orally and in written form, to peers and to non-technical audiences.

### **Cooperative Education Program**

Students may participate in the Cooperative Education Internship Program, but credits earned are not applicable for degree credit.

### **Environmental Engineering Curriculum/Checklist**

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog. Additional advising information is available on the departmental web page: [cee.sdsmt.edu](http://cee.sdsmt.edu).

#### **Freshman Year**

##### **First Semester**

- ENGL 101 Composition I **Credits: (3-0) 3**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- MATH 123 Calculus I **Credits: (4-0) 4**
- ENVE 111/111L Introduction to Chemical Process Modeling/Lab **Credits: (1-1) 2**
- <sup>1</sup>General Education Goal 3 or 4 Elective **Credits: 3**

**Total: 16**

##### **Second Semester**

- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- GEOE 221/221L Geology for Engineers/Lab **Credits: (2-1) 3**
- <sup>1</sup>General Education Goal 3 or 4 Elective **Credits: 3**

**Total: 17**

#### **Sophomore Year**

##### **First Semester**

- ENVE 217 Chemical Engineering Material Balances **Credits: (3-0) 3**
- MATH 225 Calculus III **Credits: (4-0) 4**
- CHEM 230 Analytical Chemistry for Engineers **Credits: (2-0) 2**
- CEE 284 Applied Numerical Methods **Credits: (3-0) 3**
- CHEM 332L Analytical Chemistry Lab **Credits: (0-1) 1**
- <sup>1</sup>General Education Goal 3 or 4 Elective **Credits: 3**

**Total: 16**

##### **Second Semester**

- <sup>2</sup> EM 216 Statics and Dynamics **Credits: (4-0) 4**
- <sup>3</sup> CBE 222 Chemical Engineering Process Thermodynamics **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- ENVE 390 Seminar **Credits: 0 to 1**
- <sup>1</sup>General Education Goal 3 or 4 Elective **Credits: 3**

**Total: 16**

## Junior Year

### First Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- ENVE 317 Chemical Engineering Heat Transfer **Credits: (3-0) 3**
- ENVE 326 Environmental Engineering **Credits: (3-0) 3**
- BIOL 341 Microbial Processes in Engineering and Natural Sciences **Credits: (3-0) 3**
- Science Elective **Credits: 3**
- IENG 301 Basic Engineering Economics **Credits: (2-0) 2**

**Total: 17**

### Second Semester

- ENVE 318 Chemical Engineering Mass Transfer **Credits: (3-0) 3**
- ENVE 325 Introduction to Sustainable Design **Credits: (3-0) 3**
- ENVE 327/327L Environmental Engineering/Lab **Credits: (3-0) 3**
- EM 331 Fluid Mechanics **Credits: (3-0) 3**
- ENVE 390 Seminar **Credits: 0 to 1**
- Science Elective **Credits: 3**

**Total: 16.5**

## Senior Year

### First Semester

- ENVE 466 Environmental Engineering Process Design **Credits: (3-0) 3**
- ENVE 428L Environmental Engineering Operations and Processes Laboratory **Credits: (0-1) 1**
- ENVE 464 Environmental Engineering Project Design I **Credits: (0-1) 1**
- ENVE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- Program Approved Elective Credits: 3<sup>5</sup>
- Program Approved Elective Credits: 3<sup>5</sup>
- 3xx/\*4xx Hum/SocSc Elective Credits: 3

**Total: 17**

### Second Semester

- ENVE 337 Engineering Hydrology **Credits: (3-0) 3**
- ENVE 390 Seminar **Credits: 0 to 1**
- ATM 405/505 Air Quality **Credits: (3-0) 3**
- ENVE 465 Environmental Engineering Project Design II **Credits: (0-2) 2**
- ENVE 421 Aqueous Geochemistry **Credits: (3-0) 3**  
Program Approved Elective<sup>5</sup>

**Total: 14.5**

**130 credits are required for graduation**

## Curriculum Notes

<sup>1</sup>Consult the section of the catalog addressing graduation requirements for a description of the combinations of lower level (1xx/2xx) social sciences and humanities courses meeting the SDBOR General Education Goals #3 and #4.

<sup>2</sup>A combination of EM 214/EM 321, EM 214/EM 215, or EM 214/ME 221 may replace EM 216.

<sup>3</sup>ME 211 or MET 320 may replace CBE 222.

<sup>4</sup>CBE 218, EM 331, or ME 331 will also satisfy fluid mechanics requirements.

<sup>6</sup>Six (6) of nine (9) program approved elective credits must be engineering topics. See your advisor for a listing of applicable engineering topics courses. The remainder must be 3xx or higher level, addressing natural science, applied science, mathematics, or engineering topics.

<sup>5</sup>Consult the section of the catalog addressing graduation requirements for a description of the combinations of lower level (1xx/2xx) social sciences and humanities courses meeting the SDBOR General Education Goals #3 and #4.

<sup>6</sup>ME 211 or MET 320 may replace CBE 222.

## **Geological Engineering, B.S.**

### **Contact Information**

#### **Dr. Laurie Anderson**

Department of Geology and Geological Engineering  
Mineral Industries 303  
(605) 394-2461  
E-mail: Laurie.Anderson@sdsmt.edu

### **Faculty**

Professors Davis and Stetler; Assistant Professors Katzenstein and Sawyer; Professor Emeritus Rahn.

### **Supporting Faculty**

Professors Duke, Hladysz, Paterson, Price and Uzunlar; Associate Professor Masterlark; Assistant Professor Terry; Adjunct Professors M. Anderson, Iles, Long and Roggenthen.

### **Geological Engineering**

Geological engineering is the development and conservation of natural resources in ways useful to humankind. It encompasses diverse fields such as ground-water resources, subsurface contamination, slope stability, environmental site design, and mineral and petroleum exploration and production. Instruction in geological engineering provides training at both the undergraduate and graduate levels through the Ph.D.

### **Geological Engineering Program Objectives**

The program educational objectives defined here describe the career and professional accomplishments that the geological engineering program is preparing graduates to achieve.

1. Graduates of the geological engineering program will perform competently in professional practice in the areas of:
  - ground water
  - environmental site planning and natural hazards
  - geomechanics and geotechnics
  - fuels or minerals
2. Graduates will demonstrate the ability to design and implement appropriate solutions to geological engineering problems, while exercising ethical responsibilities and continued professional development.

In support of these objectives, the program in geological engineering provides students with:

- a. an understanding of the fundamental principles of geological engineering, basic engineering, and geology,
- b. academic training and design experiences to prepare them for engineering practice and career advancement in the geological engineering profession during their first several years of work, and
- c. an education that prepares them to pursue advanced studies if they so desire.

### **Geological Engineering Education**

An integral part of the educational experience is development of the ability to design solutions for meeting desired needs in geological engineering work. The design component of the curriculum is developed within geological engineering courses that integrate basic science (including geology, chemistry, and physics) and engineering science (including statics, mechanics of materials, fluid mechanics, soil mechanics, and thermodynamics).

This engineering design experience includes a two-semester capstone design sequence. The capstone engineering design courses build upon and integrate previous coursework to prepare graduates for the professional practice of geological engineering.

The nature of geological engineering is continually evolving as the needs of employers change in response to advances in technology and economic forces. To prepare adequately for careers in geological engineering, students must be willing to engage in life-long learning in order to embrace new technologies and to stay current within the engineering profession. Graduates with a broad range of skills, flexibility in learning new technologies, and sound training in fundamental principles can expect a competitive advantage in the job market and workplace.

The bachelor of science program in geological engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

A minor in geological engineering is not available.

## Professional Development

Students in geological engineering are encouraged to participate in the Tech Geological Association as well as to become student members of the Association of Engineering Geologists (AEG), National Ground Water Association, the Society for Mining, Metallurgy, and Exploration (SME), and/or the Society of Petroleum Engineers (SPE). Students are strongly encouraged to take the Fundamentals of Engineering examination, as the first step in becoming a registered professional engineer.

## The Black Hills Natural Sciences Field Station

The Black Hills Natural Sciences Field Station functions in cooperation with universities from South Dakota, North Dakota, Mississippi, and Wisconsin with the purpose of providing summer field courses in the Black Hills and nearby areas, as well as overseas. Field courses in geology, geological engineering and environmental science and engineering are offered. For descriptions of all courses offered, see the listings of the Department of Geology and Geological Engineering in this catalog.

The Field Station operates from five sites: School of Mines campus, Ranch A in the northern Black Hills of Wyoming, Taskesti in the country of Turkey, and the city of Chennai and the Andaman Islands in India, and the Himalayas of Nepal.

## Geology and Geological Engineering Field Camps:

[GEOL 410 Field Geology](#) — five (5) weeks (six (6) semester hours) — Ranch A, Wyoming

[GEOL 410 Field Geology](#) — five (5) weeks (six (6) semester hours) --- Taskesti, Turkey

[GEOE 410 Engineering Field Geology](#) five (5) weeks (six (6) semester hours) — Rapid City, SD

[GEOE 410 Engineering Field Geology](#) five (5) weeks (six (6) semester hours) – Taskesti, Turkey

[GEOL 412/512 /GEOE 412/512 Science and Engineering Applications](#) (3 to 6 semester hours), Rapid City - SD, Taskesti – Turkey, Chennai/Andaman Islands,-- India, and Himalayas, Nepal.

## Paleontology Field Camps:

[GEOL 371 Field Paleontology](#) – two (2) weeks two (2) semester hours – held at one of several ongoing paleontology sites throughout South Dakota, Wyoming, Oregon, and the western United States with department and Museum of Geology faculty and personnel

[BHNSFS](#) also offers youth and freshman geology field camps and field trips.

Further information may be obtained by calling (605) 394-2494, or go to the website: <http://geologyfieldcamp.sdsmt.edu>.

Online registration or applications (available from the web page) should be received by **March 1st**. *All deposit fees are non-refundable upon acceptance into the course.*

## Geographic Information Systems (GIS) and Remote Sensing Lab

The Geographic Information Systems (GIS) and Remote Sensing Laboratory is a facility for generating and analyzing spatially-referenced digital information, including maps and remotely-sensed data. Undergraduate and graduate courses in GIS are offered through the Department of Geology and Geological Engineering. (See section on Research Centers and Related Activities for a full description.)

## Geological Engineering Laboratories

The Department of Geology and Geological Engineering has laboratory facilities that include a ground-water laboratory with digital and analytical modeling capabilities, a Geographic Information Systems (GIS) laboratory, a van-mounted geoprobe unit, wind engineering equipment, a geotechnics laboratory, a drilling fluids laboratory, a 3D photogrammetric camera system, a ground-based LIDAR camera, and an operational well field with data loggers and transducers. Instrumentation includes ground-probing radar, a hydrologic analysis system, a portable wind tunnel, a mobile drilling rig, and petroleum engineering equipment. The computing facilities are continually updated and contain high-speed computers with GIS and other analytical capabilities. Computer programs are available for digital modeling of ground-water flow and contaminant migration, petroleum engineering, slope stability, geophysical applications, geochemical modeling, and spreadsheet applications.

## Minor in Geospatial Technology

Geospatial technology is a rapidly expanding field that covers the management and analysis of spatial data from many sources, such as satellites, airborne remote sensing, geographic information systems (GIS), global positioning systems (GPS), surveying, and more. Complete information on requirements are given at: Geospatial Technology Minor :

### Geospatial Technology Minor

Geospatial Technology is a rapidly expanding field that covers the management and analysis of spatial data from many sources, such as satellites, airborne remote sensing, geographic information systems (GIS), global positioning systems (GPS), surveying, and more. It has many applications in the sciences, engineering, business, planning, and transportation. Other science and engineering majors may pursue a Minor in Geospatial Technology by completing eighteen (18) credit hours of courses, including [GEOL 416/416L/516/516L](#), [GEOL 417/517](#), [GEOL 419/519](#), [GEOL 420/520](#). Six additional credits taken from any of the groups below complete the minor. Up to three credits of a senior capstone, research, or design project with a significant proportion of geospatial content may be substituted for one elective, with permission of the program director, Dr. Maribeth Price. E-mail: [Maribeth.Price@sdsmt.edu](mailto:Maribeth.Price@sdsmt.edu)

**One of these surveying courses may be applied to the minor:**

- [CEE 206/206L - Engineering Surveys I/Lab](#) Credits: (2-1) 3
- [MEM 201L - Surveying for Mineral Engineers](#) Credits: (0-2) 2

**One of these statistics courses may be applied to the minor:**

- [MEM 307 - Mineral Exploration and Geostatistics](#) Credits: (3-0) 3
- [MATH 281 - Introduction to Statistics](#) Credits: (3-0) 3
- [MATH 381 - Introduction to Probability and Statistics](#) Credits: (3-0) 3
- [MATH 442 - Engineering Statistics](#) Credits: (4-0) 4

**One of these programming courses may be applied to the minor:**

- [GEOE 211/211L - Earth Systems Engineering Analysis/Lab](#) Credits: (1-1) 2
- [CEE 284 - Applied Numerical Methods](#) Credits: (3-0) 3
- [CSC 150/150L - Computer Science I/Lab](#) Credits: (2-1) 3

**Any of these courses may be applied to the minor:**

- [GEOE 475/475L - Ground Water/Lab](#) Credits: (2-1) 3
- [CEE 437/437L/537/537L - Watershed and Floodplain Modeling/Lab](#) Credits: (2-1) 3
- [CSC 250 - Computer Science II](#) Credits: (4-0) 4
- [GEOE 376 - Geospatial Field Methods](#) Credits: (0-3) 3

## Minor in Environmental Engineering

Environmental engineering involves design of systems and solving pressing global problems, including developing ecosystem protection and restoration efforts, designing site remediation and mining reclamation programs; developing air quality monitoring and pollution prevention programs; designing sustainable drinking water treatment and distribution, wastewater treatment, and solid and hazardous waste disposal systems; among others. Complete information on the minor requirements are given at: [Environmental Engineering Minor](#).

### Contact Information

**Dr. James Stone**  
Program Coordinator  
Department of Civil and Environmental Engineering  
Civil/Mechanical 314  
(605) 394-2443  
E-mail: [James.Stone@sdsmt.edu](mailto:James.Stone@sdsmt.edu)

Environmental engineers design systems and solve pressing global problems in all areas related to the environment and public health: sustainable design of drinking water treatment and wastewater treatment, and solid hazardous waste disposal systems; development of air quality monitoring and pollution prevention programs; design of site remediation and mining reclamation programs; and development of ecosystem protection and restoration efforts, among others. Students may pursue an environmental engineering education as an emphasis area in the B.S. civil engineering degree program, and/or pursue an environmental engineering minor.

Students from any discipline at the School of Mines may pursue a minor in environmental engineering by completing 18 credit hours of coursework as described below.

### Required core courses:

- [CBE 217 - Chemical Engineering Material Balances](#) Credits: (3-0) 3
- [CEE 326 - Environmental Engineering I](#) Credits: (3-0) 3
- [CEE 327/327L - Environmental Engineering II/Lab](#) Credits: (2-1) 3
- [GEOE 421/521 - Aqueous Geochemistry](#) Credits: (3-0) 3
- [BIOL 341 - Microbial Processes in Engineering and Natural Sciences](#) Credits: (3-0) 3

### Elective course

- In addition, students select one 3-credit elective course from the list below. To ensure that enrollees gain the broad and interdisciplinary background expected in the environmental engineering discipline, the elective must be taken from a discipline outside the student's major field of study.
- [CBE 455/555 - Pollution Phenomena and Process Design](#) Credits: (3-0) 3
- [CEE 426/526 - Environmental Engineering Physical/Chemical Process Design](#) Credits: (3-0) 3
- [CHEM 326 - Organic Chemistry I](#) Credits: (3-0) 3
- [CHEM 482/582 - Environmental Chemistry](#) Credits: (3-0) 3
- [GEOE 475/475L - Ground Water/Lab](#) Credits: (2-1) 3
- [IENG 331 - Safety Engineering](#) Credits: (3-0) 3
- [MEM 405 - Mine Permitting and Reclamation](#) Credits: (3-0) 3
- [MET 220 - Mineral Processing and Resource Recovery](#) Credits: (3-0) 3
- [MET 220L - Mineral Processing and Resource Recovery Laboratory](#) Credits: (0-1) 1

## Geological Engineering 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.

### Freshman Year

#### First Semester

- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- MATH 123 Calculus I **Credits: (4-0) 4**
- ENGL 101 Composition I **Credits: (3-0) 3**
- GEOE 110L Introduction to Geological and Mining Engineering/Lab **Credits: (0-1) 1**
- General Education Goal 3 and Goal 4 Elective(s) **Credits: 6**

**Total: 17**

#### Second Semester

- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- GEOE 221/221L Geology for Engineers/Lab **Credits: (2-1) 3**
- CEE 117/117L Introduction to CADD/Lab **Credits: (1-1) 2**

**Total: 16**

### Sophomore Year

#### First Semester

- EM 214 Statics **Credits: (3-0) 3**
- MATH 225 Calculus III **Credits: (4-0) 4**
- MEM 201L Surveying for Mineral Engineers **Credits: (0-2) 2**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- General Education Goal 3 Elective(s) **Credits: 3**

**Total: 15**

#### Second Semester

- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- EM 321 Mechanics of Materials **Credits: (3-0) 3**
- GEOL 212/212L Mineralogy and Crystallography/Lab **Credits: (2-1) 3**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- Gen. Ed. Goal 4 Electives **Credits: 3**

**Total: 15**

### Junior Year

#### First Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- GEOL 331/331L Stratigraphy and Sedimentation/Lab **Credits: (2-1) 3**
- GEOL 341/341L Igneous and Metamorphic Petrology/Lab **Credits: (2-1) 3**
- CEE 346/346L Geotechnical Engineering/Lab **Credits: (2-1) 3**
- MET 320 Metallurgical Thermodynamics **Credits: (4-0) 4**

**Total: 16**

#### Second Semester

- GEOE 322/322L Structural Geology/Lab **Credits: (2-1) 3**

- GEOE 324/324L Engineering Geophysics I/Lab **Credits: (2-1) 3**
- EM 328 Applied Fluid Mechanics **Credits: (3-0) 3**
- GEOL 416/416L/516/516L Introduction to GIS/Lab **Credits: (2-1) 3**
- MEM 302 Mineral Economics and Finance **Credits: (3-0) 3**

**Total: 15**

#### **Summer**

- GEOE 410 Engineering Field Geology **Credits: 5 to 6**  
(SDSM&T students must take GEOE 410 for 6 credits.)

**Total: 6**

#### **Senior Year**

##### **First Semester**

- GEOE 466/466L/566/566L Engineering and Environmental Geology/Lab **Credits: (2-1) 3**
- GEOE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- GEOE 464 Geological Engineering Design Project I **Credits: (0-3) 3**
- <sup>1</sup>Approved Elective(s) **Credits: 3**
- <sup>2</sup>Professional Elective(s) **Credits: 3**

**Total: 15**

##### **Second Semester**

- MEM 304/304L Theoretical and Applied Rock Mechanics/Lab **Credits: (2-1) 3**
- <sup>2</sup>Professional Elective(s) **Credits: 3**
- GEOE 465 Geological Engineering Design Project II **Credits: (0-3) 3**
- GEOE 461 Petroleum Drilling and Production Engineering **Credits: (3-0) 3**
- Upper Level Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 15**

#### **130 credits required for graduation**

#### **Curriculum Notes**

Additional coursework in mathematics and statistics is encouraged. MATH 381 and MATH 382 are recommended statistics courses. MATH 432 is recommended for students interested in numerical modeling of partial differential equations.

<sup>1</sup>Approved Elective. Must be a course approved by the Department of Geology and Geological Engineering.

<sup>2</sup>Professional Electives.

#### **Students may choose two of the courses listed below:**

- GEOE 451/451L Economic Geology/Lab **Credits: (2-1) 3**
- GEOE 482/482L Applied Geomorphology/Lab **Credits: (3-0) 3**
- ENVE 327/327L Environmental Engineering/Lab **Credits: (3-0) 3**
- ENVE 421 Aqueous Geochemistry **Credits: (3-0) 3**
- CEE 337 Engineering Hydrology **Credits: (3-0) 3**
- CEE 347 Geotechnical Engineering II **Credits: (3-0) 3**
- CEE 437/437L/537/537L Watershed and Floodplain Modeling/Lab **Credits: (2-1) 3**
- CEE 447/547 Foundation Engineering **Credits: (3-0) 3**
- CEE 474/574 Construction Engineering and Management **Credits: (3-0) 3**
- ME 351/351L Mechatronics and Measurement Systems/Lab **Credits: (3-1) 4**
- MEM 301/301L Computer Applications in Mining/Lab **Credits: (1-1) 2**
- MEM 305 Introduction to Explosives Engineering **Credits: (3-0) 3**
- MEM 307 Mineral Exploration and Geostatistics **Credits: (3-0) 3**
- MEM 405 Mine Permitting and Reclamation **Credits: (3-0) 3**
- MEM 450/550 Rock Slope Engineering **Credits: (3-0) 3**

## Geology, B.S.

### Contact Information

#### Dr. Laurie Anderson

Department of Geology and Geological Engineering  
Mineral Industries 303  
(605) 394-2461  
E-mail: Laurie.Anderson@sdsmt.edu

### Faculty

Professors Anderson, Duke, Paterson, Price and Uzunlar; Associate Professor Masterlark; Assistant Professors Belanger, Pagnac and Terry; Professors Emeritus Fox, Lisenbee, Martin and Redden; Haslem Post-doctoral Fellow Boyd.

### Supporting Faculty

Professors Davis and Stetler; Assistant Professors Katzenstein and Sawyer; Professor Emeritus Rahn; Adjunct Professors Benton and McCormick.

### Geology and Paleontology

The program in geology and paleontology fully utilizes the magnificent geologic setting of the Black Hills and Badlands, and the extensive fossil and mineral specimens in the Museum of Geology. We train students for careers in the geosciences including environmental applications, mineral and petroleum exploration, governmental agencies, museums, academic fields, teaching, and entrepreneurship. Both undergraduate and graduate programs are available.

### The Black Hills Natural Sciences Field Station

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[GEOE 410 Engineering Field Geology](#) five (5) weeks (six (6) semester hours) – Taskesti, Turkey

[GEOL 412/512 /GEOE 412/512 Science and Engineering Applications](#) (3 to 6 semester hours), Rapid City - SD, Taskesti – Turkey, Chennai/Andaman Islands.-- India, and Himalayas, Nepal.

### Paleontology Field Camps:

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## **Professional Development**

The senior year culminates in an individual research project in which the student practices the professional accomplishments of project planning, organization, time management, and oral/written communication. Students are strongly encouraged to participate in professional societies active on campus, including the Tech Geological Association, the Society of Economic Geologists and the Paleontology Club. Paleontology students will have opportunities to volunteer or work on archival and research projects at the Museum of Geology. Internships in industry and government are commonly available and highly recommended.

## **Choosing a career focus**

Many different career opportunities are open to students in the geosciences. Students complete a core of geology courses to solidly prepare them for careers in the geosciences. Additional electives are chosen to focus on a particular career path and best prepare the student for employment or graduate school. Students may focus in one of four career paths or select electives from two or more foci, depending on their career interests. Students are strongly encouraged to consult with their advisor in selecting a focus and electives.

## **Resource Geology**

This focus prepares students for careers with the traditional employers of geologists--the mining and petroleum industries. Graduates may work to find oil or mineral resources, assist with extracting them, or develop new types of resources such as coal bed methane or oil shales.

### **Recommended electives for resource geology include:**

- GEOE 324/324L Engineering Geophysics I/Lab **Credits: (2-1) 3**
- GEOE 451/451L Economic Geology/Lab **Credits: (2-1) 3**
- GEOE 461 Petroleum Drilling and Production Engineering **Credits: (3-0) 3**
- GEOL 351 Earth Resources and the Environment **Credits: (3-0) 3**
- GEOL 442/442L/542/542L Optical Petrology/Lab **Credits: (2-1) 3**
- GEOL 476/576 Petroleum Geology **Credits: (3-0) 3**
- MEM 201L Surveying for Mineral Engineers **Credits: (0-2) 2**
- MEM 301/301L Computer Applications in Mining/Lab **Credits: (1-1) 2**

## **Paleontology**

This focus area trains students for careers studying ancient organisms and their environments. Graduates will often go to graduate school to develop research careers, but opportunities are also available to work in museums, parks, or with consulting firms that survey and preserve fossil resources prior to construction projects. Paleontology students work closely with Museum of Geology personnel and associated faculty.

### **Recommended electives for paleontology include:**

- ATM 403/503 Biogeochemistry **Credits: (3-0) 3**
- ATM 406/506 Global Environmental Change **Credits: (3-0) 3**
- OR
- BIOL 406/506 Global Environmental Change **Credits: (3-0) 3**
- BIOL 121 Basic Anatomy **Credits: (3-0) 3**
- BIOL 121L Basic Anatomy Lab **Credits: (0-1) 1**
- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 123 Basic Physiology **Credits: (3-0) 3**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 311 Principles of Ecology **Credits: (3-0) 3**
- GEOL 372 Dinosaurs **Credits: (3-0) 3**
- GEOL 471/571 Field Paleontology **Credits: (0-2) 2**

- GEOL 472/472L/572/572L Museum Conservation and Curation/Lab **Credits: (2-1) 3**
- GEOL 473/473L/573/573L Museum Preparation Techniques and Exhibit Design/Lab **Credits: (1-2) 3**

### **Environmental Geology**

This focus prepares students for work developing and preserving natural resources including ground water and soils. Students may work for environmental firms, or could do environmental work for petroleum and mineral companies. Many government agencies also hire graduates with these skills.

#### **Recommended electives for environmental geology include:**

- ATM 403/503 Biogeochemistry **Credits: (3-0) 3**
- ATM 406/506 Global Environmental Change **Credits: (3-0) 3**  
OR
- BIOL 406/506 Global Environmental Change **Credits: (3-0) 3**
- GEOE 324/324L Engineering Geophysics I/Lab **Credits: (2-1) 3**
- GEOE 466/466L/566/566L Engineering and Environmental Geology/Lab **Credits: (2-1) 3**
- GEOE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- GEOE 482/482L Applied Geomorphology/Lab **Credits: (3-0) 3**
- GEOL 351 Earth Resources and the Environment **Credits: (3-0) 3**

### **Geospatial Technology**

This focus supplies additional training for students interested in careers that involve remote sensing and Geographic Information Systems. Most geoscience careers require basic knowledge of GIS, but additional training opens new career options for students who enjoy mapping and computers. Graduates may work in traditional petroleum, mining, or environmental companies, for government agencies, or within the geospatial industry that provides and manages maps and imagery to the world.

#### **Recommended electives for geospatial technology include:**

- GEOE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- GEOL 417/517 Geospatial Databases **Credits: (3-0) 3**
- GEOL 419/519 Advanced Geospatial Analysis **Credits: (3-0) 3**
- GEOL 420/520 Introduction to Remote Sensing **Credits: (3-0) 3**
- MEM 201L Surveying for Mineral Engineers **Credits: (0-2) 2**

#### **Note(s):**

Geology majors can simultaneously satisfy elective requirements for the Geology B.S. and a Minor in Geospatial Technology by taking GEOL 417/517, GEOL 419/519, GEOL 420/520, and two courses from: MEM 201L, MATH 281, or GEOE 475/475L. Students considering the geospatial minor should take GEOL 416/416L/516/516L Intro to GIS by their junior fall.

### **Geology/Paleontology 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. When planning coursework, students are advised that the courses GEOL 212/212L, GEOL 341/341L, GEOE 322/322L and GEOL 410 form a critical sequence that must be taken in the order listed.

### **Freshman Year**

#### **First Semester**

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- ENGL 101 Composition I **Credits: (3-0) 3**
- GEOL 201 Physical Geology **Credits: (3-0) 3**
- GEOL 201L Physical Geology Laboratory **Credits: (0-1) 1**
- <sup>1</sup>IS 110 Explorations **Credits: (2-0) 2**

**Total: 17**

## Second Semester

- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- MATH 125 Calculus II **Credits: (4-0) 4**
- GEOE 211/211L Earth Systems Engineering Analysis/Lab **Credits: (1-1) 2**
- <sup>2</sup>Gen. Ed. Goal 3 and Goal 4 Electives **Credits: 6**

**Total: 16**

## Sophomore Year

### First Semester

- PHYS 211 University Physics I **Credits: (3-0) 3**
- GEOL 323 Search for Our Past **Credits: (3-0) 3**
- <sup>4</sup>Sophomore Electives **Credits: 3**
- <sup>2</sup>Gen Ed Goal 3 and Goal 4 Electives **Credits: 3**

**One of: 3-4 Credits**

See note <sup>3</sup>

- MATH 225 Calculus III **Credits: (4-0) 4**
- MATH 281 Introduction to Statistics **Credits: (3-0) 3**

**Total 15-16**

### Second Semester

- PHYS 213 University Physics II **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- GEOL 212/212L Mineralogy and Crystallography/Lab **Credits: (2-1) 3**
- <sup>4</sup>Sophomore Electives **Credits: 3**
- <sup>2</sup>Gen Ed Goal 3 and Goal 4 Electives **Credits: 3**

**Total: 15**

## Junior Year

### First Semester

- <sup>1</sup>ENGL 289 Technical Communications II **Credits: (3-0) 3**
- GEOL 331/331L Stratigraphy and Sedimentation/Lab **Credits: (2-1) 3**
- GEOL 341/341L Igneous and Metamorphic Petrology/Lab **Credits: (2-1) 3**
- GEOL 416/416L/516/516L Introduction to GIS/Lab **Credits: (2-1) 3**
- PE 100 Activity Courses **Credits: (1-0) 1**

**Total: 13**

### Second Semester

- GEOE 322/322L Structural Geology/Lab **Credits: (2-1) 3**
- <sup>5</sup>GEOL 403/503 Regional Field Geology **Credits: (0-1) 1**
- \*\* GEOL 461/461L Invertebrate Paleontology/Lab **Credits: (2-1) 3**
- <sup>4</sup>Geology Electives **Credits: 3**

**One of: 3 Credits**

- GEOE 324/324L Engineering Geophysics I/Lab **Credits: (2-1) 3**
- GEOE 482/482L Applied Geomorphology/Lab **Credits: (3-0) 3 \*\***

**Total: 13**

## Summer

- GEOL 410 Field Geology **Credits: (0-6) 6**

## Senior Year

### First Semester

- GEOL 464 Senior Research I **Credits: (0-1) 1**
- Geology Electives Credits: 6 <sup>4</sup>
- Free Elective(s) Credits: 3 <sup>3</sup>
- Humanities/Social Science electives Credits: 3

**Total: 13**

### Second Semester

- <sup>6</sup>GEOL 465 Senior Research II **Credits: (0-3) 3**
- Geology Electives **Credits: 6**
- Free electives **Credits: 2-3**

**Total: 11-12**

**120 credits required for graduation**

## Curriculum Notes

\*\* Course offered in alternate years.

<sup>1</sup> Transfer students may substitute 2 credits of free electives for IS 110.

<sup>2</sup> Students must complete 27 credits of the general education core in their first 64 credit hours, including 6 credits of science, 3 cr math, 6 cr English/Technical Communication, 6 cr humanities, and 6 cr social science. ENGL 289 yields an addition 3 general education credits, for a total of 30.

<sup>3</sup> Students should consult an advisor when choosing math courses.

<sup>4</sup> Sophomore and Geology electives must be selected from the approved lists. At least 9 credits must be taken from 400-level courses. Substitutions must be approved by the department head.

<sup>5</sup> Students may substitute GEOL 471/571 for GEOL 403/503 ; the extra credit is a geology elective.

<sup>6</sup> Under exceptional circumstances, a student may petition the department head to substitute geology electives for senior research.

## Advanced Degrees

This B.S. in Geology can provide a pathway to professional careers in teaching, law, or medicine. For careers in science education, students should consult teaching programs at other colleges for auxiliary education courses that would be needed for teacher certification. With some adaptation, this degree can provide a foundation for professional graduate degrees such as in medicine or law.

Graduate programs, both master's and doctoral, are available and involve additional specialization in geology or paleontology and incorporate original research leading to the completion and defense of a thesis or dissertation. Completion of graduate degrees leads to higher-level professional employment including college-level instruction.

Analytical and computational facilities in the department and related departments include electron microprobe, heating-cooling fluid inclusion stage, AA-ICP, XRD, SEM, TEM, the Geographic Information Systems/ Remote Sensing Laboratory. The Museum of Geology holds over 500,000 fossil and mineral specimens that are available for educational and research use.

## Minor in Geology

Other science and engineering majors may pursue a minor in geology by completing eighteen (18) credit hours of geology courses. Complete information on requirements are given at **Geology Minor**.

### Geology Minor

#### Geology Courses

Other science and engineering majors may pursue a minor in geology by completing eighteen (18) credit hours of geology courses including the following:

- [GEOL 201 - Physical Geology](#) **Credits: (3-0) 3**
- [GEOL 201L - Physical Geology Laboratory](#) **Credits: (0-1) 1**
- [GEOL 212/212L - Mineralogy and Crystallography/Lab](#) **Credits: (2-1) 3**
- [GEOL 331/331L - Stratigraphy and Sedimentation/Lab](#) **Credits: (2-1) 3**
- [GEOL 341/341L - Igneous and Metamorphic Petrology/Lab](#) **Credits: (2-1) 3**
- [GEOE 322/322L - Structural Geology/Lab](#) **Credits: (2-1) 3**

#### Note(s):

[GEOE 221/221L](#) and one additional geology elective credit may be substituted for [GEOE 201 /GEOE 201L](#) . No other substitutions are permitted for this minor.

### Minor in Geospatial Technology

Geospatial technology is a rapidly expanding field that covers the management and analysis of a spatial data from many sources, such as satellites, airborne remote sensing, geographic information systems (GIS), global positioning systems (GPS), surveying, and more. Complete information on requirements are given at **Geospatial Technology Minor**.

Geospatial Technology is a rapidly expanding field that covers the management and analysis of spatial data from many sources, such as satellites, airborne remote sensing, geographic information systems (GIS), global positioning systems (GPS), surveying, and more. It has many applications in the sciences, engineering, business, planning, and transportation. Other science and engineering majors may pursue a Minor in Geospatial Technology by completing eighteen (18) credit hours of courses, including [GEOE 416/416L/516/516L](#) , [GEOE 417/517](#) , [GEOE 419/519](#) , [GEOE 420/520](#) . Six additional credits taken from any of the groups below complete the minor. Up to three credits of a senior capstone, research, or design project with a significant proportion of geospatial content may be substituted for one elective, with permission of the program director, Dr. Maribeth Price. E-mail: [Maribeth.Price@sdsmt.edu](mailto:Maribeth.Price@sdsmt.edu)

#### One of these surveying courses may be applied to the minor:

- [CEE 206/206L - Engineering Surveys I/Lab](#) Credits: (2-1) 3
- [MEM 201L - Surveying for Mineral Engineers](#) Credits: (0-2) 2

#### One of these statistics courses may be applied to the minor:

- [MEM 307 - Mineral Exploration and Geostatistics](#) Credits: (3-0) 3
- [MATH 281 - Introduction to Statistics](#) Credits: (3-0) 3
- [MATH 381 - Introduction to Probability and Statistics](#) Credits: (3-0) 3
- [MATH 442 - Engineering Statistics](#) Credits: (4-0) 4

#### One of these programming courses may be applied to the minor:

- [GEOE 211/211L - Earth Systems Engineering Analysis/Lab](#) Credits: (1-1) 2
- [CEE 284 - Applied Numerical Methods](#) Credits: (3-0) 3
- [CSC 150/150L - Computer Science I/Lab](#) Credits: (2-1) 3

#### Any of these courses may be applied to the minor:

- [GEOE 475/475L - Ground Water/Lab](#) Credits: (2-1) 3
- [CEE 437/437L/537/537L - Watershed and Floodplain Modeling/Lab](#) Credits: (2-1) 3
- [CSC 250 - Computer Science II](#) Credits: (4-0) 4
- [GEOE 376 - Geospatial Field Methods](#) Credits: (0-3) 3

### Minor in Environmental Engineering

Environmental engineering involves design of systems and solving pressing global problems, including developing ecosystem protection and restoration efforts, designing site remediation and mining reclamation programs; developing air quality monitoring and pollution prevention programs; designing sustainable drinking water treatment and distribution, wastewater treatment, and solid and hazardous waste disposal systems; among others.

Complete information on the minor requirements are given at **Environmental Engineering Minor**.

#### Contact Information

**Dr. James Stone**  
Program Coordinator  
Department of Civil and Environmental Engineering  
Civil/Mechanical 314  
(605) 394-2443  
E-mail: [James.Stone@sdsmt.edu](mailto:James.Stone@sdsmt.edu)

Environmental engineers design systems and solve pressing global problems in all areas related to the environment and public health: sustainable design of drinking water treatment and wastewater treatment, and solid hazardous waste disposal systems; development of air quality monitoring and pollution prevention programs; design of site remediation and mining reclamation programs; and development of ecosystem protection and restoration efforts, among others. Students may pursue an environmental engineering education as an emphasis area in the B.S. civil engineering degree program, and/or pursue an environmental engineering minor.

Students from any discipline at the School of Mines may pursue a minor in environmental engineering by completing 18 credit hours of coursework as described below.

#### Required core courses:

- [CBE 217 - Chemical Engineering Material Balances](#) Credits: (3-0) 3
- [CEE 326 - Environmental Engineering I](#) Credits: (3-0) 3
- [CEE 327/327L - Environmental Engineering II/Lab](#) Credits: (2-1) 3
- [GEOE 421/521 - Aqueous Geochemistry](#) Credits: (3-0) 3
- [BIOL 341 - Microbial Processes in Engineering and Natural Sciences](#) Credits: (3-0) 3

#### Elective course

- In addition, students select one 3-credit elective course from the list below. To ensure that enrollees gain the broad and interdisciplinary background expected in the environmental engineering discipline, the elective must be taken from a discipline outside the student's major field of study.

- [CBE 455/555 - Pollution Phenomena and Process Design](#) Credits: (3-0) 3
- [CEE 426/526 - Environmental Engineering Physical/Chemical Process Design](#) Credits: (3-0) 3
- [CHEM 326 - Organic Chemistry I](#) Credits: (3-0) 3
- [CHEM 482/582 - Environmental Chemistry](#) Credits: (3-0) 3
- [GEOE 475/475L - Ground Water/Lab](#) Credits: (2-1) 3
- [IENG 331 - Safety Engineering](#) Credits: (3-0) 3
- [MEM 405 - Mine Permitting and Reclamation](#) Credits: (3-0) 3
- [MET 220 - Mineral Processing and Resource Recovery](#) Credits: (3-0) 3
- [MET 220L - Mineral Processing and Resource Recovery Laboratory](#) Credits: (0-1) 1

## **Industrial Engineering and Engineering Management, B.S.**

### **Contact Information**

**Dr. Stuart D. Kellogg**

Industrial Engineering

IER 301

(605) 394-1271

E-mail: [Stuart.Kellogg@sdsmt.edu](mailto:Stuart.Kellogg@sdsmt.edu)

### **Faculty**

Professor Kellogg; Ervin Pietz Professor Kerk; Associate Professors Matejcik, Karlin and Jensen; Assistant Professor Piper; and Instructor Jensen.

### **Industrial Engineering and Engineering Management**

Industrial engineering and engineering management is concerned with the design, improvement, installation, and management of integrated systems of people, material, and equipment. Graduates of the program employ a set of skills that includes mathematical modeling, probability and statistics, computer science, human factors, interpersonal skills, project management, and an ability to manage and administer large technical engineering and research projects. Thus, industrial engineering and engineering management may be thought of as applied problem solving, from inception to implementation and management.

### **Program Objectives**

The objectives of the industrial engineering and engineering management program are to produce graduates who

- Contribute to the success of companies through effective problem solving.
- Design, develop, implement, and improve integrated systems that include people, materials, information, equipment, and environments.
- Effectively manage business operations and project management teams.
- Continue to develop holistically, including the personal and professional skills necessary to adapt to our changing societal, technological, and global environments.

Graduates of the industrial engineering and engineering management program are expected to meet the challenges for contemporary professional practice, be able to adapt and solve the increasingly complex problems faced by industry, embrace innovation through intellectual diversity and creative problem solving, and continue to develop holistically as a learner to become leaders of tomorrow.

### **Laboratories**

The Human Engineering Laboratory supports the minor in occupational safety and courses in work methods and measurement, ergonomics/human factors engineering, safety engineering, and industrial hygiene. Laboratories typically include an enterprise team or service learning component that provide real world work experience. The Manufacturing, Industrial Learning Laboratory (MILL) supports the computer controlled manufacturing course and operational strategies. Using modern equipment, students will utilize robots, material handling equipment, and computer numerically controlled machinery to design and fabricate a finished product as well as allowing students to simulate large production systems to explore flexible manufacturing systems and strategies for lean manufacturing.

### **Certificate Programs (See pages 159 - 162 for further certificate information/requirements)**

Students may elect to add value to their transcript via certificate program offerings in Six Sigma Greenbelt, Engineering Management and Leadership, and Technology Innovation.

The Six Sigma Greenbelt program provides the necessary components and training for greenbelt certification desired by industry. Students will gain an exposure to the six sigma quality management philosophy culminating in a project application of quality by design.

The Engineering Management and Leadership program provides students an opportunity to complement their technical skills with modern management techniques, organizational theory, and change management practices required to effectively manage technical industries.

The Technology Innovation certificate provides students with a value-added curriculum in creativity and innovation, product development, and business and entrepreneurial functions. Additional information may be found at the department website: <http://ie.sdsmt.edu>.

### **Curriculum**

The curriculum is designed to give students a thorough knowledge in the fundamental principles within the four primary stems of industrial engineering: operations research and optimization, manufacturing, statistical processes, and human engineering. In addition, through a variety of coursework and experiential learning activities, students develop an understanding of the engineering relationships with the management tasks of planning, leading, organizing, and controlling as well as the integrative nature of management systems.

Throughout the program of studies, special emphasis is placed upon application of systems principles in engineering design to assure proper integration of the individual (or individuals), procedures, materials, and equipment. Service learning components, laboratories, case work, simulations, and the capstone design sequence reinforce the managerial aspects of systems integration, systems design, and the global, societal, and business context for product and process improvement.

Students may participate in the Cooperative Education Internship Program. The co-op credits may count as approved engineering elective courses.

### **Accreditation**

The bachelor of science program in industrial engineering and engineering management is accredited for industrial engineering by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### **Industrial Engineering Curriculum/Checklist**

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

### **Freshman Year**

#### **First Semester**

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) Credits: 3
- ENGL 101 Composition I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- ME 110/110L Introduction to Mechanical Engineering/Lab **Credits: (1-1) 2 OR**
- CEE 117/117L Introduction to CADD/Lab **Credits: (1-1) 2**

**Total: 16**

#### **Second Semester**

- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- PSYC 101 General Psychology **Credits: (3-0) 3**
- IENG 241L Introduction to Quality Methods and Teaming **Credits: (0-2) 2**
- Humanities or Social Sciences Elective(s) Credits: 3

**Total: 15**

### **Sophomore Year**

#### **First Semester**

- Engineering Fundamentals Elective Credits: 3
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- MATH 225 Calculus III **Credits: (4-0) 4**
- IENG 381 Introduction to Probability and Statistics **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**

**Total: 17**

#### **Second Semester**

- IENG 382 Probability Theory and Statistics II **Credits: (3-0) 3**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- IENG 215 Cost Estimating for Engineers I **Credits: (1-0) 1 AND**
- IENG 216 Cost Estimating for Engineers II **Credits: (1-0) 1 AND**
- IENG 217 Cost Estimating for Engineers III **Credits: (1-0) 1**
- Engineering Fundamentals Elective Credits: 3

- IENG 302 Engineering Economics **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) Credits: 3

**Total: 18**

### **Junior Year**

#### **First Semester**

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- IENG 311/311L Work Methods and Measurements/Lab **Credits: (2-1) 3**
- IENG 486 Statistical Quality and Process Control **Credits: (3-0) 3**
- IENG 352 Creativity and Innovation **Credits: (1-0) 1**
- IENG 354 Marketing Technology Innovations **Credits: (1-0) 1**
- IENG 362 Stochastic Models **Credits: (3-0) 3**
- Professional Breadth Elective Credits: 3

**Total: 17**

#### **Second Semester**

- IENG 355 Financing Technology Innovations **Credits: (1-0) 1**
- IENG 441 Simulation **Credits: (3-0) 3**
- MATH 353 Linear Optimization **Credits: (3-0) 3**
- IENG 321/321L Ergonomics/Human Factors Engineering/Lab **Credits: (2-1) 3**
- Engineering Fundamentals Elective Credits: 3
- Professional Breadth Elective Credits: 4

**Total: 17**

### **Senior Year**

#### **First Semester**

- IENG 425 Production and Operation Management **Credits: (3-0) 3**
- IENG 331 Safety Engineering **Credits: (3-0) 3**<sup>1</sup>
- IENG 471 Facilities Planning **Credits: (3-0) 3**
- IENG 464 Senior Design Project I **Credits: (0-2) 2**
- IENG 462 Industrial and Engineering Management Profession **Credits: (1-0) 1**
- Professional Breadth Elective Credits: 3

**Total: 15**

#### **Second Semester**

- IENG 366 Engineering Management **Credits: (3-0) 3**
- IENG 465 Senior Design Project II **Credits: (0-3) 3**
- IENG 475/475L Computer-Controlled Manufacturing Systems and Robotics **Credits: (2-1) 3**
- Humanities or Social Sciences Elective(s) Credits: 3
- Department Elective Credits: 3

**Total: 15**

### **130 credits required for graduation**

#### **Curriculum Notes**

<sup>1</sup>IENG 341 (Industrial Hygiene) may be substituted during a second semester.

#### **Elective courses must be chosen to satisfy all of the following requirements.**

1. Fifteen semester hours in humanities or social science. At least 6 hours must be in humanities and at least 6 hours must be in social sciences. This may include PSYC 101, which is required.

2. Six hours of humanities or social science must be included in the list of approved cultural diversity courses.
3. At least 3 hours of humanities or social science must be at the 300 or 400 level.

### **Department Electives (6 credits)**

#### **Human Engineering (3 credits)**

- IENG 331 Safety Engineering **Credits: (3-0) 3**
- IENG 431/531 Industrial Hygiene **Credits: (3-0) 3**

#### **Department Breadth (3 credits)**

- IENG 353 Commercialization of New Technology **Credits: (1-0) 1**
- IENG 356 Technology Start Ups **Credits: (1-0) 1**
- IENG 451/451L Operational Strategies/Lab **Credits: (2-1) 3**
- IENG 452 Introduction to Six Sigma **Credits: (1-0) 1**
- IENG 466/566 Project Planning and Control **Credits: (3-0) 3**
- IENG 492 Topics **Credits: 1 to 3**

### **Engineering Fundamentals (11 credits)**

#### **Graphics (2 credits)**

- ME 110/110L Introduction to Mechanical Engineering/Lab **Credits: (1-1) 2**
- CEE 117/117L Introduction to CADD/Lab **Credits: (1-1) 2**

### **Fundamentals (9 credits from at least two different areas)**

#### **Materials**

- MET 231 Structures and Properties of Materials Lab **Credits: (0-1) 1**
- MET 232 Properties of Materials **Credits: (3-0) 3**

#### **Circuits**

- EE 301/301L Introduction to Circuits, Machines, and Systems/Lab **Credits: (3-1) 4**
- OR**
- EE 220/220L Circuits I/Lab **Credits: (3-1) 4**

#### **Statics/Dynamics**

- EM 214 Statics **Credits: (3-0) 3**
- **OR**
- EM 216 Statics and Dynamics **Credits: (4-0) 4**
- OR**
- EM 214 Statics Credits: 3 **AND**
- EM 215 Dynamics **Credits: (3-0) 3**
- OR**
- EM 214 Statics Credits: 3 **AND**
- ME 221 Dynamics of Mechanisms **Credits: (3-0) 3**

#### **Thermodynamics**

- CBE 222 Chemical Engineering Process Thermodynamics **Credits: (3-0) 3**
- ENVE 320
- OR**
- MET 320 Metallurgical Thermodynamics **Credits: (4-0) 4**
- ME 211 Introduction to Thermodynamics **Credits: (3-0) 3**

#### **Fluid Mechanics**

- EM 327
- EM 328 Applied Fluid Mechanics **Credits: (3-0) 3**
- OR**
- EM 331 Fluid Mechanics **Credits: (3-0) 3**
- OR**

- ME 331 Thermo Fluid Dynamics **Credits: (3-0) 3**

### **Mechanics**

- ME 216 Introduction to Solid Mechanics **Credits: (3-0) 3**  
**OR**
- EM 321 Mechanics of Materials **Credits: (3-0) 3**  
Professional Breadth (12 credits)
- Courses in Department Electives beyond 6-credit requirement
- Courses in Engineering Fundamentals beyond 11 credit requirement

### **Engineering Breadth**

- ME 262 Product Development **Credits: (2-0) 2**
- CENG 244/244L Introduction to Digital Systems/Lab **Credits: (3-1) 4**
- GEOE 211/211L Earth Systems Engineering Analysis/Lab **Credits: (1-1) 2**
- GEOE 221/221L Geology for Engineers/Lab **Credits: (2-1) 3**
- CP 297/397/497 Cooperative Education **Credits: 1 to 3**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- CSC 250 Computer Science II **Credits: (4-0) 4**
- CBE 217 Chemical Engineering Material Balances **Credits: (3-0) 3 OR**
- ENVE 217 Chemical Engineering Material Balances **Credits: (3-0) 3**
- CBE 317 Chemical Engineering Heat Transfer **Credits: (3-0) 3**
- CBE 318 Chemical Engineering Mass Transfer **Credits: (3-0) 3**  
**OR**
- ENVE 318
- MEM 203 Introduction to Mine Health and Safety **Credits: (1-0) 1**

### **Mathematics and Science Breadth**

- MATH 315 Linear Algebra **Credits: (3-0) 3**
- MATH 373 Introduction to Numerical Analysis **Credits: (3-0) 3**
- MATH 423 Advanced Calculus I **Credits: (4-0) 4**
- MATH 431 Dynamical Systems **Credits: (3-0) 3**
- MATH 451 Math Modeling **Credits: (3-0) 3**
- MATH 447/547 Design of Experiments **Credits: (3-0) 3**
- GEOL 201 Physical Geology **Credits: (3-0) 3**
- BIOL 121 Basic Anatomy **Credits: (3-0) 3**
- BIOL 121L Basic Anatomy Lab **Credits: (0-1) 1**
- BIOL 123 Basic Physiology **Credits: (3-0) 3**
- BIOL 123L Basic Physiology Lab **Credits: (0-1) 1**
- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**
- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- CHEM 326 Organic Chemistry I **Credits: (3-0) 3**
- CHEM 326L Organic Chemistry I Lab **Credits: (0-2) 2**
- CHEM 328 Organic Chemistry II **Credits: (3-0) 3**
- CHEM 328L Organic Chemistry II Lab **Credits: (0-2) 2**

### **Organizational Management Breadth**

- PSYC 331 Industrial and Organizational Psychology **Credits: (3-0) 3**
- ENGM xxx
- ACCT 210
- ACCT 211

- BADM 350
- BADM 370
- BADM 407
- ECON 201
- ECON 202

**Petitioned Courses**

Students may petition the department to consider specific courses that are not on the approved list. Students must submit a formal petition in writing requesting that a specific course be considered for inclusion on the student's program of study. The petition must include the course prefix and number and specific, but concise, rationale as to how the course complements the student's professional development for a given career goal.

## Humanities and Social Sciences Department

Although SDSM&T offers no degrees in the humanities and social sciences, our HU/SS courses will complement your technical study and enrich your academic and intellectual life.

### Contact Information

**Dr. Sue Shirley**

Departments of Humanities and Social Sciences

Classroom Building 310

(605) 394-2481

E-mail: Sue.Shirley@sdsmt.edu

## Humanities

### Humanities Faculty

Professors Antonen, Boysen, Feiszli, Palmer, Rice, Shirley and Sneller; Associate Professors Hudgens, Lee and Mitchell; Assistant Professor Adkins and Tidwell; Instructor Drobnak.

### Humanities

The Department of Humanities provides study in the fields of art, communication, foreign languages, humanities, literature, music, philosophy, and western civilization. The curriculum uses a broad-based approach, often developing linkages between the humanities and the technological fields that our School of Mines students enter after graduation.

### Humanities Courses

#### Art:

- ART 111/111A Drawing I **Credits: (3-0) 3**
- ART 112/112A Drawing II **Credits: (3-0) 3**
- ARTH 211 History of World Art I **Credits: (3-0) 3**

#### Art Upper-level:

- ARTH 321 Modern and Contemporary Art **Credits: (3-0) 3**
- ARTH 491 Independent Study **Credits: 1 to 9**
- ARTH 492 Topics **Credits: 1 to 6**

#### English:

- <sup>1</sup> ENGL 031 **Credits: 3**
- <sup>1</sup> ENGL 032 **Credits: 3**
- <sup>1</sup> ENGL 033 **Credits: 3**
- <sup>2</sup> ENGL 101 Composition I **Credits: (3-0) 3**
- <sup>3</sup> ENGL 201 Composition II **Credits: (3-0) 3**
- ENGL 210 Introduction to Literature **Credits: (3-0) 3**
- ENGL 212 World Literature II **Credits: (3-0) 3**
- ENGL 221 British Literature I **Credits: (3-0) 3**
- ENGL 222 British Literature II **Credits: (3-0) 3**
- ENGL 241 American Literature I **Credits: (3-0) 3**
- ENGL 242 American Literature II **Credits: (3-0) 3**
- ENGL 250 Science Fiction **Credits: (3-0) 3**
- <sup>2</sup> ENGL 279 Technical Communications I **Credits: (3-0) 3**
- <sup>2</sup> ENGL 289 Technical Communications II **Credits: (3-0) 3**

#### English Upper-level:

- ENGL 300 The Literary Experience of Nature **Credits: (3-0) 3**
- ENGL 330 Shakespeare **Credits: (3-0) 3**
- ENGL 343 Selected Authors **Credits: (1-0) 1**
- ENGL 350 Humor in American Culture **Credits: (3-0) 3**
- ENGL 360 Studies in European Literature **Credits: (3-0) 3**
- ENGL 374 Studies in American Literature **Credits: 1 to 3**

- ENGL 383 Creative Writing **Credits: (3-0) 3**
- <sup>3</sup> ENGL 391 Independent Study **Credits: 1 to 3**
- <sup>3</sup> ENGL 392 Topics **Credits: 1 to 3**

**Foreign Language:**

- CHIN 101 Introductory Chinese I **Credits: (4-0) 4**
- CHIN 102 Introductory Chinese II **Credits: (4-0) 4**
- GER 101 Introductory German I **Credits: (4-0) 4**
- GER 102 Introductory German II **Credits: (4-0) 4**
- SPAN 101 Introductory Spanish I **Credits: (4-0) 4**
- SPAN 102 Introductory Spanish II **Credits: (4-0) 4**

**History:**

- HIST 121 Western Civilization I **Credits: (3-0) 3**
- HIST 122 Western Civilization II **Credits: (3-0) 3**

**Humanities:**

- HUM 100 Introduction to Humanities **Credits: (3-0) 3**
- HUM 200 Connections: Humanities & Technology **Credits: (3-0) 3**
- HUM 291 Independent Study **Credits: 1 to 4**
- HUM 292 Topics **Credits: 1 to 3**

**Music:**

- MUAP 102 Class Instruction-Voice **Credits: (1-0) 1**
- <sup>6</sup> MUAP 120 Applied Music-Woodwinds **Credits: 1 to 4**
- <sup>6</sup> MUAP 121 Applied Music-Woodwinds **Credits: 1 to 4**
- <sup>6</sup> MUAP 130 Applied Music-Brass **Credits: 1 to 4**
- <sup>6</sup> MUAP 131 Applied Music-Brass **Credits: 1 to 4**
- MUAP 200 Applied Music-Voice **Credits: 1 to 4**
- MUAP 201 Applied Music-Voice **Credits: 1 to 4**
- <sup>4</sup> MUEN 100 Concert Choir **Credits: 0 to 2**
- <sup>4</sup> MUEN 101 Choral Ensembles **Credits: 1 to 2**
- <sup>4</sup> MUEN 121 Symphonic Band **Credits: (1-0) 1**
- <sup>4</sup> MUEN 122 Concert Band **Credits: (1-0) 1**
- <sup>5</sup> MUEN 260 Non-Credit Music Ensemble **Credits: 0**
- MUS 100 Music Appreciation **Credits: (3-0) 3**
- MUS 110 Basic Music Theory I **Credits: 2 to 4**
- <sup>6</sup> MUS 217 Music in Performance I **Credits: (3-0) 3**
- <sup>6</sup> MUS 317 Music in Performance II **Credits: (3-0) 3**

**Humanities Upper-level:**

- HUM 350 American Social History **Credits: (3-0) 3**
- HUM 375 Computers in Society **Credits: (3-0) 3**
- HUM 491 Independent Study **Credits: 1 to 4**
- HUM 492 Topics **Credits: 1 to 3**

**Philosophy:**

- PHIL 100 Introduction to Philosophy **Credits: (3-0) 3**
- PHIL 200 Introduction to Logic **Credits: (3-0) 3**
- PHIL 220 Introduction to Ethics **Credits: (3-0) 3**
- PHIL 233 Philosophy and Literature **Credits: (3-0) 3**

**Speech Communications:**

- SPCM 101 Fundamentals of Speech **Credits: (3-0) 3<sup>3</sup>**

**Notes:**

<sup>1</sup> Does not meet general requirements for graduation.

<sup>2</sup> Meets general requirements for graduation, but not for humanities credits.

<sup>3</sup> May not be used as humanities credit, but may be used for free elective credit. Consult advisor for further details.

<sup>4</sup> May not be used as humanities credit, but may be used for PE or free elective credit. Consult advisor for further details.

<sup>5</sup> May not be used for credit.

<sup>6</sup> May be used for humanities credit but does not count as general education credit.

## **The Music Program and the Apex Gallery**

### **The Music Program**

The Music Program, a division of the Department of Humanities, is housed in the Music Center on the southeast corner of the main quadrangle.

Cultural and educational enrichment opportunities provided by Music Activities include the following:

- Academic offerings — see courses listed under MUS, MUEN, or MUAP in this catalog, on Web Advisor, or on the Music Activities website <http://music.sdsmt.edu>.
- Ensembles — Symphonic Band, Concert Choir, Jazz Band, Master Chorale, Brass Choir, String Ensemble, and other instrumental and vocal ensembles.
- Performance Opportunities

Concerts and recitals are presented throughout the year both on campus in the Music Center and at venues around Rapid City and the Black Hills. Appearances are made throughout South Dakota and neighboring states at various venues such as the music association conventions, alumni gatherings, festivals, and competition.

Music ensembles have traveled to major national and international music events resulting in critical acclaim and recognition through first-place awards such as the New Years Eve Mass in Vienna's Karlskirche (1990), Lindenholzhausen Harmonie-Festival (1993), Florence's Palazzo Vecchio (1996), Circolo Musica in Venice (2001), the Association of Irish Musical Societies Choral Festival (2006), and the Konstanz (Germany) Münster (1993, 1996, 2003, 2010).

For current concert listings and more information, visit [music.sdsmt.edu](http://music.sdsmt.edu)

### **The Apex Gallery**

The Apex gallery was established in 1989 and is housed in the Classroom Building. Open year-round, it offers educational and science exhibitions for the enjoyment and enrichment of people of all ages. The gallery features contemporary works of artists and scientists, many of whom are nationally and internationally recognized. These exhibits are designed to reflect a cross section of cultural expressions and perspectives.

In addition to providing on-campus students and staff with opportunities to view the exhibits, the Apex Gallery offers tours to local middle-schools, features lectures from visiting artists, provides campus and community workshops, and conducts collaborative programming and exhibitions with Rapid City's Dahl Fine-Arts Center.

For additional information, visit [apexgallery.sdsmt.edu/](http://apexgallery.sdsmt.edu/)

## Social Sciences

### Contact Information

**Dr. Sue Shirley**

Departments of Humanities and Social Sciences

Classroom Building 310

(605) 394-2481

E-mail: Sue.Shirley@sdsmt.edu

### Social Sciences Faculty

Professor Goss; Associate Professors Dendinger, McReynolds and Van Nuys; Assistant Professor Dreyer; Devereaux Library Director Andersen; Associate Librarian Collection Development Davies.

### Social Sciences

The Department of Social Sciences provides courses in the branch of study that focuses on the institutions and functioning of people in society. By utilizing empirical and quantitative methods in the study of human beings, the curriculum often reflects the technical and scientific nature and mission of the university.

### Social Sciences Courses

#### Anthropology:

- ANTH 210 Cultural Anthropology **Credits: (3-0) 3**

#### Geography:

- GEOG 101 Introduction to Geography **Credits: (3-0) 3**
- GEOG 210 World Regional Geography **Credits: (3-0) 3**
- GEOG 212 Geography of North America **Credits: (3-0) 3**

#### Geography Upper-level:

- GEOG 400 Cultural Geography **Credits: (3-0) 3**
- GEOG 492 Topics **Credits: 1 to 3**

#### History:

- HIST 151 United States History I **Credits: (3-0) 3**
- HIST 152 United States History II **Credits: (3-0) 3**

#### History Upper-level:

- HIST 492 Topics **Credits: 1 to 4**

#### Political Science:

- POLS 100 American Government **Credits: (3-0) 3**
- POLS 250 World Politics **Credits: (3-0) 3**

#### Political Science Upper-level:

- POLS 350 International Relations **Credits: (3-0) 3**
- POLS 407 Environmental Law & Policy **Credits: (3-0) 3**
- POLS 492 Topics **Credits: 1 to 3**

#### Psychology:

- PSYC 101 General Psychology **Credits: (3-0) 3**

#### Psychology Upper-level:

- PSYC 319 Teams and Teaming **Credits: (1-0) 1**
- PSYC 323 Human Develop Through the Lifespan **Credits: (4-0) 4**
- PSYC 331 Industrial and Organizational Psychology **Credits: (3-0) 3**
- PSYC 391 Independent Study **Credits: 1 to 3**
- PSYC 392 Topics **Credits: 1 to 3**
- PSYC 451 Psychology of Abnormal Behavior **Credits: (3-0) 3**
- PSYC 461 Theories of Personality **Credits: (3-0) 3**

#### Sociology:

- SOC 100 Introduction to Sociology **Credits: (3-0) 3**
- SOC 150 Social Problems **Credits: (3-0) 3**
- SOC 250 Courtship and Marriage **Credits: (3-0) 3**

### **Sociology Upper-level:**

- SOC 391 Independent Study **Credits: 1 to 3**
- SOC 392 Topics **Credits: 1 to 3**

### **Business and Economics Courses:**

Business courses are available from Black Hills State University. ECON 201 or ECON 202 may be used toward fulfillment of the general education requirements in Social Sciences. BADM 350 and BADM 360 may be used as upper division Social Science courses. All other BADM and ACCT courses are counted toward graduation as electives only.

### **Bachelor of Science in Interdisciplinary Sciences**

Faculty from humanities and social sciences administer and advise the bachelor of science in interdisciplinary sciences (IS) program - a science program that seeks to serve the needs of students whose goals cannot be met within the other science or engineering programs at SDSM&T. The IS degree program allows students to enroll in a wide variety of math and science courses, as well as carefully chosen electives in the humanities, fine arts, and social sciences. Students choose from three specializations: atmospheric science; pre-professional health sciences; and science, technology, and society. For additional information, see

- **Interdisciplinary Sciences: Atmospheric Sciences Specialization, B.S. – see pages 74 - 76**
- **Interdisciplinary Sciences: Pre-Professional Health Sciences Specialization, B.S. – see pages 77 - 79**
- **Interdisciplinary Sciences: Science, Technology, and Society Specialization, B.S. – see pages 80 - 82**

### **Associate of Arts in General Studies**

Faculty from humanities and social sciences also administer and advise the associate of arts in general studies, a two-year degree program that offers students a broad and varied background in general education. Completion of the AA will fulfill the general education requirements for the baccalaureate degree at the state universities of South Dakota. For additional information, see

- **General Studies, A.A. – see pages 9 - 11**

### **Interdisciplinary Sciences B.S.**

#### **Areas of Specialization**

Interdisciplinary sciences majors choose from three areas of specialization that will prepare them for graduate and professional programs.

- **Atmospheric Sciences**
- **Pre-Professional Health Services**
- **Science, Technology, and Society**

#### **Contact Information for:**

- **Atmospheric Sciences**  
**Dr. Andrew Detwiler (Head)**  
Department of Atmospheric Sciences  
Mineral Industries 205  
(605) 394-2291  
E-mail: Andrew.Detwiler@sdsmt.edu

#### **Contact Information for:**

- **Pre-Professional Health Sciences**

**AND**

- **Science, Technology, and Society**  
**Dr. Sue Shirley**  
Departments of Humanities and Social Sciences  
Classroom Building 310  
(605) 394-2481  
E-mail: Sue.Shirley@sdsmt.edu

The bachelor of science degree in interdisciplinary sciences (IS) is a science degree program that seeks to serve the needs of students whose goals cannot be met within the other science departments. IS students choose from three areas of specialization: atmospheric sciences; pre-professional health

sciences; and science, technology, and society. The IS degree program allows students to enroll in a wide variety of math and science courses, as well as carefully chosen electives in the humanities, fine arts, and social sciences.

**The Interdisciplinary Sciences degree is especially appropriate for the following individuals.**

- Students pursuing professional and health services careers, including but not limited to law, medicine, physical therapy, and radiography.
- Students whose educational and career goals require courses in several departments and the integration of knowledge from diverse fields. The benefits of the interdisciplinary sciences degree include
- Flexibility in a wide range of study;
- Individual design allowing the student to help select the content of the degree; and
- The opportunity to study natural sciences, social sciences, humanities, and liberal arts from a broad perspective, thus providing a well-rounded program.

**Interdisciplinary Sciences Program Admission Policy**

After successful completion of at least 64 credit hours and at least one year prior to the intended graduation date, the student must apply for admission to the degree program by filing a plan of study with the IS Steering Committee. The plan of study must be approved by the steering committee before a student will be formally admitted to the program. This plan of study consists of (1) a Letter of Intent stating the career goals to which the IS degree coursework is to be applied and (2) an IS worksheet showing the courses already taken and the courses to be completed prior to graduation. The Letter of Intent and worksheet must be reviewed and approved by the student’s IS advisor before submission to the Steering Committee. The Letter of Intent form and worksheet are available from the IS office or may be accessed on the IS website.

Deadline for submitting the Letter of Intent and worksheet to the IS office: For May graduates — April 30 of the preceding year; for August graduates — July 30 of preceding year; for December graduates — November 30 of preceding year. Students must have an approved Letter of Intent and IS worksheet on file in the IS office before registering for IS 498, the senior capstone project.

**Science Minors available to IS Students**

When possible, students pursuing the IS specializations are strongly encouraged to complete a minor in another science field at School of Mines as part of their 120 total credits. Minors are available in computer science, geology, geospatial technology, mathematics, physics, or occupational safety. Students should consult the policy on minors and the specific courses required for each minor, provided elsewhere in the catalog. The IS degree is not available as a minor.

**Transfer Studies**

Students who reside in local communities can achieve considerable savings in their education costs by completing a portion of their studies close to home before transferring to another institution to complete their desired major. Students who do not intend to pursue a degree offered at the School of Mines are encouraged to take courses appropriate for the two-year associate of arts (A.A.) degree in general studies. Through this program of access and transfer, students still experience the excellent educational environment found on the School of Mines campus. Students should consult the programs of study for the school from which they plan to graduate and then work closely with their A.A. advisor to select courses with the highest likelihood of transferability. Completion of the A.A. degree will fulfill the general education requirements for a baccalaureate degree at the other state universities of South Dakota (BHSU, DSU, NSU, SDSU, and USD).

**Teaching Opportunities and Certification**

Students who are interested in teaching science at the secondary education level should contact education programs at the other state universities for information on the auxiliary courses required for certification. Project SELECT, an accelerated one-year certification program offered through Black Hills State University, may be of interest to students completing the IS and other science degrees at the School of Mines. Information on this program can be obtained from the BHSU website at [www.bhsu.edu/select](http://www.bhsu.edu/select)

**General Requirements for Graduation**

For all interdisciplinary sciences specializations, students are responsible to check with their advisors for any program modifications that may occur after the publication of this catalog.

I. IS Core Courses (IS 110, IS 201, IS 401, IS 498)	11 credits
II. English sequence (ENGL 101, ENGL 279, ENGL 289)	9 credits
III. Math, Computer Science, Sciences	
Math and Computer Sciences <sup>1</sup>	min. 12
Biology <sup>2</sup>	min. 3
Chemistry <sup>2</sup>	min. 3
Additional Natural Sciences <sup>2</sup>	min. 24

Other Math, CSC, Sciences	min. 18
<b>SUBTOTAL</b>	<b>60</b>
IV. Humanities and Social Sciences	
Humanities general education	6
Humanities upper division	6
Social Sciences general education	6
Social Science upper division	6
<b>SUBTOTAL</b>	<b>24</b>
V. Program Approved Electives <sup>3</sup>	16

**120 credits required for graduation**

**Curriculum Notes**

<sup>1</sup> All IS specializations require MATH 123 Calculus I and a minimum of 3 credit hours in computer science. Some specializations require additional math courses beyond Math 123.

<sup>2</sup> All IS specializations require a minimum of 30 credit hours in the natural sciences, including 6 hours in sequence (e.g., BIOL 151/BIOL 153) and 12 hours at the upper division. Chemistry must be at the CHEM 112 level or higher. Biology must be at the BIOL 121 level or higher. Students are expected to identify a science concentration and are encouraged to pursue a science minor as appropriate to their specialization. Students should work with their advisors to determine the most appropriate science courses for their career goals.

<sup>3</sup> Engineering courses may be counted toward graduation as electives only.

Thirty-six of the required 120 credits must be at the junior or senior level (courses numbered 300 and above.)

**Interdisciplinary Sciences Core Courses**

All IS students take a sequence of four core courses, spread out over the course of four years. These courses are sequential and cannot be taken concurrently. IS courses cannot be counted for humanities/social science credit.

- IS 110 Explorations **Credits: (2-0) 2** in the freshman year;
- IS 201 Introduction to Science, Technology, and Society **Credits: (3-0) 3** in the sophomore year;
- IS 401 Writing and Research in the Interdisciplinary Sciences **Credits: (3-0) 3** in the first semester of the senior year; and
- IS 498 Undergraduate Research/Scholarship **Credits: (0-3) 3** (senior project) in the second semester of the senior year.

## **Specialization in Atmospheric Sciences with the Bachelor of Science in Interdisciplinary Sciences Degree Program**

Students in the Bachelor of Science in Interdisciplinary Sciences (IS) degree program may choose a specialization in atmospheric sciences. The successful student is expected to be capable of independent and critical thinking in the areas of physical, synoptic, and dynamic meteorology; remote sensing; and global atmospheric change. As such, the student should be qualified for employment where expertise in atmospheric sciences is a primary requirement, though need not necessarily qualify as a meteorologist by the federal government's criteria. The curriculum also is suitable for preparation toward graduate study at the M.S. and Ph.D. level.

The atmospheric sciences specialization is designed for students whose career goal is meteorology or atmospheric research. Working with faculty from the Department of Atmospheric Sciences, students can take coursework to satisfy federal guidelines (e.g., for National Weather Service, US Bureau of Reclamation and US Geological Survey) for the title of meteorologist. This specialization also serves as excellent preparation for graduate study in meteorology, atmospheric sciences, and related fields. Courses range from those in traditional operational meteorology to those in earth system sciences. All students entering under the 2010 Catalog and later satisfy the United States Government's requirements to qualify as a meteorologist for federal employment. For more information, students should review the resources available on the BSIS website at [is.sdsmt.edu](http://is.sdsmt.edu)

### **Contact Information for Atmospheric Sciences, B.S.**

#### **Dr. Andrew Detwiler (Head)**

Department of Atmospheric Sciences

Mineral Industries 205

(605) 394-2291

E-mail: [Andrew.Detwiler@sdsmt.edu](mailto:Andrew.Detwiler@sdsmt.edu)

### **Faculty**

Professor Detwiler; Emeritus Professors Helsdon, Hjelmfelt and Smith; Associate Professors Capehart, Kliche, Sundareshwar and French; Instructors Clabo and Farley; Adjunct Professors Stamm and Bothwell; Adjunct Research Scientist Bunkers.

The IS Bachelor of Science degree program offers a specialization in atmospheric sciences. General requirements for a B.S. in Interdisciplinary Sciences are described Interdisciplinary Sciences: Atmospheric Sciences Specialization, B.S. Required coursework for the atmospheric sciences specialization includes

### **Federal Certifications as a Meteorologist**

Students in the undergraduate minor or IS programs desiring to be qualified for federal employment as meteorologists (with the National Weather Service or other federal government agencies employing meteorologists) should contact a Department of Atmospheric Sciences advisor to ensure that their plan of study meets the strictly enforced civil service requirements. The IS ATM academic program from catalog year 2010 and onward satisfies these requirements. The basic requirements for federal civil service qualification as a meteorologist (as dictated by the United States Office of Personnel Management):

### **Degree: meteorology, atmospheric science, or other natural science major that includes**

- A. At least 24 semester hours (36 quarters) of credit in atmospheric science/meteorology including a minimum:
  1. Six semester hours of atmospheric dynamics and thermodynamics
  2. Six semester hours of analysis and prediction of weather systems (synoptic/mesoscale)
  3. Three semester hours of physical meteorology and
  4. Two semester hours of remote sensing of atmosphere and/or instrumentation
- B. Six semester hours of physics, with at least one course that includes laboratory sessions
- C. Three semester hours of ordinary differential equations
- D. At least 9 semester hours of coursework appropriate for a physical science major in any combination of three or more of the following: physical hydrology, statistics, chemistry, physical oceanography, physical climatology, radiative transfer, aeronomy, advanced thermodynamics, advanced electricity and magnetism, light and optics, and computer science.

**OR:** Combination of education and experience-coursework as shown in A above, plus appropriate experience or additional education.

**Note:** There is a prerequisite or corequisite of calculus, physics, and differential equations for coursework in atmospheric dynamics and thermodynamics. Calculus courses must be appropriate for a physical science major.

### **Specialization in Atmospheric Sciences: Curriculum/Course Checklist**

Course sequences may vary by student entry year, math/science placements, availability of ATM courses, and career objectives. Students should consult with an atmospheric sciences/interdisciplinary sciences advisor for a more personalized course of study based on career goals within the atmospheric sciences.

### **Required Courses for the Atmospheric Sciences Specialization Are:**

- All courses and other curriculum requirements for the general IS degree requirement.
- The atmospheric sciences undergraduate series: ATM 301, ATM 401, ATM 404, ATM 403, ATM 430, ATM 450, ATM 450L, ATM 455, ATM 460.
- The following mathematics and science courses (including required prerequisites): BIOL 311, CHEM 112, CHEM 112L, CHEM 114, CHEM 114L, CSC 150, PHYS 211, PHYS 213, PHYS 213L, MATH 123, MATH 125, MATH 225, MATH 321.
- Sufficient professional development electives for a total of 120 academic credit hours.

### **Freshman Year**

#### **First Semester**

- <sup>1</sup> CHEM 112 General Chemistry I **Credits: (3-0) 3**
- <sup>1</sup> CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- ENGL 101 Composition I **Credits: (3-0) 3**
- IS 110 Explorations **Credits: (2-0) 2**
- <sup>2</sup> MATH 123 Calculus I **Credits: (4-0) 4**
- Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 16**

#### **Second Semester**

- <sup>1</sup> CHEM 114 General Chemistry II **Credits: (3-0) 3**
- <sup>1</sup> CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- <sup>2</sup> CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- <sup>2</sup> MATH 125 Calculus II **Credits: (4-0) 4**
- Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 14**

### **Sophomore Year**

#### **First Semester**

- ATM 301 Introduction to Atmospheric Sciences **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- <sup>2</sup> MATH 225 Calculus III **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 16**

#### **Second Semester**

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- IS 201 Introduction to Science, Technology, and Society **Credits: (3-0) 3**
- <sup>2</sup> MATH 321 Differential Equations **Credits: (3-0) 3**
- <sup>1</sup> PHYS 213 University Physics II **Credits: (3-0) 3**
- <sup>1</sup> PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**
- Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 16**

### **Junior Year**

#### **First Semester**

- ATM 450/450L Synoptic Meteorology I/Lab **Credits: (2-1) 3**
- ATM 460/560 Atmospheric Dynamics **Credits: (3-0) 3**
- <sup>1</sup> BIOL 311 Principles of Ecology **Credits: (3-0) 3**
- <sup>3</sup> ATM/SCI/MATH/ENG Elective **Credits: 1**

- Upper Division HUM/SS Elective **Credits: 3**

**Total: 13**

### **Second Semester**

- ATM 403/503 Biogeochemistry **Credits: (3-0) 3**
- ATM 430/530 Radar Meteorology **Credits: (3-0) 3**
- ATM 455/455L/555/555L Synoptic Meteorology II/Lab **Credits: (2-1) 3**
- <sup>3</sup> ATM/SCI/MATH/ENG Electives **Credits: 3**
- Upper Division HUM/SS Elective **Credits: 3**

**Total: 15**

### **Senior Year**

#### **First Semester**

- ATM 401/501 Atmospheric Physics **Credits: (3-0) 3**
- IS 401 Writing and Research in the Interdisciplinary Sciences **Credits: (3-0) 3**
- <sup>3</sup> ATM/SCI/MATH/ENG Electives **Credits: 6**
- Upper Division HUM/SS Elective **Credits: 3**

**Total: 15**

#### **Second Semester**

- ATM 404/504 Atmospheric Thermodynamics **Credits: 2 or 3**
- <sup>3</sup> ATM/SCI/MATH/ENG Electives **Credits: 6**
- IS 498 Undergraduate Research/Scholarship **Credits: (0-3) 3**
- Upper Division HUM/SS Elective **Credits: 3**

**Total: 15**

### **120 credits required for graduation**

#### **Curriculum Notes**

<sup>1</sup> All IS specializations require a minimum of 30 semester hours of natural sciences, including a minimum of 3 semester hours in chemistry, 3 semester hours in biology, 6 semester hours in a science sequence, and 12 semester hours at the upper division. The atmospheric sciences/meteorology specialization requires one year of general chemistry with labs, one year of university physics with lab, and one semester of BIOL 311 Principles of Ecology. Students should consult with their advisors to determine additional science courses appropriate for their career paths.

<sup>2</sup> All IS specializations require MATH 123 or a math course requiring MATH 123 as its prerequisite. Atmospheric sciences/meteorology requires CSC 150/150L and additional math coursework beyond MATH 123. MATH 102 and MATH 120 may not be used toward graduation requirements for IS-ATM specialization.

<sup>3</sup> Students should consult with their atmospheric sciences/interdisciplinary sciences advisors on the most appropriate ATM/science/math/ engineering electives for their career paths. Engineering courses are counted as electives. See Atmospheric Sciences Minor.

## **Interdisciplinary Sciences: Pre-Professional Health Sciences Specialization, B.S.**

A strong background in science will prepare students in the pre-professional health sciences specialization for entry into a variety of graduate and professional programs, including medical and dental schools, physical and occupational therapy programs, physician assistant and chiropractic programs, optometry and radiography programs. Volunteer work in the community and complementary coursework in the humanities and social sciences are included to help students meet the admissions requirements of these professional schools.

Students planning to enter these professions should consult the programs of study for the schools of interest to them. Working closely with their advisor, they will select the courses needed to fulfill the graduation requirements for the IS degree and to meet the entrance requirements for the professional schools in health science.

For more information, students should review the resources available on the BSIS website at [is.sdsmt.edu](http://is.sdsmt.edu)

## **Contact Informations for Pre-Professional Health Sciences, B.S.**

### **Dr. Sue Shirley**

Departments of Humanities and Social Sciences

Classroom Building 310

(605) 394-2481

E-mail: [Sue.Shirley@sdsmt.edu](mailto:Sue.Shirley@sdsmt.edu)

## **Pre-Nursing Study at Mines**

The IS degree program does not include a pre-nursing track. Students interested in earning a nursing degree from SDSU (four-year B.S.N.) or USD (two-year A.D.N.) should apply to the degree-granting university. Upon acceptance to SDSU or USD, students can take courses offered by School of Mines that meet pre-nursing requirements. For more information visit [www.gotomines.com/academics/majors/non-degree/nursing](http://www.gotomines.com/academics/majors/non-degree/nursing)

## **Specialization in Pre-Professional Health Sciences Curriculum/Course Checklist**

Students should consult with their advisors for a more personalized course of study based on career goals within the health sciences. Course requirements vary according to professional program, e.g., medical school, radiographic technology, physical therapy. Course sequence may also vary by student entry year, math/science placements, course availability, and career objectives.

## **Freshman Year**

### **First Semester**

- ENGL 101 Composition I **Credits: (3-0) 3**
- IS 110 Explorations **Credits: (2-0) 2**
- <sup>1</sup> BIOL 121 Basic Anatomy **Credits: (3-0) 3**
- BIOL 121L Basic Anatomy Lab **Credits: (0-1) 1**
- <sup>2</sup> Math/CSC Elective **Credits: 3**
- <sup>3</sup> Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 15**

### **Second Semester**

- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- BIOL 123 Basic Physiology **Credits: (3-0) 3**
- BIOL 123L Basic Physiology Lab **Credits: (0-1) 1**
- Math/CSC Elective **Credits: 4**
- Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 15**

## **Sophomore Year**

### **First Semester**

- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**

- IS 201 Introduction to Science, Technology, and Society **Credits: (3-0) 3**
- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 17**

### **Second Semester**

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- Math/CSC Elective **Credits: 3**
- Gen Ed Humanities/Social Science Elective **Credits: 3**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**

**Total: 13**

### **Junior Year**

#### **First Semester**

- <sup>4</sup> Science Electives **Credits: 9**
- Upper Division HUM/SS Elective **Credits: 3**
- <sup>5</sup> Electives **Credits: 3**

**Total: 15**

#### **Second Semester**

- Science Electives **Credits: 6**
- Upper Division HUM/SS elective **Credits: 3**
- Electives **Credits: 7**

**Total: 16**

### **Senior Year**

#### **First Semester**

- IS 401 Writing and Research in the Interdisciplinary Sciences **Credits: (3-0) 3**
- Science Electives **Credits: 5**
- Upper Division HUM/SS Elective **Credits: 3**
- Math/CSC Elective **Credits: 3**

**Total: 14**

#### **Second Semester**

- IS 498 Undergraduate Research/Scholarship **Credits: (0-3) 3**
- Science Elective **Credits: 3**
- Upper Division HUM/SS Elective **Credits: 3**
- Electives **Credits: 6**

**Total: 15**

### **120 credits required for graduation**

#### **Curriculum Notes**

Thirty-six (36) credits of the 120 credits required for graduation must be at a junior or senior level (courses numbered 300 or above).

<sup>1</sup> All IS specializations require a minimum of thirty (30) semester hours of natural sciences, including a minimum of three (3) semester hours in chemistry (Chem 112 or higher), three (3) semester hours in biology (Biol 121 or higher), and twelve (12) semester hours at the upper division. Of the thirty hours required in natural sciences, a minimum of six (6) credits must be sequential. The Professional Health Sciences specialization requires one year of general biology with labs, one year of general chemistry with labs, and one year of anatomy/physiology with labs. Students should consult with

their advisors to determine the sequence of additional science courses appropriate for and required by their career paths, e.g., medicine, dentistry, physical or occupational therapy, chiropractics, radiography, and physician assistantships.

<sup>2</sup> A minimum of twelve (12) semester hours of approved mathematics and computer sciences is required, including Math 123 or a math course requiring Math 123 as its prerequisite and a minimum of three (3) semester hours in computer science. Math 102 and Math 120 may be used towards graduation requirements. Students should consult with their advisors on the most appropriate math/computer science courses for their career paths.

<sup>3</sup> A minimum of twenty-four (24) semester hours of university-approved humanities and social sciences are required. This minimum includes six (6) hours of general education coursework in Humanities, six (6) hours of general education coursework in Social Sciences, six (6) hours of upper division Humanities, and six (6) hours of upper division Social Sciences.

<sup>4</sup> Science electives include additional coursework in math, computer science, and the natural sciences. Students should consult with their advisors on the most appropriate science electives for their career paths. Students are expected to identify a science concentration and are encouraged to pursue a science minor as appropriate to their specialization. A total of 60 hours in math, computer science, and natural sciences is required.

<sup>5</sup> Elective credits may include additional college coursework at the 100 level or above in math, computer science, sciences, humanities, social sciences, business, military science, or engineering as needed to meet the required minimums or to qualify for a science minor.

## **Interdisciplinary Sciences: Science, Technology, and Society Specialization, B.S.**

The science, technology, and society specialization combines a strong science background with a firm grounding in environmental, social, and science policy issues. Students pursue a science concentration, such as environmental science, or a minor in a science field, which is complemented by studies in areas such as political science, history, humanities, English, and philosophy. Coursework will prepare students for additional study in law school, in science policy or public policy programs, or in graduate programs in science. Careers can include positions in community and government agencies, in science and technology companies, in the military, as science teachers, or as science lobbyists.

For more information, students should review the resources available on the BSIS website at [is.sdsmt.edu](http://is.sdsmt.edu)

## **Contact Informations for Science, Technology, and Society Specialization, B.S.**

**Dr. Sue Shirley**

Departments of Humanities and Social Sciences

Classroom Building 310

(605) 394-2481

E-mail: [Sue.Shirley@sdsmt.edu](mailto:Sue.Shirley@sdsmt.edu)

## **Pre-law/Pre-medicine Study at Mines**

While the IS specializations in pre-professional health sciences and science, technology, and society (STS) are especially designed to help students meet the entrance requirements for medical or law school, a particular baccalaureate degree is not required for admission into most law and medical programs. Graduates from the School of Mines with degrees in several of the science and engineering programs have successfully completed these professional programs. Students are encouraged to consult the admissions requirements and policies for those law and medical schools to which they intend to apply.

## **Science, Technology, and Society: Curriculum/Course Checklist**

Course sequence may vary by student entry year, math/science placements, course availability, and career objectives. Students should consult with their advisors for a more personalized course of study based on career goals.

### **Freshman Year**

#### **First Semester**

- ENGL 101 Composition I **Credits: (3-0) 3**
- IS 110 Explorations **Credits: (2-0) 2**
- <sup>1</sup> Math/CSC Elective **Credits: 3**
- <sup>2</sup> Science Elective **Credits: 4**
- <sup>3</sup> Gen Ed Humanities/Social Science Elective **Credits: 3**

**Total: 15**

#### **Second Semester**

- Math/CSC Elective **Credits: 3**
- Science Electives **Credits: 8**
- Gen Ed Humanities/Social Science Elective **Credits: 3**
- <sup>4</sup> Elective **Credits: 1**

**Total: 15**

### **Sophomore Year**

#### **First Semester**

- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- IS 201 Introduction to Science, Technology, and Society **Credits: (3-0) 3**
- Science Elective **Credits: 4**
- Gen Ed Humanities/Social Science Elective **Credits: 3**
- Elective **Credits: 2**

**Total: 15**

## Second Semester

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- Math/CSC Elective **Credits 4**
- Science Elective **Credits: 4**
- Gen Ed Humanities/Social Science Elective **Credits: 3**
- Elective **Credits: 1**

**Total: 15**

## Junior Year

### First Semester

- Math/CSC Elective **Credits: 3**
- Science Electives **Credits: 7**
- Upper Division HUM/SS Elective **Credits: 3**
- Elective **Credits: 2**

**Total: 15**

### Second Semester

- Science Electives **Credits: 6**
- Upper Division HUM/SS elective **Credits: 3**
- Elective **Credits: 6**

**Total: 15**

## Senior Year

### First Semester

- IS 401 Writing and Research in the Interdisciplinary Sciences **Credits: (3-0) 3**
- Science Electives **Credits: 7**
- Upper Division HUM/SS Elective **Credits: 3**
- Elective **Credits: 2**

**Total: 15**

### Second Semester

- IS 498 Undergraduate Research/Scholarship **Credits: (0-3) 3**
- Science Electives **Credits: 7**
- Upper Division HUM/SS Elective **Credits: 3**
- Elective **Credits: 2**

**Total: 15**

## 120 credits required for graduation

### Curriculum Notes

Thirty-six (36) credits of the 120 credits required for graduation must be at a junior or senior level (courses numbered 300 or above).

<sup>1</sup>A minimum of twelve (12) semester hours of university-approved mathematics and computer sciences is required, including Math 123 or a math course requiring Math 123 as its prerequisite and a minimum of three (3) semester hours in computer science. Math 102 and Math 120 may be used towards graduation requirements. Students should consult with their advisors on the most appropriate math/computer science courses for their career paths.

<sup>2</sup>All IS specializations require a minimum of 30 semester hours of natural sciences including a minimum of three (3) semester hours in chemistry at the CHEM 112 level or higher, three (3) semester hours in biology at the BIOL 121 level or higher, and twelve (12) semester hours at the upper division level. Of the thirty hours required in natural sciences, a minimum of six (6) credits must be sequential. Students pursuing the science, technology, and society specialization are expected to choose a science concentration. A minor in a science field (e.g., atmospheric science, biology, computer science, geology, geospatial technology, mathematics, physics) is highly encouraged. A total of 60 hours in math, computer sciences, and natural sciences is required. Students should consult with their advisors to determine the most appropriate science courses and sequence for their career paths.

<sup>3</sup>A minimum of twenty-four (24) semester hours of university-approved humanities and social sciences are required. This minimum includes six (6) hours of general education coursework in Humanities, six (6) hours of general education coursework in Social Sciences, six (6) hours of upper division Humanities, and six (6) hours of upper division Social Sciences.

<sup>4</sup> Elective credits may include additional college coursework at the 100 level or above in math, computer science, sciences, humanities, social sciences, business, military science, or engineering as needed to meet the required minimums or to qualify for a science minor. Students should consult with their advisors to determine the most appropriate elective courses for their career goals. This information and additional information on the IS degree program can be found at: <http://is.sdsmt.edu>

## **Mechanical Engineering, B.S.**

### **Contact Information**

**Dr. Michael Langerman**

Department of Mechanical Engineering

Civil Mechanical 133

(605) 394-2408

E-mail: Michael.Langerman@sdsmt.edu

### **Faculty**

Professors Abata, Dolan, Kalanovic, Kjerengtroen, Korde, Muci-Kuchler and Langerman; Associate Professor Bedillion; Assistant Professors Ellingsen, Kingsbury, Shahbazi, Simmons and Widener; Professors Emeritus Buck, Chiang, Gnirk, Krause, Pendleton, and Snyder; Instructor Ash.

### **Mechanical Engineering**

Mechanical engineering (ME) is a very broad field that provides opportunities for interesting and challenging work in every phase of modern technology. The curriculum in the mechanical engineering department is designed to give students a thorough knowledge of the fundamental principles of engineering and science within the major areas of mechanical engineering: thermal science, mechanics, and robotics and controls. Beyond this basic foundation, the curriculum also develops:

1. The various aspects of engineering design including design theory and teamwork;
2. An effective integration of computer technology;
3. Communication skills and effective presentations; and
4. Improved understanding of engineering theory through practical laboratory experience.

In the senior year, students select from course electives that best reflect their interests and career objectives. Students may select courses from one or more of the following general areas:

1. Manufacturing, e.g., control, design, development, and manufacture of diverse equipment and processes;
2. Thermal Science/Energy, e.g., design of power systems and heating/air conditioning systems.
3. Mechanical Systems/Design, e.g., design of machines, structures, and systems.

### **Mechanical Engineering Laboratories**

There are several undergraduate laboratories in the department, including mechanical systems and instrumentation, thermal and fluid systems, manufacturing, robotic systems, and vibrations. Laboratories are updated with personal computers, peripherals, and data acquisition equipment.

Graduate research laboratories and resources include advanced workstation computer facilities, equipment for modern digital controls, machine vision systems, image analysis equipment, structural testing and analysis equipment, compliant structures and computational solid mechanics, fluid mechanics, and heat transfer codes on the workstation facilities.

### **Supersonic Wind Tunnel**

The Advanced Fluid Mechanics Laboratory at the South Dakota School of Mines and Technology has designed and constructed a supersonic wind tunnel of the in-draft type, with an extremely low level of free stream turbulence ( $Tu < 0.01$  percent).

The test section area is 16 in<sup>2</sup> (4 inch x 4 inch) with full view Schlieren quality glass windows and removable access plugs for ease of model and sensor installation. N

ovel implementation of a solid desiccant drying system permits a measured test section Mach number of 2.8, with no evidence of condensation, for the current nozzle geometry.

A two-stage vacuum system allows for pump down times less than 30 minutes between runs, with an ultimate low pressure capability of several tenths of a psi absolute, which should allow start-up at Mach numbers up to 5 with an appropriately designed nozzle geometry.

For pedagogical purposes, the current Mach 2.8 nozzle was also designed to permit schlieren viewing of the flow acceleration from stagnation conditions to the test section supersonic condition along with static pressure measurements at various locations along the length of the nozzle, for comparison with classroom theory.

Because of the low free-stream noise level attendant to the indraft design, the facility is ideally suited for basic research studies of supersonic flow stability and transition mechanisms.

## Vision

Our vision is to become one of the leading undergraduate mechanical engineering programs in the nation by offering a premier engineering design curriculum and by providing our graduates with a superior educational experience through teaching and learning, research and development, and service and responsibility. Most immediately, our goal is to be recognized as the mechanical engineering program-of-choice within South Dakota and among our peer groups of specialized science and engineering schools across the nation.

## Mission

The mission of the mechanical engineering program is to prepare our graduates for leadership roles in the mechanical engineering profession by:

- Offering a quality education to foster a distinctive curriculum accentuating design and project-based learning;
- Committing to individual development while emphasizing the values of teamwork in a culturally diverse, multidisciplinary environment; and
- Encouraging undergraduate and graduate research to nurture creative solutions to complex engineering problems.

## Objectives

Building upon the department's tradition of excellence requires continual development of active partnerships among the faculty, the students, and our constituents. In keeping with this tradition, the mechanical engineering program produces graduates who are able to perform at a level that meets or exceeds industry expectations. ME students will be able to achieve the objectives listed below within a few years of graduation through attainment of the outcomes listed below at the time of graduation.

**OBJECTIVE 1:** Lead and/or manage effective engineering design analyses

### Outcomes

- Apply skills in engineering, science, and mathematics
- Practice effective analysis
- Conduct data analyses and analyses verification

**OBJECTIVE 2:** Lead and/or manage effective engineering design teams

### Outcomes

- Apply effective engineering design skills
- Demonstrate teaming proficiency
- Participate in research and professional development

Students may participate in the Cooperative Education Internship Program. In some instances, credits earned during the co-op may be applied toward department elective requirements. The mechanical engineering department does not offer a minor.

The bachelor of science program in mechanical engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>

## Mechanical Engineering Curriculum/Checklist

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog. To graduate, students must attain a grade of C or better in all ME core courses (noted below with an \*)

### Freshman Year

#### First Semester

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- ME 110/110L Introduction to Mechanical Engineering/Lab **Credits: (1-1) 2**
- ENGL 101 Composition I **Credits: (3-0) 3**
- PE Physical Education Credits: 1
- 1 Humanities or Social Sciences Elective(s) Credits: 3

**Total: 17**

#### Second Semester

- MATH 125 Calculus II **Credits: (4-0) 4**PHYS 211 University Physics I **Credits: (3-0) 3**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**

- PE Physical Education Credits: 1
- Humanities or Social Sciences Elective(s) Credits: 6

**Total: 17**

## **Sophomore Year**

### **First Semester**

- EM 214 Statics **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- ME 262 Product Development **Credits: (2-0) 2**
- ME 264/264L Sophomore Design/Lab **Credits: (1-1) 2**
- MATH 225 Calculus III **Credits: (4-0) 4**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**

**Total: 18**

### **Second Semester**

- ME 221 Dynamics of Mechanisms **Credits: (3-0) 3 \***
- ME 211 Introduction to Thermodynamics **Credits: (3-0) 3 \***
- MATH 321 Differential Equations **Credits: (3-0) 3**
- ME 216 Introduction to Solid Mechanics **Credits: (3-0) 3 \***
- MET 231 Structures and Properties of Materials Lab **Credits: (0-1) 1**
- MET 232 Properties of Materials **Credits: (3-0) 3**

**Total: 16**

## **Junior Year**

### **First Semester**

- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- ME 316 Solid Mechanics **Credits: (3-0) 3 \***
- EE 301/301L Introduction to Circuits, Machines, and Systems/Lab **Credits: (3-1) 4**
- ME 331 Thermo Fluid Dynamics **Credits: (3-0) 3 \***
- MATH 373 Introduction to Numerical Analysis **Credits: (3-0) 3**

**Total: 16**

### **Second Semester**

- ME 312 Thermodynamics II **Credits: (3-0) 3 \***
- ME 313 Heat Transfer **Credits: (3-0) 3 \***
- ME 352 Introduction to Dynamic Systems **Credits: (3-0) 3 \***
- ME 322 Machine Design I **Credits: (3-0) 3 \***
- ME 351/351L Mechatronics and Measurement Systems/Lab **Credits: (3-1) 4 \***

**Total: 16**

## **Senior Year**

### **First Semester**

- ME 477 Mechanical Engineering Design I **Credits: (0-2) 2**
- MATH 381 Introduction to Probability and Statistics **Credits: (3-0) 3**
- ME 4XX Mechanical Engr Elective #1 **Credits: 4**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- ME 4XX Mechanical Engr Elective # 2 **Credits: 3**

**Total: 15**

**Second Semester**

- ME 479 Mechanical Systems Design II **Credits: (0-2) 2**
- ME 482L Advanced Product Development Lab II **Credits: (0-2) 2**
- ME 4XX Mechanical Engr Elective #3 **Credits: 3**
- ME 4XX Mechanical Engr Elective #4 **Credits: 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- IENG 301 Basic Engineering Economics **Credits: (2-0) 2**

**Total: 15**

**130 credits required for graduation****Curriculum Notes**

\* A minimum grade of C required for graduation

<sup>1</sup> Many courses are prerequisites for other courses, and their sequencing is important. A faculty advisor should be consulted for any deviation from the above schedule.

## **Metallurgical Engineering, B.S.**

### **Contact Information**

**Dr. Michael K. West**

Department of Materials and Metallurgical Engineering

Mineral Industries 101

(605) 394-1283

E-mail: Michael.West@sdsmt.edu

### **Faculty**

Douglas W. Fuerstenau Professor Kellar; Professors Howard and Salem; Associate Professors Cross and West; Assistant Professors Crawford and Widener; Research Scientist Hong; Adjunct Professors Jasthi, Sears and Medlin; Distinguished Professor Emeritus Han; Professor Emeritus Stone.

### **Materials and Metallurgical Engineering**

Materials and metallurgical engineering is the branch of engineering that develops and supplies the materials for virtually every other engineering field. Three-fourths of all elements are metals, so metals play a vital role in nearly every aspect of modern life. Metallurgical engineers transform the Earth's mineral resources into finished products by extracting metals from ores, producing ceramics from metal compounds, and fabricating composite structures.

Modern materials are exotic and so are the methods of producing them. Metallurgy is based upon the principles of chemistry, physics, and mathematics. These sciences provide an understanding of the methods of metal production processes and the behavior of materials. In addition to familiar materials such as steel, aluminum, copper, glass, gold, and silver, metallurgical engineers produce many exotic materials such as metals with shape memories, ultrahigh-purity materials for integrated circuits, materials for surgical implants, ceramics for space vehicles, nano-scale metal particles and superconductors.

There are 3 areas of specialization in metallurgical engineering: mineral processing, extractive metallurgy, and materials engineering. Mineral processors concentrate ores and recycled materials so that extractive metallurgists can produce pure, high-quality metals and non-metallics for use by materials engineers who transform these materials into the marvels of our advanced civilization, ranging from space craft to thin diamond films. Metallurgical engineers are actively involved in nanotechnology and the production and utilization of nano-scale materials.

Advances made by metallurgical and material engineers make advances possible in other engineering fields. This happens because virtually every engineering field is in constant search of higher-performing materials. Metallurgical engineers are responsible for the production of materials and also for the evaluation of metals, ceramics, and polymer-based composites.

The evaluation of materials includes tests to determine strength, hardness, toughness, corrosion behavior, and many other properties. It is the role of metallurgical engineers to develop processing methods to create materials with specific and exacting properties for every conceivable application.

The primary source for materials continues to be extracted as ores and petroleum from the Earth. However, recycled materials are an increasingly important material source for metallurgical engineers.

Materials and metallurgical engineers are employed throughout the nation and the world.

The Bachelor of Science Degree in Metallurgical Engineering is accredited by the Engineering Accreditation Commission of ABET, <http://www.abet.org>.

### **The Objectives of the B.S. Metallurgical Engineering Degree Program**

#### **The program graduates will:**

- Successfully apply metallurgical engineering principles in their employment.
- Meet societal needs through science and technology.
- Grow professionally and personally.
- Serve their profession and community.

**Curriculum:**

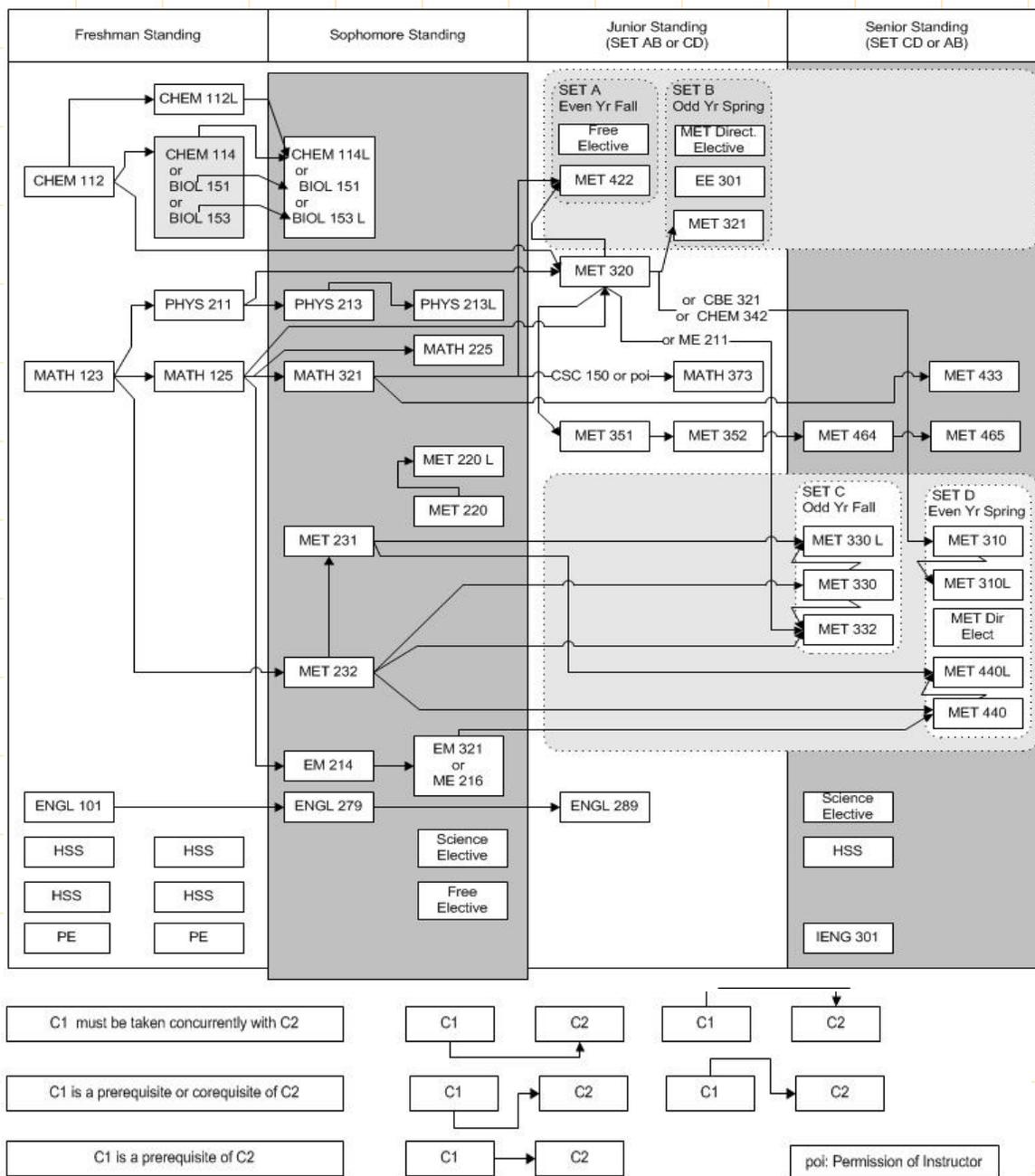


Figure 5.1 Curriculum Flow Diagram for BS Metallurgical Engineering: 2012-2013

**Metallurgical Engineering Curriculum/Checklist**

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

**Freshman Year**

**First Semester**

- <sup>5</sup> MATH 123 Calculus I **Credits: (4-0) 4**
- <sup>6</sup> CHEM 112 General Chemistry I **Credits: (3-0) 3**
- <sup>1</sup> ENGL 101 Composition I **Credits: (3-0) 3**

- PE Physical Education **Credits: 1**
- <sup>3,4</sup> Humanities or Social Science Elective(s) **Credits: 6**

**Total: 17**

### Second Semester

- MATH 125 Calculus II **Credits: (4-0) 4**
- <sup>6</sup> CHEM 114 General Chemistry II **Credits: (3-0) 3**

**OR**

- <sup>6</sup> BIOL 151 General Biology I **Credits: (3-0) 3**

**OR**

- <sup>6</sup> BIOL 153 General Biology II **Credits: (3-0) 3**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- <sup>3,4</sup> Humanities or Social Sciences Elective(s) **Credits: 6**

**Total: 17**

### Sophomore Year

#### First Semester

- MET 232 Properties of Materials **Credits: (3-0) 3**
- MET 231 Structures and Properties of Materials Lab **Credits: (0-1) 1**
- MATH 321 Differential Equations **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**

**OR**

- BIOL 151L General Biology I Lab **Credits: (0-1) 1**

**OR**

- BIOL 153L General Biology II Lab **Credits: (0-1) 1**
- <sup>1</sup> ENGL 279 Technical Communications I **Credits: (3-0) 3**
- EM 214 Statics **Credits: (3-0) 3**

**Total: 17**

#### Second Semester

- MATH 225 Calculus III **Credits: (4-0) 4**
  - EM 321 Mechanics of Materials **Credits: (3-0) 3**
- OR**
- ME 216 Introduction to Solid Mechanics **Credits: (3-0) 3**
  - MET 220 Mineral Processing and Resource Recovery **Credits: (3-0) 3**
  - MET 220L Mineral Processing and Resource Recovery Laboratory **Credits: (0-1) 1**
  - <sup>7</sup> Science Elective **Credits: 3**
  - Free Elective **Credits: 2**

**Total: 16**

### Junior Year

#### First Semester

- <sup>2</sup> ENGL 289 Technical Communications II **Credits: (3-0) 3**
- MET 320 Metallurgical Thermodynamics **Credits: (4-0) 4**
- MET 351 Engineering Design I **Credits: (2-0) 2**
- Set A or C **Credits: 7**

**Total: 16**

## Second Semester

- MET 352 Engineering Design II **Credits: (1-0) 1**
- MATH 373 Introduction to Numerical Analysis **Credits: (3-0) 3**
- Set B or D **Credits: 11**

**Total: 15**

## Senior Year

### First Semester

- MET 464 Engineering Design III **Credits: (0-2) 2**
- IENG 301 Basic Engineering Economics **Credits: (2-0) 2**
- <sup>7</sup> Science Elective **Credits: 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- Set A or C **Credits: 7**

**Total: 17**

### Second Semester

- MET 433 Process Control **Credits: (3-0) 3**
- MET 465 Engineering Design IV **Credits: (0-1) 1**
- Set B or D **Credits: 11**

**Total: 15**

## 130 credits required for graduation

### Curriculum Notes

<sup>1</sup> Satisfies General Education Goal #1

<sup>2</sup> Satisfies General Education Goal #2

<sup>3</sup> Satisfies General Education Goal #3

<sup>4</sup> Satisfies General Education Goal #4

<sup>5</sup> Satisfies General Education Goal #5

<sup>6</sup> Satisfies General Education Goal #6

<sup>7</sup> See Advisor for approved Science Electives

<sup>8</sup> See Advisor for approved Directed Met Electives

### Set A-Fall Even Years

- MET 422 Transport Phenomena **Credits: (4-0) 4**
- Free Elective **Credits: 3**

### Set B-Spring Odd Years

- MET 321/321L High Temperature Extraction, Concentration, and Recycling/Lab **Credits: (3-1) 4**
- <sup>8</sup> Directed Met Elective **Credits: 3**
- EE 301/301L Introduction to Circuits, Machines, and Systems/Lab **Credits: (3-1) 4**

### Set C-Fall Odd Years

- MET 330 Physics of Metals **Credits: (3-0) 3**
- MET 330L Physics of Metals Lab **Credits: (0-1) 1**
- MET 332 Thermomechanical Processing **Credits: (3-0) 3**

### Set D-Spring Even Years

- MET 440/540 Mechanical Metallurgy **Credits: (3-0) 3**
- MET 440L/540L Mechanical Metallurgy Lab **Credits: (0-1) 1**
- <sup>8</sup> Directed Met Elective **Credits: 3**
- MET 310 Aqueous Extraction, Concentration, and Recycling **Credits: (3-0) 3**
- MET 310L Aqueous Extraction, Concentration, and Recycling Lab **Credits: (0-1) 1**

## **Mining Engineering, B.S.**

### **Contact Information**

**Mr. Shashi Kanth**

Mining Engineering

Mineral Industries 235B

(605) 394-1973

E-mail: Shashi.Kanth@sdsmt.edu

### **Faculty**

Professors Kliche, Tukkaraja and Hladysz; Instructor Kanth.

### **Adjunct Faculty**

Dr. David Hammon and Dr. Ivy Allard.

### **Mining Engineering**

The mining engineering and management program, introduced as a new program in 2003, is designed to better meet the needs of the mining industry. It combines traditional mining engineering education with selected management-related concepts in order to better prepare the graduates for the modern mining industry.

Mining engineering is the application of engineering and scientific principles to the discovery, appraisal, and extraction of minerals from the Earth and sea. Mining engineering and management takes traditional mining engineering education one step farther by including management-related education in the curriculum.

The curriculum provides students with fundamental training in the basic sciences, engineering sciences, engineering design, geology, the humanities, and mining engineering. Principles of mine operations, mine planning, mining technology, advanced 3-D design and modeling, rock mechanics, explosives technology and computer applications receive special emphasis. Key management-related concepts are introduced at all levels of the curriculum.

Significant design experience is built into the curriculum and is enhanced by the use of sophisticated 3-D design software in many of the mining courses. Teamwork is stressed in the program. As students work together in small, specialized teams during many of the laboratory exercises and to complete the final capstone design project. The students present their final design project both orally and in written form.

The mining engineering degree is accredited by the Engineering Accreditation Commission of ABET, 111 Market Place, Suite 1050, Baltimore, MD 21202-4012; telephone (410) 347-7700.

### **Mining Engineering Laboratories**

Laboratory facilities exist in the department for rock mechanics, ventilation, GPS surveying and computer-aided mine design. Laboratory equipment available for student use includes equipment for rock specimen preparation, uniaxial and triaxial rock strength testing machine, direct shear machine, computerized data acquisition system, ventilation network model, and modern GPS-based surveying equipment.

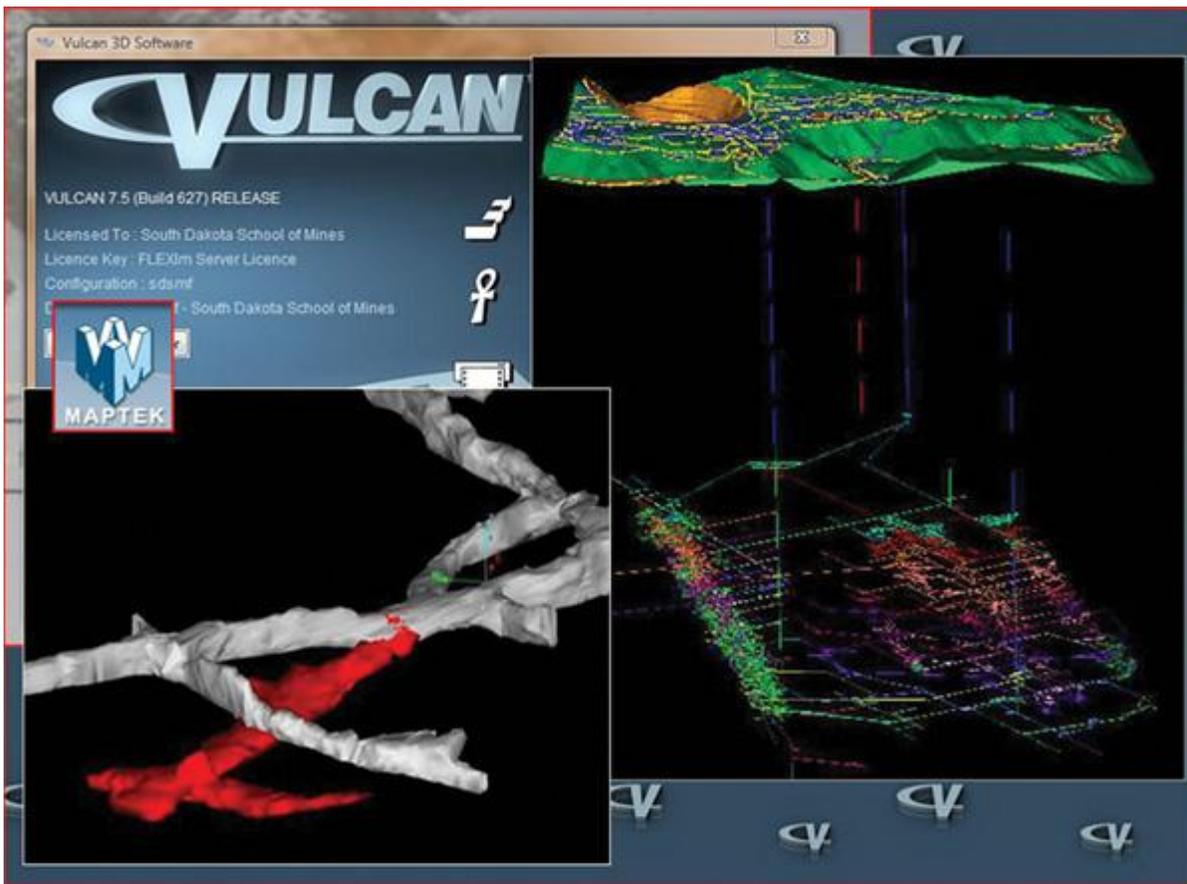
The computer laboratory consists of a new (2007) lab sponsored by industry leader in mine design software (MAPTEK) with personal computers. Available software packages are routinely used by undergraduate and graduate students for the solution of problems in rock mechanics, geostatistics, management, mineral economics, ventilation, blasting, mapping, and mine design. Contemporary geoscience modeling and mine planning software is used by students for surface and underground mine design.

### **MAPTEK Lab**

The MAPTEK Advanced Mine Design and Global Communications Center is a modern computer design lab that is fully equipped with the world's most popular Mine Design Software – VULCAN from MAPTEK. This program is the leading design software used by the majority of mining operations worldwide. It enables students to design, review, analyze and perform extremely complex mine design tasks that are commonly performed daily at mining operations.

In addition, the lab is equipped with all of the requisite audio-video equipment to conduct video conference sessions with any organization across the globe. The set-up also allows for easy integration to distance learning modules and participation from industry executives worldwide.

*Mines Matters: 3-D modeling Vulcan software donated by Maptek helps students learn advanced technical design aspects of the mining industry. The Maptek Advanced Mine Design Center enhances the faculty's ability to promote and teach advanced technical aspects of the mining industry, with emphasis on 3D-modeling and design.*



### **Mining Engineering Program Objectives**

The program in mining engineering is designed to meet the changing needs of the mining industry all over the nation and the world by providing graduates who are technically sound in mining engineering and can progress quickly through supervision and into management.

The curriculum has been designed to meet accreditation requirements in mining engineering. The core mining engineering curriculum provides technical training in areas such as rock mechanics, mine ventilation, ore reserve evaluation, mine design, explosive application, mining equipment selection, mining method selection, and mine land reclamation. The curriculum also includes a strong emphasis on management-related topics: health and safety, economics and finance, labor relations, project management, environmental management, international business, and communication skills.

The educational objectives of the program are:

- Graduates from the mining engineering program will have the analytical, technical and mine design abilities necessary to work effectively in the field of mining engineering and will be informed of recent technical advances in the field.
- Graduates from the mining engineering program will be cognizant of societal issues and their role as future professional engineers working for the general benefit of society.

### **Professional Development**

Students in the program are encouraged to become student members of their primary professional organization—the Society for Mining, Metallurgy, and Exploration (SME). Upon graduation, they are further encouraged to continue professional membership in SME. In addition, the students can become student members of the International Society of Explosives Engineers (ISEE). Both SME and ISEE have local chapter meetings, which students are encouraged to attend.

During their senior year, students in the mining engineering program are encouraged to take the Fundamentals of Engineering (FE) examination. Passing the FE examination is the first step toward registration as a Professional Engineer (PE). The second and final step in the registration process is the successful completion of the Professional Engineering examination, which is normally taken at least four years after graduation.

The mining engineering program participates in a cooperative education program that provides an opportunity for students to combine coursework with meaningful work experience in industry. Participating companies in the program provide jobs for students during semesters scheduled for work. A student in the cooperative program should plan on four and one half to five years to graduate.

## **Mining Engineering Curriculum/Checklist**

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

### **Freshman Year**

#### **First Semester**

- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- MATH 123 Calculus I **Credits: (4-0) 4**
- Humanities or Social Sciences Elective(s) **Credits: 3**
- ENGL 101 Composition I **Credits: (3-0) 3**

**Total: 14**

#### **Second Semester**

- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- MEM 120 Introduction to Mining, Sustainable Development and Introductory Management **Credits: (2-0) 2**
- PE Physical Education **Credits: 1**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 13**

### **Sophomore Year**

#### **First Semester**

- MATH 205 Mining and Management Mathematics I **Credits: (2-0) 2**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- EM 216 Statics and Dynamics **Credits: (4-0) 4**
- MEM 201L Surveying for Mineral Engineers **Credits: 2**
- MEM 203 Introduction to Mine Health and Safety **Credits: (1-0) 1**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- ECON 201 Microeconomics **Credits: 3**

**Total: 18**

#### **Second Semester**

- MATH 321 Differential Equations **Credits: (3-0) 3**
- GEOE 221/221L Geology for Engineers/Lab **Credits: (2-1) 3**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- Humanities/Social Science Elective(s) **Credits: 3**
- MEM 202 Materials Handling and Transportation **Credits: (2-0) 2**
- MEM 204 Surface Mining Methods and Unit Operations **Credits: (2-0) 2**

**Total: 16**

### **Junior Year**

#### **First Semester**

- MEM 301/301L Computer Applications in Mining/Lab **Credits: (1-1) 2**
- MEM 303 Underground Mining Methods and Equipment **Credits: (2-0) 2**
- MEM 305 Introduction to Explosives Engineering **Credits: (3-0) 3**
- EE 303/303L Basic Circuits/Lab **Credits: (2-1) 3**
- IENG 366 Engineering Management **Credits: (3-0) 3**
- MEM 307 Mineral Exploration and Geostatistics **Credits: (3-0) 3**

**Total: 16**

### **Second Semester**

- ATM 404/504 Atmospheric Thermodynamics **Credits: 2 or 3**
- GEOL 314/314L Mineralogy and Petrology for Mining Engineers/Lab **Credits: (3-1) 4**
- MEM 302 Mineral Economics and Finance **Credits: (3-0) 3**
- MEM 304/304L Theoretical and Applied Rock Mechanics/Lab **Credits: (2-1) 3**
- EM 331 Fluid Mechanics **Credits: (3-0) 3**
- MET 220 Mineral Processing and Resource Recovery **Credits: (3-0) 3**

**Total: 19**

### **Senior Year**

#### **First Semester**

- BADM 407 International Business **Credits: 3**
- MEM 401/401L Theoretical and Applied Mine Ventilation/Lab **Credits: (3-1) 4**
- MEM 466 Mine Management **Credits: (2-0) 2**
- Free Elective **Credits: 4**
- Hum/Soc. Sci. (Language) **Credits: 4**
- <sup>1</sup>MEM 4XX Mining Technical Elective **Credits: 1**

**Total: 18**

#### **Second Semester**

- MEM 464 Mine Design and Feasibility Study **Credits: (0-4) 4**
- ECON 304 Managerial Economics **Credits: 3**
- GEOE 322/322L Structural Geology/Lab **Credits: (2-1) 3**
- MEM 405 Mine Permitting and Reclamation **Credits: (3-0) 3**
- HRM 417 Human Resource Management **Credits: 3**

**Total: 16**

**130 credits required for graduation**

### **Curriculum Notes**

<sup>1</sup> Elective chosen from a list of approved mining or business courses.

## Physics, B.S.

### Contact Information

**Dr. Andre G. Petukhov**

Department of Physics

Electrical Engineering/Physics 223

(605) 394-2364

E-mail: Andre.Petukhov@sdsmt.edu

### Faculty

Professors Corey, Foygel, Petukhov and Sobolev; Assistant Professor Bai.

### Physics

The goal of a program of study in physics is to provide students with an understanding of the basic laws of physics and to develop skills that will enable students to further explore physical phenomena and to solve related problems.

Students should have a sense of curiosity about their surroundings and a strong desire, not only to find solutions to problems that are encountered, but also to develop a deeper understanding of the basic principles involved. Students will be expected to develop a high level of mathematical skills and to become proficient in oral and written communications. Laboratory skills are also emphasized.

At the bachelor of science level, students will not be expected to specialize in any branch of physics. However, the curriculum does have room for electives, providing an opportunity to develop a minor in other fields of science or in an engineering discipline. It provides a background in applications of physics for students seeking employment in industry and also provides a solid foundation for graduate study in physics or in other fields such as geophysics, meteorology, metallurgy, computer science, mathematics, materials science, and many branches of engineering.

Because physics is the basis of most engineering disciplines, understanding basic principles of physics can help one become a better engineer. An increasing number of students are choosing a double major, consisting of physics plus some field of engineering. Students going this route often end up in industrial research and development. In a rapidly changing economy where one field of engineering may be in a slump while others are not, understanding physics can assist students in moving across disciplines. For these reasons, students are encouraged to consider double majors.

Graduate studies leading to the degree of Master of Science in Physics and Materials Science and Ph.D. in Materials Science and Nanoscience are offered. Research is primarily in condensed matter and particle physics. At this level of study, students are expected to assume much of the responsibility for carrying out a research project. For details of graduate programs in physics, see the graduate section.

### Physics Laboratories

The facilities in the EE-Physics building are ample for all aspects of the department's experimental work from the introductory laboratories through graduate research.

They are equipped to enable students to observe physical phenomena, demonstrate physical principles, and learn techniques for making quantitative measurements in the fields of mechanics, heat, optics, electricity and magnetism, atomic, particle, and solid state physics. T

he equipment is the type that students will likely to encounter after graduation, with emphasis on computer-based data acquisition and control of experiments.

### Physics Curriculum Checklist

Students are responsible for checking with their advisors for any program modifications that may occur after the publication of this catalog.

### Freshman Year

#### First Semester

- MATH 123 Calculus I **Credits: (4-0) 4**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- ENGL 101 Composition I **Credits: (3-0) 3**
- IS 110 Explorations **Credits: (2-0) 2**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 16**

## Second Semester

- MATH 125 Calculus II **Credits: (4-0) 4**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**

**Total: 14**

## Sophomore Year

### First Semester

- MATH 225 Calculus III **Credits: (4-0) 4**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**
- PHYS 275 Relativity **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 17**

### Second Semester

- MATH 321 Differential Equations **Credits: (3-0) 3**
- EE 220/220L Circuits I/Lab **Credits: (3-1) 4**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**
- Humanities or Social Sciences Elective(s) **Credits: 6**

**Total: 16**

## Junior Year

### First Semester

- MATH 432 Partial Differential Equations **Credits: (3-0) 3**
- PHYS 341 Thermodynamics **Credits: (2-0) 2**
- PHYS 343 Statistical Physics **Credits: (2-0) 2**
- PHYS 312 Experimental Physics Design I **Credits: (0-2) 2**
- CENG 244/244L Introduction to Digital Systems/Lab **Credits: (3-1) 4**
- PHYS 451/551 Classical Mechanics **Credits: (4-0) 4**

**Total: 17**

### Second Semester

- MATH 315 Linear Algebra **Credits: (3-0) 3**
- PHYS 471/571 Quantum Mechanics **Credits: (4-0) 4**
- PHYS 314 Experimental Physics Design II **Credits: (0-2) 2**
- Physics/Math/Computer Science Elective(s) **Credits: 3**

**Total: 12**

## Senior Year

### First Semester

- PHYS 421/521 Electromagnetism **Credits: (4-0) 4**
- <sup>1</sup> PHYS 361 Optics **Credits: (3-0) 3**
- PHYS 412 Advanced Design Projects I **Credits: (0-2) 2**
- <sup>1</sup> PHYS 481/581 Mathematical Physics **Credits: See Notes Below**
- Humanities or Social Sciences Elective(s) **Credits: 3**

**Total: 16**

**Second Semester**

- <sup>1</sup> PHYS 433/533 Nuclear and Elementary Particle Physics **Credits: (3-0) 3**
- <sup>1</sup> PHYS 439/539 Solid State Physics **Credits: (3-0) 3**
- PHYS 414 Advanced Design Projects II **Credits: (0-2) 2**
- Math/Physics Elective(s) **Credits: 3**

**Total: 12****120 credits required for graduation****Curriculum Notes**

At the end of the sophomore year 12 hours of electives must include 6 hours in humanities (in two disciplines or in a sequence of foreign language courses) and 6 hours in social sciences (in two disciplines).

The electives must contain a minimum of 15 hours in social sciences and humanities and 3 hours of mathematics or computer science at the 200 level or above. 10 credit hours of military science may also be used as electives.

<sup>1</sup> Courses offered alternate years.

# Master of Science

## Atmospheric and Environmental Sciences, M.S.

### Contact Information

#### Dr. Andrew Detwiler (Head)

Department of Atmospheric Sciences

Mineral Industries 205

(605) 394-2291

E-mail: Andrew.Detwiler@sdsmt.edu

### Faculty

Professor Detwiler; Emeritus Professors Helsdon, Hjelmfelt and Smith; Associate Professors Capehart, Kliche and Sundareshwar; Assistant Professor French; Instructors Clabo and Farley; Adjunct Professor Stamm; Adjunct Research Scientist Bunkers.

### Atmospheric Sciences

The Department of Atmospheric Sciences offers advanced undergraduate and graduate courses leading to the master of science degree in atmospheric sciences with specializations in meteorology or earth systems science, and the doctor of philosophy degree in atmospheric and environmental sciences (AES). For more information on the AES program please use the following link: [Atmospheric and Environmental Sciences Ph.D. Faculty in the](#)

Department of Atmospheric Sciences are members of the Institute of Atmospheric Sciences (IAS), an active research group that conducts research with sponsorship from the State of South Dakota and various federal agencies.

The primary objective of the atmospheric sciences graduate program is to give students a basic understanding of the factors influencing atmospheric phenomena, including solar and terrestrial radiation, fluid dynamics, thermodynamics, microphysical and electrical processes in clouds, ecology, atmospheric chemistry, and biogeochemistry. Instruction is offered in the interpretation of conventional weather, satellite and radar data; observations collected by specially instrumented aircraft; and output from numerical models of atmospheric processes. The graduate student is expected to carry out original research in the atmospheric sciences using some of these tools and resources. In addition, the student must successfully complete the coursework and program requirements enumerated below.

A student applying for admission to the master's degree program in the Department of Atmospheric Sciences should have a baccalaureate degree in meteorology or atmospheric sciences, one of the biological or physical sciences, earth system sciences, mathematics, or engineering. It is desirable for applicants to have received undergraduate credit for mathematics through Calculus 2 (for the earth systems science specialization — see below) or ordinary differential equations (for the meteorology specialization). For the meteorology specialization, undergraduate physics is required, and for the earth systems specialization, undergraduate physics and chemistry are desirable. Experience with computer programming is recommended. Graduate Record Examination (GRE) scores from the General Test are required for all students except School of Mines graduates. TOEFL scores are required of all applicants from colleges outside the U.S.

### Facilities and Resources

Students typically work directly with faculty on externally-funded research projects. Graduate research assistantships associated with these projects are available that provide part-time employment for students during the academic months and possible full-time employment during the summer. Facilities and resources of the IAS are utilized in these research efforts. These facilities comprise various meteorological instrument platforms and packages including several automated surface weather stations and a laser optical distrometer. Sophisticated computer facilities are available on campus, including a state-of-the-art 3-D computer visualization facility and a high-performance multiple-node computer cluster, with additional access to the larger computer complexes elsewhere.

### Faculty Research

Current research projects include field investigations of thunderstorms; applications of weather radar data to rainfall measurements and remote inference of cloud microphysical characteristics; numerical modeling of clouds ranging in size from small cumulus to severe storms including storm electrification, lightning, and lightning-influenced atmospheric chemistry; analysis of field observations and numerical simulations of complex surface ecosystems; land-surface hydrology; satellite remote sensing; land-surface/atmosphere exchange processes; fire weather prediction and modeling; biogeochemical cycling; and carbon sequestration and ecological modeling. In addition, IAS scientists are currently involved in activities to disseminate scientific knowledge to wider audiences and improve and enhance scientific literacy and educational opportunities for the people of South Dakota.

### **Course requirements for the M.S. degree**

1. Fifteen credit hours of coursework in atmospheric sciences at the 500-level or above.
2. Nine additional credit hours of non-atmospheric sciences electives at the 400-level or above (300-level non-atmospheric sciences courses can be accepted if approved by the Graduate Education and Research Council), or atmospheric sciences electives at the 500-level. (Please note undergraduate credit limitations given under "Advanced Degree Grade Requirements" heading on the Graduate Policies for master of science degrees.)
3. Thesis research — 6 credit hours.

### **Other program requirements**

The following program requirements apply to all students in atmospheric sciences:

- Satisfactory performance on a general coursework exam.
- Registration in ATM 700 Graduate Research (thesis) each semester the student is receiving an assistantship.
- Registration in ATM 690 Seminar each spring semester.
- Completion of a master's thesis. The thesis must adhere to the format and content guidelines as set forth by the graduate school, and be approved by the student's graduate advisory committee and the Dean of Graduate Education.

In addition, there are requirements specific to the two ATM M.S. specializations. Each student will choose one of these specializations. The requirements are:

### **Meteorology Specialization**

Students entering the program with a bachelor's degree in fields outside of atmospheric sciences or meteorology must take the following courses: ATM

450/450L Synoptic Meteorology I/Lab (not for graduate credit), ATM 401/501 Atmospheric Physics, ATM 455/455L/555/555L Synoptic Meteorology II/Lab, and ATM 460/560 Atmospheric Dynamics. Additional coursework may be determined by the student's graduate committee.

### **Earth System Science Specialization**

All students will be required to take the following course: ATM 603 Biosphere-Atmosphere Interactions. They also must complete at least one remote sensing course.

- ATM 603 Biosphere-Atmosphere Interactions **Credits: (3-0) 3**
- They also must complete at least one remote sensing course.

### **Program of Study**

A specific plan of study will be determined on an individual basis with concurrence from the student's advisor and graduate advisory committee members. In either specialization, exceptions to these departmental requirements may be granted by the student's committee for good cause.

Elective courses offered by other departments are encouraged as long as the 15 hours of coursework in atmospheric sciences at the 500-level or above are completed as outlined in course requirements for M.S. degree. Graduate students may take electives in the fields of physics, mathematics, computer science, chemistry, engineering, engineering management, social sciences, or the humanities to further integrate their coursework in the atmospheric sciences with knowledge in other technical fields and with the general concerns of society.

A student may choose the meteorology specialization with the intent to qualify for employment in the federal civil service as a meteorologist. Specific course distribution requirements for these requirements are listed on page 62 earlier in this catalog within the general description of the Department of Atmospheric Sciences. Students in either specialization may pursue an M.S. degree in atmospheric sciences without satisfying these requirements and be qualified for careers in many non-federal and/or non-meteorological careers. Examples of such career options include research in and applications of remote sensing techniques; work in air quality either for non-federal government agencies, or for industry or the consulting firms industries often employ; research and applications in the environmental sciences with an emphasis on atmospheric issues, and further graduate work in atmospheric or environmental sciences.

Undergraduate students at School of Mines may decrease the time required to obtain a master of science degree in atmospheric sciences by taking as electives the preparatory undergraduate and entry-level graduate courses available to them or by completing the bachelor of science in interdisciplinary sciences program with an emphasis on atmospheric sciences. They may then enter the graduate program with the necessary background for graduate study in atmospheric sciences as above.

## **Biomedical Engineering, M.S.**

### **Contact Information**

#### **Dr. Jon Kellar**

Department of Materials and Metallurgical Engineering

Mineral Industries Building 112

(605) 394-2343

E-mail: Jon.Kellar@sdsmt.edu

### **Advisory Council**

Professors Bang, Buck, Kalanovic, Kerk, Kjerengtroen, Korde, Langerman and Weiss, Associate Professors Medlin and Muci; Assistant Professors Fong, Yoon and AML lab-Sears.

### **Biomedical Engineering**

Offered jointly with University of South Dakota (USD). Biomedical engineering (BME) is concerned with the application of engineering and science methodologies to the analysis of biological and physiological problems and to the delivery of health care. The biomedical engineer serves as an interface between traditional engineering disciplines and living systems and may work in either direction, applying the patterns of living organisms to engineering design or engineering new approaches to human health.

Both the master of science and doctor of philosophy degrees are cross-disciplinary degrees. The objective of the M.S. program is to prepare a student for research and development careers in biomedical industry and further research at the doctoral level. The Ph.D. program will prepare a student for a career as a researcher who advances the frontiers of biomedical science and engineering with attention to generating new ideas for commercialization.

Current focus areas of faculty activity within the program are (1) cardiovascular mechanics, pathology, and devices (heart valves, stents, etc.), (2) biomaterials (nanomaterials, bioadhesives, tissue engineering, etc.), (3) computational biomedical engineering (biomechanics, imaging, advanced modeling/simulations, etc.), and (4) assistive technology/rehabilitation engineering (advanced prosthetics, control, biomimetics, etc.). Students in the programs will be associated with one or more of several existing and newly formed research centers and laboratories, e.g., the Cardiovascular Research Institute, the Center for Accelerated Applications at the Nanoscale, the Center for Development of Light Activated Materials, the Computational Mechanics Laboratory, or the Direct Write Technology Laboratory.

Admission to either program will be based on the established graduate admission standards at the South Dakota School of Mines and Technology. The Graduate Record Examination (GRE), three letters of recommendation, and a GPA of 3.00 or better are expected of all applicants for the Ph.D. program. The TOEFL exam is required for students whose native language is not English. Students seeking exceptions warranted by special circumstances are requested to contact the biomedical engineering graduate program coordinator.

### **Students completing their M.S. degrees will graduate with a high level of competence in**

- understanding of cardiovascular systems and devices;
  - the application and characterization of various forms of biomaterials;
  - the acquisition and processing of medical signals and images;
  - the computation and simulation of phenomena in biomechanical systems; and
  - transferring their understanding of biomaterials, biomechanics, and signal processing to the creation of new applications.
- Students completing their Ph.D. degrees will graduate with a higher level of expertise in transferring their understanding of one of the program focus areas - cardiovascular mechanics/pathology/devices, biomaterials, computational biomedical engineering, or rehabilitation engineering/assistive technology to the creation of new knowledge and applications.
- In addition, doctoral students will possess a high level of expertise in their specialized area of research. This competency will be developed through focused research objectives which culminate in the doctoral dissertation. Graduates of the programs will also demonstrate
- the ability to communicate effectively in written and oral presentations,
  - intellectual honesty when working with data and ideas, and
  - the ability to make an original contribution to their field.

Courses are offered at both SDSM&T and USD campuses, and students may elect either campus as their campus of residence. Courses offered at SDSM&T are relayed to students at USD by video, and vice versa.

Students who have already completed an M.S. in Biomedical Engineering or a related field are eligible for admission to the Ph.D. program. All other applicants will be admitted to the M.S. program and will be considered for the Ph.D. program upon successful completion of the master's degree.

### **Financial Support**

The Biomedical Engineering program has a limited number of Teaching Assistantships and Research Assistantships. All students admitted to the program are automatically considered for financial support.

### **M.S. Curriculum Requirements, Thesis Option**

- BME 601 Biomaterials **Credits: (3-0) 3**
- BME 602 Anatomy and Physiology for Engineers **Credits: (3-0) 3**
- BME 603 Molecular Biology for Engineers **Credits: (3-0) 3**
- BME 608 Biomedical Engineering **Credits: (3-0) 3**
- BME 610 Experimental Design and Data Analysis in Biological Engineering **Credits: (3-0) 3**
- BME 790 Biomedical Engineering Seminar **Credits: 3**
- BME 798 Master's Thesis **Credits: 6**
- BME Electives **Credits: 9**

**Total: 33**

### **Note(s):**

Elective courses in the area of the student's intended research are to be selected in consultation with the student's advisory committee.

### **M.S. Curriculum Requirements, Non-Thesis Option**

- BME 601 Biomaterials **Credits: (3-0) 3**
- BME 602 Anatomy and Physiology for Engineers **Credits: (3-0) 3**
- BME 603 Molecular Biology for Engineers **Credits: (3-0) 3**
- BME 608 Biomedical Engineering **Credits: (3-0) 3**
- BME 610 Experimental Design and Data Analysis in Biological Engineering **Credits: (3-0) 3**
- BME 790 Biomedical Engineering Seminar **Credits: 3**
- BME 788 Non-Thesis Project **Credits: 3**
- BME Electives **Credits: 12**

**Total: 33**

### **Note(s):**

Elective courses in the area of the student's intended research are to be selected in consultation with the student's advisor committee.

## Chemical Engineering, M.S.

### Contact Information

#### Dr. Jan Puszynski

Department of Chemical and Biological Engineering  
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E-mail: Jan.Puszynski@sdsmt.edu  
<http://cbe.sdsmt.edu>

### Faculty

Professors Bang, Dixon, Puszynski (Program Coordinator), Salem and Winter; Associate Professors Gilcrease, Menkhaus and Sani; Assistant Professors Benjamin, Hadley and Shende.

### Chemical Engineering

The Department of Chemical and Biological Engineering offers programs of study leading to the master degree in chemical engineering (ChE). Students may consider either a thesis or non-thesis executive program option.

A student who elects the thesis option will be required to present a thesis based upon an original investigation for which 6 credits must be earned toward a total requirement of 30 credits in an approved program of study.

For the non-thesis executive program option, a student must earn 32 credits in an approved program of study and complete a special project. In the non-thesis executive program, which is oriented primarily toward industrial needs, students take at least one course in technology management as part of their required courses for the M.S. in chemical engineering.

Chemical engineers with a M.S. degree obtain graduate education that provides them with an in-depth understanding of the chemistry, mathematics, and physical laws describing systems at both molecular and macroscopic levels. With this knowledge, the chemical engineer can participate in interdisciplinary research, development, and implementation of new and improved technologies in areas such as: biotechnology, catalysis, nanotechnology, chemical technology, energy, environmental processes, as well as manufacturing of high-performance materials for electronic and structural applications. A student who does not have a bachelor's degree in chemical engineering will be expected to take several additional undergraduate chemical engineering courses to provide a solid ChE foundation. The current research interest of the faculty can be found on the departmental website at: <http://cbe.sdsmt.edu>.

### Core Curriculum

A core curriculum for all M.S. candidates in chemical engineering includes the following courses or approved substitutions:

- CBE 450/550 Systems Analysis Applied to Chemical Engineering **Credits: 2 to 3**
- CBE 612 Transport Phenomena: Momentum **Credits: (3-0) 3**
- CBE 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- CBE 621 Advanced Chemical Engineering Thermodynamics I **Credits: (3-0) 3**
- Kinetics Elective Credits: 3 <sup>1</sup>
- Applied Computation Elective Credits: 3 <sup>2</sup>
- CBE 790 Seminar **Credits: (0.5-0) 0.5**

### Curriculum Notes

<sup>1</sup> Kinetics Elective: CBE 444/544 or MES 728

<sup>2</sup> Applied Computation Elective: CBE 616/ME 616, MATH 432, IENG 486, and ATM 519/519L

### In addition to the core curriculum

Students pursuing the non-thesis option must complete a minimum of 2 credits of non-thesis research, CBE 788, 3 credits in engineering management, and 8 credits of chemical engineering approved electives. Students pursuing the thesis option are required to complete, in addition to the core curriculum, a minimum 6 credits of thesis research, CBE 798, and 5 credits of chemical engineering approved electives. An oral thesis defense for the thesis degree or oral project examination for the non-thesis degree, as well as final examination in the field of chemical engineering, are required prior to the completion of the graduate study.

## **Chemistry and Applied Biological Sciences**

### **Contact Information**

#### **Dr. Richard Sinden (Department Head)**

Department of Chemistry and Applied Biological Sciences

Chemistry/Chemical Engineering, Room 219

(605) 394-1678

E-mail:

### **Faculty**

Professor Bang, Boyles and Sinden; Associate Professors Fong, Heglund, Sani and Zhu; Assistant Professor Smirnova; Senior Lecturer Meyer; Lecturer Filipova; Instructors Christofferson, Coble, Dahl and Marshall.

### **Chemistry**

Students interested in pursuing graduate studies in chemistry or biology at the School of Mines should consider the following programs where the faculty of the Department of Chemistry and Applied Biological Sciences participate: M.S. and Ph.D. in Biomedical Engineering; M.S. and Ph.D. in Chemical and Biological Engineering; M.S. and Ph.D. in Materials Engineering and Science; and Ph.D. in Nanoscience and Nanoengineering

## **Civil Engineering, M.S.**

### **Contact Information**

#### **Dr. Scott Amos, Graduate Coordinator**

Department of Civil and Environmental Engineering, Civil/Mechanical 123

(605) 394-1694

E-mail: Scott.Amos@sdsmt.edu

### **Faculty**

Professors Amos, Bang, Fontaine, Gribb, Hansen, and Kenner; Associate Professors Christopher, Stone and Surovek; Assistant Professors Arneson-Meyer, Benning, Cetin, Fick, Nam and Robinson; Adjunct Assistant Professor Roberts; Distinguished Professor Emeritus Ramakrishnan; Professors Emeritus Hovey and Preber; Associate Professor Emeritus Klasi.

The Civil and Environmental Engineering Department offers thesis and non-thesis M.S. degrees in civil engineering. Students may also participate in the interdisciplinary Atmospheric and Environmental Sciences and Materials Engineering and Science PhD programs on campus. Current School of Mines undergraduates may be eligible for the new accelerated master's program.

Most of our CEE graduate courses are scheduled at times to allow working students to attend. Our wide array of ongoing research projects gives you the real experience you need to launch a successful career, including topics such as developing composite materials for lunar habitats to investigating soil parameters for better road-way pavement design.

For more information about our research areas, visit the CEE departmental webpage at [cee.sdsmt.edu](http://cee.sdsmt.edu).

### **Program Information**

The Department of Civil and Environmental Engineering offers coursework and research opportunities leading to the Master of Science degree in civil engineering (MSCE) in the following emphasis areas: advanced materials, construction management, environmental, geotechnical, water resources, and structural engineering.

Students may specialize or take courses from several areas.

### **Entrance Requirements**

A GPA of 3.00 or better is required of all applicants for the MSCE program. The Graduate Record Examination (GRE) is required of all applicants except School of Mines graduates. The TOEFL exam is required for students whose native language is not English.

Incoming students should have completed three semesters of calculus, one semester of differential equations, two semesters of chemistry and at least one semester of physics. Deficiencies in these areas must be remedied by taking the necessary coursework prior to, or in the first year of enrollment in the graduate program.

All incoming students, including those without a B.S. degree in civil engineering, are also expected to have completed courses in, or to develop proficiency in, the appropriate background courses for their intended emphasis area. Additional subjects may be required by the student's graduate committee depending on selected area of concentration. These requirements will be a formal component of a student's program of study.

An accelerated Master of Science (B.S./M.S.) degree program is available for qualified seniors enrolled in engineering B.S. programs at the South Dakota School of Mines and Technology. The accelerated master's degree program allows B.S. engineering students to take up to nine (9) graduate level credits to simultaneously meet undergraduate and graduate degree program requirements.

For more information about background requirements or the accelerated master's degree program, contact Dr. Scott Amos (Scott.Amos@sdsmt.edu).

### **Curriculum**

All rules and regulations of the graduate office, included elsewhere, apply to candidates for the degree of Master of Science in civil engineering. Thesis and non-thesis options are available. All full-time MSCE students are required to attend the CEE graduate student seminar series during the course of their studies.

#### **Thesis Option**

The MSCE thesis degree option consists of program of graduate coursework and independent thesis research. Candidacy for the MSCE degree with the thesis option is contingent upon the student's aptitude to do research. The thesis must constitute an original contribution to knowledge in civil and environmental engineering and must be successfully defended at a final oral presentation and examination. Students are accepted into the MSCE thesis option upon the successful submission of a written thesis proposal, public presentation, and the recommendation of a major professor.

**The requirements for the MSCE thesis degree are as follows:**

1. A program of at least 30 credit hours of coursework and research. At least 50% of the credit hours must be at the 600 level or higher.
2. At least 15 credit hours of CEE approved graduate coursework (500 level courses and above) to include Research Methods (CEE 500). Independent study (CEE 691) and Non-thesis Research (CEE 788) are not applicable toward the thesis option.
3. At least 6 credit hours of thesis research. No more than 6 credit hours of thesis research will count toward degree requirements.
4. Completion of a satisfactory thesis based upon independent research.
5. Meeting or exceeding prescribed academic standards.
6. Successfully defending the thesis.

**Non-thesis Option**

The non-thesis MSCE degree consists of a program of graduate coursework. A thesis, project paper, or final examination is not required; this is a course-work only degree. The requirements for the MSCE non-thesis degree are as follows:

1. A program of at least 33 credit hours of course work, of which no more than 3 credits may be from CEE 691 or CM 691, CM 788, CM 790, CM 791, CM 798, or CP 697. At least 50% of the credit hours must be at the 600 level or higher.
2. At least 20 credit hours of approved CEE graduate coursework (500 level courses and above).
3. Meeting or exceeding prescribed academic standards.

**Research Opportunities**

Our faculty have established reputations of excellence and can provide exciting opportunities for making your own contribution to cutting-edge research projects such as:

- Developing thermally resistant composite materials for extreme environments.
- Developing stronger, lighter, and more corrosion resistant aircraft components.
- Determining the fate and transport of mercury and arsenic in the environment.
- Developing geo-biological dust control techniques for construction or waste sites.
- Life cycle assessment modeling to prepare agricultural processes for a carbon-constrained and sustainability-aware marketplace.
- Investigating the influence of unsaturated soil characteristics on pavement systems.
- Evaluating response of turbine structures to wind loads.
- Developing a sustainable stormwater management program for the Pine Ridge Indian Reservation, South Dakota.
- Characterizing transport of phthalate plasticizers in building materials leaching into the air and adsorbing to particles.
- Improving the sustainability and evaluating the environmental suitability of geotechnical structures built into waste materials.

## **Computational Sciences and Robotics, M.S.**

### **Contact Information**

#### **Dr. Jeff McGough**

Department of Mathematics and Computer Science

McLaury 201

Dept: (605) 355-3455

E-mail: Jeff.Mcgough@sdsmt.edu

www.mcs.sdsmt.edu/csr

### **Faculty**

Professors Corwin, Logar and Weiss; Associate Professors McGough, Pyeatt and Riley; Assistant Professors Karlsson and Qiao; Instructor Schrader.

### **Computational Sciences and Robotics**

The Master of Science in Computational Sciences and Robotics (CSR) is a distinctive degree that combines the intelligent power of the computational sciences with the cutting edge utility present in modern day robotics.

The CSR graduate program provides students with the advanced skills they will need in a rapidly evolving field. The program has the specialized courses to develop technical skills along with a strong emphasis on teamwork, including research projects which involve faculty and students from a variety of disciplines.

The core of the program covers the fundamentals and the students have the opportunity to gain advanced knowledge in focus areas such as pattern recognition, machine intelligence, simulation, computer vision, nonlinear control, digital signal processing and communications.

The primary objective of the CSR program is to give students a basic understanding of the tools required to implement intelligent systems in a dynamic context.

Two options for the degree are offered: thesis and non-thesis. The thesis program provides a research experience which is more focused. The non-thesis option provides the opportunity for students to expand their technical background with additional course work.

Graduates of this program should have a variety of career options in industrial applications, defense, homeland security, space exploration, or graduates can elect to continue their studies with a more advanced degree.

### **General Background**

The entering student will normally have completed a four year degree (B.S.) in either computer science, computer engineering, electrical engineering, mechanical engineering, or a closely related field of study. However, any capable and highly motivated student interested in this program is encouraged to apply regardless of academic background. Credit by examination is available. In the case of deficits in background, the student may be admitted on a probationary status while they make up missing coursework.

### **Mathematics Background**

- Year of Calculus (Calculus I and II)
- One semester of Multivariate Calculus (Calculus III)
- Discrete Mathematics
- One semester of Linear Algebra
- One semester of Probability and Statistics

### **Physics Background**

- Two semesters of calculus-based physics are suggested but not required.

### **Computing Background**

- Three semesters of programming including a semester of data structures.

### **GRE**

- Recommended but not required.

## English Proficiency

International students must meet the Graduate School English requirements. See Graduate School website for details: [graded.sdsmt.edu/](http://graded.sdsmt.edu/)

## Thesis

The candidate who qualifies for the thesis degree must satisfy the following requirements:

1. A minimum of 30 credits is required.
2. A minimum of 6 credits of CSC 798 (Master's Thesis) and 24 credit of course work is required.
3. The twenty-four credits of course work is divided into core and elective courses.
  - a. Completion of the 6 credits of core courses: Robotics and Autonomous Systems.
  - b. A minimum of 17 credits of elective courses.
  - c. One credit of seminar.
4. A satisfactory thesis based on individual research. The student must present a formal defense of his or her thesis research.

## Non-thesis

The candidate who qualifies for the non-thesis degree must satisfy the following requirements:

1. A minimum of 33 credits is required.
2. The 33 credits of course work is divided into core and elective courses.
  - a. Completion of the 6 credits of core courses: Robotics and Autonomous Systems.
  - b. A minimum of 23 credits of elective courses.
  - c. Three credits of a Master's Project.
  - d. One credit of seminar.

## Language Requirements

There is no foreign language requirement for the M.S. degree in CSR.

## Core Curriculum (Total of 6 credits)

- CSC 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3**  
**OR**
- CENG 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3**
- CSC 416/416L/516/516L Introduction to Autonomous Systems/Lab **Credits: (2.5-0.5) 3**

## CSR Electives

May be found at the CSR website: [www.mcs.sdsmt.edu/csr](http://www.mcs.sdsmt.edu/csr)

## Note(s)

There is room in the current course rotation for two background courses without having to extend the time of the degree or overload in hours.

## Research Areas and Resources

Currently active research areas include: Autonomy, Computer Vision, Controls, Localization, Mapping, Motion Planning, and Navigation.

Some of the active research projects include: Unmanned Aerial Vehicle, Autonomous Underwater Vehicle, Unmanned Ground Vehicle, and Intelligent Controls.

The CSR program has dedicated development labs including the recently dedicated L-3 Communications Embedded Systems and Robotics Laboratory. In addition, the interdisciplinary nature of the research and project teams allows students to utilize a variety of resources from around campus. Please see the CSR website for additional information: [www.mcs.sdsmt.edu/csr](http://www.mcs.sdsmt.edu/csr)

## **Construction Management, M.S.**

### **Contact Information**

Dr. Scott Amos  
Department of Civil and Environmental Engineering  
C/M 123  
(605) 394-1694  
E-mail: Scott.Amos@sdsmt.edu

### **Construction Management**

The Master of Science in Construction Management (MSCM) degree is designed to provide a program of advanced study for candidates anticipating a managerial career in the construction industry. In addition to course delivery in a hybrid distance mode, flexibility is built into the program to provide an optimum educational experience to students.

### **Background Requirements**

The construction management coursework is geared towards the working professional. The successful applicant will have a background in business, science, engineering, technology or a related field with at least one semester of calculus and a course in probability and statistics.

Many students enter the program immediately after completing an appropriate undergraduate degree in the traditional disciplines of civil, electrical, mechanical, architectural, or industrial engineering. An accelerated Master of Science (BS/MS) degree is available for qualified seniors in the

engineering B.S. programs at the School of Mines. The accelerated master's degree program allows B.S. engineering students to take up to nine (9) graduate level credits to simultaneously meet undergraduate and graduate degree program requirements.

For more information about background requirements or the accelerated master's degree program, contact Dr. Scott Amos Scott.Amos@sdsmt.edu

### **Curriculum**

The 33 hour non-thesis MSCM degree program is an interdisciplinary curriculum that includes 18 hours of construction management oriented course and 15 hours of electives allowing a candidate's program of study to reflect both individual interests and career goals.

### **The requirements for the MSCM degree are as follows:**

1. A program of at least 33 credit hours of coursework, of which no more than 3 credits may be CM 691, CM 788 , CM 791, or CP 697.
2. At least 18 credit hours of approved graduate level CM coursework (600 level courses and above).
3. Undergraduate courses (400 level and below) or project credits will not count toward graduation.
4. Meeting or exceed prescribed academic standards.
5. All rules and regulations of the graduate office, including elsewhere, apply to candidates for the degree of master of science in construction management.

### **Required Core Courses**

- CM 608 Construction Contracts **Credits: (3-0) 3**
- CM 610 Construction Project Management **Credits: (3-0) 3**
- CM 619 Construction Company Management **Credits: (3-0) 3**
- CM 665 Construction Equipment Management **Credits: (3-0) 3**
- CM 710 Advanced Construction Management **Credits: (3-0) 3**

### **Approved Elective Courses**

A maximum of 12 hours may be transferred from other programs or institutions if approved by advisor.

- CM 500 Risk Management/Construction Safety (SDSU)
- CM 560 Sustainable Building Systems (SDSU)
- CM 574 Construction Engineering and Management **Credits: (3-0) 3**
- CM 706 Managing Sustainable Projects **Credits: (3-0) 3**
- CM 715 Advanced Materials and Methods **Credits: (3-0) 3**
- CM 788 Master's Research Problems and Projects **Credits: Credit to be arranged.**
- ENGM 620 Quality Management **Credits: (3-0) 3**
- ENGM 625 Innovation and Commercialization **Credits: (3-0) 3**

- ENGM 640 Business Strategy **Credits: (3-0) 3**
- ENGM 650 Safety Management **Credits: (3-0) 3**
- ENGM 661 Engineering Economics for Managers **Credits: 1 to 4**
- ENGM 655 Ergonomics for Managers **Credits: (3-0) 3**
- ENGM 675 Legal and Ethical Issues in Engineering Management **Credits: (3-0) 3**
- ENGM 742 Engineering Management and Labor Relations **Credits: (3-0) 3**
- IENG 431/531 Industrial Hygiene **Credits: (3-0) 3**
- IENG 466/566 Project Planning and Control **Credits: (3-0) 3**

## **Electrical Engineering, M.S.**

### **Contact Information**

#### **Dr. Kazem Sohraby**

Department of Electrical and Computer Engineering  
Electrical Engineering/Physics 311  
(605) 394-1219  
E-mail: Kazem.Sohraby@sdsmt.edu

### **Faculty**

Steven P. Miller Endowed Chair and Professor Whites; Professor Sohraby; Associate Professors Montoya and Tolle; Assistant Professors Anagnostou and Hoover; Instructor Linde.

### **Electrical Engineering**

The mission of the electrical and computer engineering graduate program is to provide quality student learning at an advanced level and to disseminate new knowledge in electrical engineering, while at the same time working to increase resources in support of these objectives.

The graduate program in electrical engineering consists of research and study leading to the master of science degree in electrical engineering (M.S. EE) and multidisciplinary Ph.D. degrees in materials engineering and science, nanoscience and nanoengineering, and biomedical engineering. In special cases, with the consent of the graduate committee of the electrical and computer engineering department, students may elect to do research in association with another engineering or science department.

The prospective student should have completed a baccalaureate degree in electrical engineering or computer engineering. Applicants from universities that are not accredited by the Accreditation Board for Engineering and Technology (ABET) are generally required to submit Graduate Record Exam (GRE) scores from the General Test with their application.

### **Graduate Committee and Program of Study**

The ECE Graduate Committee is the graduate committee for all M.S. EE non-thesis degree students, with the ECE Graduate Coordinator serving as the advisor. M.S. EE thesis students form a graduate committee with a major professor who has agreed to supervise the research of the student. In both cases, the student must arrange to have a faculty member external to the Department of Electrical and Computer Engineering on his or her committee. Each student must submit a program of study to the candidate's graduate committee by the end of the first semester of study. Approval of the program of study is necessary in order to register for the second and subsequent semesters.

The student's graduate committee has the right to disallow any course proposed in the student's program of study that they feel is not appropriate for the graduate degree in electrical engineering. A student accepted into the Ph.D. program in materials engineering and science, nanoscience and nanoengineering, or biomedical engineering must have his or her program approved by the graduate committee responsible for that respective program.

### **Graduate Credit Taken as an Undergraduate**

Undergraduate students taking 600 level graduate courses and petitioning these courses for graduate credit should realize that application of these credits to the program of study is subject to the approval of the student's graduate committee. A student's graduate program will come under the control of the graduate committee at the time the student is accepted into the graduate program.

### **Thesis/Non-Thesis Options**

Depending on the student's undergraduate background, and at the discretion of the electrical and computer engineering graduate committee, graduates of other institutions may also be required to take one or more courses of preparatory undergraduate work in addition to their graduate program of study. The M.S. EE degree is available with thesis and non-thesis tracks. The course requirements for these tracks are as follows:

#### **Thesis option**

The thesis M.S. EE degree consists of a program of graduate coursework and thesis research. Candidature for the M.S. EE degree with Thesis is contingent on an aptitude to do research. A limited number of students are accepted into the M.S. EE Thesis option, on the recommendation of a major professor. The requirements for the M.S. EE Thesis degree are as follows:

1. A program of at least 30 credit hours of coursework and research.
2. At least 15 credit hours of graduate coursework (500 level courses and above).
3. At least 6 credit hours of thesis research. (No more than 9 credit hours of thesis research will count toward degree requirements.)
4. A satisfactory thesis based upon individual research.
5. Meeting or exceeding prescribed academic standards.
6. Passing an examination on general knowledge and successfully defending the thesis.

### **Non-Thesis option**

The non-thesis MSEE degree consists of a program of graduate coursework. A project is not required and normally is not encouraged for the M.S. EE non-thesis option. The requirements for the M.S. EE non-thesis degree are as follows:

1. A program of at least 32 credit hours of coursework.
2. At least 20 credit hours of graduate coursework (500 level courses and above).
3. Meeting or exceeding prescribed academic standards.
4. Passing an examination on general knowledge in the field.

### **Language Requirements**

1. Students whose native language is not English are generally required to take the Test of English as a Foreign Language Test (TOEFL).
2. Graduate students with a TOEFL score below 560 are required to attend a remedial course in English.
3. Meeting or exceeding prescribed academic standards.
4. Passing an examination on general knowledge in the field.

### **Research Areas and Resources**

The M.S. EE degree offers emphases in the areas of communications and applied electromagnetics, and embedded systems and control systems. In addition to the more discipline-specific equipment listed below, the ECE department has well-equipped laboratories of networked PCs, general purpose test and measurement equipment such as high-speed oscilloscopes, arbitrary function generators, logic analyzers, and printed circuit board prototyping machines and software.

Research activities in the communications and applied electromagnetics area include: compact and reconfigurable antennas, electromagnetic propulsion of space sailcraft, engineered electromagnetic materials using active and passive circuit particles, and ultra-wideband and ground penetrating radar.

Resources in support of this program include a number of vector network analyzers, impedance analyzers, Agilent Advanced Design System, Microwave Studio, and IE3D. In addition, the Steven P. Miller Endowed Chair in electrical engineering was established in 2001 to support telecommunications in the ECE department.

Research activities in the embedded systems and signal processing area include: neural network and fuzzy logic chips, computationally intelligent systems, FPGA- and CPLD-based embedded system design, fault tolerant computer systems, residue and pseudo-floating point number architectures, pattern recognition, system identification, wavelet signal processing and adaptive signal processing. Resources in support of this program include logic analyzers, a variety of microcontroller and microprocessor development systems, FPGA and CPLD prototyping boards, VHDL and Verilog compilers, Analog Devices DSP development tools, Mentor Graphics Computer Aided Design Toolset, a variety of microchip fabrication equipment, and printed circuit board manufacturing equipment.

Research activities in the area of control systems include: robotics, machine control, fuzzy logic control, nonlinear and adaptive control, modeling of power systems, power systems stability, generator dynamics, fault analysis, and wind power. In addition, a number of robotics projects are performed in association with the School of Mines Center of Excellence in Advanced Manufacturing and Production (CAMP).

### **M.S. EE Course Offerings**

Courses that students would take for each of the focus areas would typically include, but would not be limited to, those listed below:

#### **Communication and Applied Electromagnetics:**

- EE 621 Information and Coding Theory **Credits: (3-0) 3**
- EE 622 Statistical Communication Systems **Credits: (3-0) 3**
- EE 623 Random Signals and Noise **Credits: (3-0) 3**
- EE 692 Topics **Credits: 1 to 3**

#### **Note(s):**

Regular topics (EE 692) offerings include:  
Advanced Engineering Electromagnetics  
Guided Waves and Material Measurements  
Advanced Antennas  
Computational Electromagnetics

**Embedded Systems and Signal Processing:**

- EE 612/612L High-Speed Digital Design/Lab **Credits: (2.5-0.5) 3**
- EE 624/624L Advanced Digital Signal Processing/Lab **Credits: (2.5-0.5) 3**
- EE 641 Digital Systems Design **Credits: (3-0) 3**
- EE 643 Advanced Digital Systems **Credits: (3-0) 3**
- EE 644 Fault Tolerant Computing **Credits: (3-0) 3**
- EE 647/647L HDL Design/Lab **Credits: (2.5-0.5) 3**
- EE 648/648L Advanced VLSI Design/Lab **Credits: (2.5-0.5) 3**

**Control and Power Systems:**

- EE 452/452L/552/552L Robotic Control Systems/Lab **Credits: (2.5-0.5) 3**
- EE 618/618L Sensors and Signal Processing/Lab **Credits: (2-1) 3**
- EE 633 Power Systems Analysis I **Credits: (3-0) 3**
- EE 634 Power System Analysis II **Credits: (3-0) 3**
- EE 651 Digital Control Systems **Credits: (3-0) 3**
- EE 652 Nonlinear and Optimal Control Systems **Credits: (3-0) 3**

## Engineering Management, M.S.

### Contact Information

**Dr. Stuart D. Kellogg**

Industrial Engineering

IER 301

(605) 394-1271

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### School of Mines Faculty

Professor Kellogg; Ervin Pietz Professor Kerk; Associate Professors Matejcik, Karlin and Jensen; Assistant Professor Piper; and Instructor Jensen.

### Engineering Management

The M.S. degree in Engineering Management (MSEM) is designed to provide a program of advanced study in technically oriented disciplines for candidates anticipating a managerial career. It is a multi-disciplinary applications-oriented degree, which draws from the fields of engineering, management, business, operations research and management science.

The intent of the program is to provide an interface between training received in engineering and scientific disciplines with the management of resources and personnel in a technical environment. In addition to being available in distance mode, flexibility is built into the program in order to provide an optimum educational experience to students. Graduates of the EM program are likely to find an initial position as a mid level supervisor within a broad range of applications requiring the use of quantitative models to integrate human and material resources necessary to perform an integrated function. Program specific information and resources may be found at the department of industrial engineering website: <http://ie.sdsmt.edu>.

Application should be made through the graduate office at School of Mines <http://graded.sdsmt.edu/prospective/apply> All candidates for this degree must possess a bachelor's degree from a four-year accredited institution, in which satisfactory performance has been demonstrated.

### In addition to these requirements, the following minimum bachelor's level credits shall have been completed:

1. Mathematics one year minimum, to include algebra and basic calculus (Equivalent to School of Mines MATH 123).
2. Six semester hours of natural and physical science (fields of geology, astronomy, biology, meteorology, chemistry, and physics) and which must include at least 3 credit hours of chemistry or physics.
3. Three semester hours of probability and statistics. (Students may complete prerequisite requirements in probability and statistics through an Internet-based study option. Students desiring this option should contact the program coordinator.)

In addition, individual elective courses may have additional prerequisite requirements. A maximum of 12 semester hours of credit may be transferred into the candidate's program from another institution. This must be from a regionally accredited institution. Application materials will be evaluated by an admission committee composed of the program director and such other faculty as deemed appropriate for the review. Recommendations from this committee will be made to the Dean of Graduate Education and research at the School of Mines.

Requirements for the degree include the completion of a minimum of 24 credits of coursework and 6 credits of research for the thesis option, or 32 credits of coursework for the non-thesis option. A cumulative GPA of 3.0 must be obtained by the end of the program of study and other general and master's level grade requirements must be maintained as specified in this catalog. The probation policy outlined in this catalog applies to all credits taken.

The continuing registration requirement must be satisfied at the School of Mines campus. Students utilizing transfer credits should plan accordingly and ensure that they are officially enrolled in a minimum of the two credits from the School of Mines the semester in which they graduate.

In the early stages of the candidate's program, a student advisor will be appointed by the program director of School of Mines. The advisor will meet with the student to prepare a program along the direction of the specific emphasis desired. The advisor and student will then organize an advisory committee, and file their committee program of study with the School of Mines graduate office according to the directions specified under "Supervision of the Master's Program" of the Master of Science Programs section of this catalog.

### Core Course Requirements

A minimum of 3 semester hours of required coursework must be completed in each of four discipline areas. Discipline areas and allowable courses are shown below.

### **Business/Finance**

- ENGM 661 Engineering Economics for Managers **Credits: 1 to 4**
- ENGM 640 Business Strategy **Credits: (3-0) 3**

### **Management**

- ENGM 742 Engineering Management and Labor Relations **Credits: (3-0) 3**
- IENG 466/566 Project Planning and Control **Credits: (3-0) 3**

### **Quantitative Methods**

- ENGM 631 Optimization Techniques **Credits: (3-0) 3**
- ENGM 732 Stochastic Models in Operations Research **Credits: (3-0) 3**
- ENGM 745 Forecasting for Business and Technology **Credits: (3-0) 3**

### **Operations Management**

- ENGM 663 Operations Planning **Credits: (3-0) 3**
- ENGM 620 Quality Management **Credits: (3-0) 3**

### **Note(s):**

Students wishing to utilize transfer courses to satisfy core requirements should contact their advisor or the program coordinator for suitability of transfer credits. In some cases, agreements with other state institutions are already available.

### **Recommended Elective Courses**

Any core course not used to satisfy core requirements may be used as an elective. Students may use any graduate School of Mines course provided it is approved by their committee. ENGM courses are available in distance learning mode and are listed below.

- ENGM 640 Business Strategy **Credits: (3-0) 3**
- ENGM 650 Safety Management **Credits: (3-0) 3**
- ENGM 655 Ergonomics for Managers **Credits: (3-0) 3**
- ENGM 675 Legal and Ethical Issues in Engineering Management **Credits: (3-0) 3**
- ENGM 625 Innovation and Commercialization **Credits: (3-0) 3**
- ENGM 720 Statistical Process Control **Credits: (3-0) 3**
- ENGM 732 Stochastic Models in Operations Research **Credits: (3-0) 3**
- ENGM 745 Forecasting for Business and Technology **Credits: (3-0) 3**
- ENGM 792 Topics **Credits: 1 to 3**

### **Transfer Credits**

Students may transfer up to 12 credits from another accredited institution or from another SDSM&T graduate degree program provided they meet the graduate office guidelines and program approval.

### **Sample Programs**

The following are sample programs for the project option for a student with a mining engineering degree (Student A), and a non-thesis option for a student contemplating a career as a laboratory manager in a government laboratory (Student B).

#### **Student A**

- ENGM 661 Engineering Economics for Managers **Credits: 1 to 4**
- ENGM 742 Engineering Management and Labor Relations **Credits: (3-0) 3**
- IENG 466/566 Project Planning and Control **Credits: (3-0) 3**
- ENGM 663 Operations Planning **Credits: (3-0) 3**
- ENGM 631 Optimization Techniques **Credits: (3-0) 3**
- Elective **Credits: 3**
- ENGM 620 Quality Management **Credits: (3-0) 3**
- ENGM 732 Stochastic Models in Operations Research **Credits: (3-0) 3**
- ENGM 650 Safety Management **Credits: (3-0) 3**

- ENGM 745 Forecasting for Business and Technology **Credits: (3-0) 3**
- ENGM 788 Master's Research Problems/Project **Credits: Credit to be arranged.**

**Total: 32**

**Student B**

- ENGM 661 Engineering Economics for Managers **Credits: 1 to 4**
- ENGM 742 Engineering Management and Labor Relations **Credits: (3-0) 3**
- IENG 466/566 Project Planning and Control **Credits: (3-0) 3**
- ENGM 663 Operations Planning **Credits: (3-0) 3**
- ENGM 631 Optimization Techniques **Credits: (3-0) 3**
- Elective **Credits: 3**
- ENGM 732 Stochastic Models in Operations Research **Credits: (3-0) 3**
- ENGM 720 Statistical Process Control **Credits: (3-0) 3**

**Total: 3**

## **Geology and Geological Engineering, M.S.**

### **Contact Information**

#### **Dr. Laurie Anderson**

Department of Geology and Geological Engineering  
Mineral Industries 303  
(605) 394-2461  
E-mail: Laurie.Anderson@sdsmt.edu

### **Geology Faculty**

Professors L. Anderson, Duke, Paterson, Price and Uzunlar; Associate Professor Masterlark; Assistant Professors Belanger, Pagnac and Terry; Professors Emeritus Fox, Lisenbee, Martin and Redden; Adjunct Professors Benton and McCormick; and Haslem Post-doctoral Fellow Boyd.

### **Geological Engineering Faculty**

Professors Davis and Stetler; Assistant Professors Katzenstein and Sawyer; Professor Emeritus Rahn; Adjunct Faculty M. Anderson, Iles, Long and Roggenthen.

### **Geology and Geological Engineering**

The Department of Geology and Geological Engineering offers advanced study leading to an M.S. degree in geology and geological engineering or a Ph.D. degree in geology and geological engineering. Students must elect to pursue either a Geology Specialization or a Geological Engineering Specialization, each of which has different background requirements and program requirements. The available coursework and current faculty expertise support the following areas of concentration. Students complete courses determined by the student's committee based on the intended field of study in:

1. Energy and Mineral Resources
2. Environmental/Exploration Geophysics
3. Ground Water / Environmental Studies
4. Mineral Deposits/Mineralogy/Petrology
5. Sedimentation/Stratigraphy
6. Paleontology\*
7. Structural Geology/Tectonics
8. Geomechanics/Engineering Geology

\* Ph.D. only. Students concentrating in Paleontology at the Master's level should apply for the separate M.S. in Paleontology.

### **Background Requirements for M.S. and Ph.D.**

The Graduate Record Examination (GRE) is required of all applicants. The TOEFL exam is required for students whose native language is not English.

### **Geology Specialization**

1. All incoming students are expected to present a full year each of college-level calculus, physics, and chemistry as part of their undergraduate record.
2. All incoming students are expected to have completed courses in the following areas:
  - Physical Geology
  - Mineralogy
  - Stratigraphy and Sedimentation
  - Petrology
  - Structural Geology
  - Field Geology

Deficiencies in these areas must be remedied by taking the necessary coursework prior to or in the first year of enrollment in the graduate program.

Students with more than three (3) course deficiencies should complete them prior to applying for admission.

### **Geological Engineering Specialization**

1. All incoming students are expected to present three semesters of calculus and one semester of differential equations, as well as two semesters each of physics and chemistry, as part of their undergraduate record.
2. All incoming students are expected to have completed courses in the following areas:
  - Physical Geology or Geology for Engineers
  - Mineralogy

- Stratigraphy and Sedimentation
- Structural Geology
- Statics
- Mechanics of Materials
- Fluid Mechanics

Deficiencies in these areas must be remedied by taking the necessary coursework prior to or in the first year of enrollment in the graduate program.

Students with more than three (3) course deficiencies should complete them prior to applying for admission.

### **Master's Program**

The M.S. thesis option requires 32 credits, including six to eight (6-8) credits for thesis research and twenty-four to twenty-six (24-26) credits of coursework. The non-thesis option includes 32 credits of coursework and is available to students at the discretion of the department head. Candidates for the M.S. degree must fulfill all degree requirements of the graduate office and the program, including an oral comprehensive exam covering course material.

### **Geology Specialization Requirements**

The candidate's committee is responsible for assisting the student in developing a program of study that prepares the student for his/her intended field of study.

GEOL 700 Research Methods is required the first fall semester of enrollment. In addition, the program of study must include at least one

GEOL/GEOE course emphasizing field/analytical methods and one GOEL/GEOE course emphasizing computational methods. The student's advising committee determines the courses that meet these criteria.

### **Geological Engineering Specialization Requirements**

All M.S. students in the Geological Engineering specialization are expected to focus in one of the three areas of groundwater/environmental, geomechanics, or energy/mineral resources. The candidate's committee is responsible for assisting the student in developing a program of study that prepares the student for his/her intended focus area.

GEOE 700 Research Methods is required the first fall semester of enrollment. In addition, the program of study must include at least one

GEOL/GEOE course emphasizing field methods, one GOEL/GEOE course emphasizing analytical methods and one GEOL/GEOE course emphasizing computational methods. The student's advising committee determines the courses that meet these criteria.

## Materials Engineering and Science, M.S.

### Contact Information

#### Dr. Jon J. Kellar

Department of Materials and Metallurgical Engineering  
Mineral Industries 112  
(605) 394-2343  
E-mail: Jon.Kellar@sdsmt.edu

### Steering Committee

Steering Committee members are from the Departments of Materials and Metallurgical Engineering, Physics, and Chemistry.

### Faculty

Douglas W. Furstenu Professor Kellar; Professors Boyles, Foygel, Howard, Petukhov and Salem; Associate Professors Corey, Cross, Heglund and Sobolev; Assistant Professors Fong, Meyer, West, Widener and Zhu; Emeritus Professor Stone, Distinguished Professor Emeritus Han; Adjunct Professor Medlin.

### Master of Science in Materials Engineering and Science

This interdisciplinary degree program works in concert with other colleges and the Ph.D. in materials engineering and science (Ph.D./MES).

The M.S./MES degree offers an education in the broad area of materials. Students pursuing this degree will expand their knowledge and understanding of the science and technology of materials synthesis, behavior, and production. Graduates of the program formulate solutions to materials problems through the use of multi-disciplinary approaches made possible with a broad background in basic materials science and engineering coupled with an area of specialization.

Two options are available in this degree program: one option involves a thesis component and the other option involves coursework only. In the thesis option, 24 hours of coursework and a minimum 6 credit hours of thesis research are required. With the second option, 32 hours of coursework must be taken. In the latter option however, the students are required to undertake a project under the supervision of a faculty member. Because students graduating with this degree are expected to have a broad-based fundamental knowledge in both materials engineering and materials science, every student is required to take the following core courses.

### Core Courses

- MES 601 Fundamentals of Materials Engineering **Credits: (4-0) 4**
- MES 603 Condensed Matter Physics **Credits: (4-0) 4**
- MES 604 Chemistry of Materials **Credits: (4-0) 4**

### In addition

- MES 790/890 Seminar **Credits: (1-0) 1** is a required course.

### Additional Information

Areas of research currently carried out include inorganic, organic, and biological behavior/synthesis/treatments of materials, polymer chemistry, solid state physics, interfacial chemistry/physics, thermal, magnetic and transport properties of semiconductors, superconductors, metals and alloys, dielectric and composite materials, recovery and processing of minerals/materials/scrap, process simulation and optimization, thermodynamics of various materials, corrosion and corrosion inhibition, strengthening mechanisms, deformation induced transformation plasticity, artificial intelligence, and behavior/properties/synthesis of composites.

## **Mechanical Engineering, M.S.**

### **Contact Information**

#### **Dr. Michael Langerman**

Department of Mechanical Engineering  
Civil Mechanical 133  
(605) 394-2408  
E-mail: Michael.Langerman@sdsmt.edu

#### **Lisa Carlson, MBA**

Associate Director  
Recruitment and Graduate Programs  
Civil Mechanical 131  
(605) 394-5261  
E-mail: Lisa.Carlson@sdsmt.edu

### **Faculty**

Professors Langerman, Abata, Dolan, Kalanovic, Kjerengtroen, Korde, and Muci-Kuchler; Associate Professors Bedillion and Widener; Assistant Professors Ellingsen, Kingsbury, Shahbazi, and Simmons; Professors Emeritus Buck, Chiang, Gnirk, Krause, Pendleton and Snyder; Instructor Ash.

### **Mechanical Engineering**

The Department of Mechanical Engineering offers two graduate degrees the master of science and the doctor of philosophy degree. The primary goals of the graduate program are to develop the scholastic ability, independent creativity, and professional competence of an individual to a higher level than is possible in an undergraduate program.

The graduate program offers opportunities for higher education and research in manufacturing, solid mechanics, transport phenomena, computational mechanics, vibrations, controls and robotics, experimental mechanics, fracture mechanics, composite materials, and advanced materials processing.

The graduate program features courses in continuum mechanics, computational methods in transport phenomena, advanced heat transfer, advanced fluid mechanics, engineering analysis, advanced solid mechanics, integrated manufacturing systems, applied intelligent control, theory of materials behavior, and advanced mechanical system control.

The mechanical engineering department is one of the largest programs on campus and has well-equipped laboratories. Several faculty members within the department are associated with the Computational Mechanics Laboratory (CML), where high-end workstations are available for pursuing research and design in modeling. Several faculty members are associated with the Center for Advanced Manufacturing and Production (CAMP), where research in advanced manufacturing, advanced composites, and advanced design methodologies is conducted. The department has a strong collaborative relationship with the Arbogast Advanced Materials Processing (AAMP) center and the Additive Manufacturing Laboratory (AML).

Other labs include the Fluid Mechanics and Heat Transfer Lab, which houses a Mach 3 supersonic wind tunnel, Vibrations Lab, Neural Networks and Controls Lab, Micromechanics Lab, Advanced Dynamics Lab, and a small Ballistics Lab.

The campus fosters interdisciplinary research, and state-of-the-art equipment such as an electron microscope, atomic force microscope, x-ray diffractometer, Raman spectrometer, laser Vibration Pattern Imager, FADAL VMC40 Vertical Machining Center, Bridgeport Romi CNC lathe, Coordinate Measuring Machine, Injection Molding Machine, IBM 7540 Industrial Robot, and Universal Testing Machines are available in the department or on campus.

Graduate research laboratories also include equipment for modern digital controls and machine vision, thermal image analysis, high-speed imaging and experimental mechanics

**The master of science degree program in mechanical engineering can be pursued using either of two (2) equal options.**

**They are:**

#### **1. Non-Thesis:**

**Total credit hours required: 32**

- ME 788 Master's Research Problems/Projects **Credits: Credit to be arranged.**

### **Remaining 28 hours are taken**

- (maximum) at the 400/500 level Credits: 9
- (minimum) at the 600/700 level Credits: 19

### **2. Thesis:**

#### **Total credit hours required: 30**

- ME 798 Thesis **Credits: Credit to be arranged.**

### **Remaining 24 hours are taken**

- (maximum) at the 400/500 level Credits: 9
- (minimum) at the 600/700 level Credits: 15

### **Curriculum Notes**

1. 300 level acceptable if outside department and on approved blanket waiver list.
2. Students may enroll in 300/400 level courses only if 500/600 level courses within the major are not being offered or by written permission of the student's major professor and the department head.

Within the first semester in residence, each student is requested to carefully evaluate their preference of study after discussion with the mechanical engineering faculty, and a decision must be made shortly after the beginning of the second semester in residence. In either case the student must by then choose a major professor, and with the major professor's assistance develop a plan of study. The plan is due by the mid-term of the student's second semester in residence. The plan will be submitted to the program coordinator, who will disseminate to :

1. Graduate office
2. The department head
3. Major professor
4. Copy to the student

Each master's degree candidate must select an advisory committee. In addition to the candidate's major professor, the committee must consist of at least one other mechanical engineering professor and a graduate office representative. The graduate office representative, whose appointment must be approved by the graduate dean, must be selected from outside of the mechanical engineering department. The student and his/her supervising professor will nominate the out-of-department committee member after the student has received the nominee's consent.

### **The core curriculum required of all M.S. students includes:**

- ME 673 Applied Engineering Analysis I **Credits: (3-0) 3**
- ME 773 Applied Engineering Analysis II **Credits: (3-0) 3**

### **In addition**

Students should select one course from each of the three areas listed below (or approved substitutions) for a total of five core courses.

#### **Thermal Sciences**

- ME 612 Transport Phenomena: Momentum **Credits: (3-0) 3**
- ME 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- ME 616 Computations in Transport Phenomena **Credits: (3-0) 3**
- ME 618 Conduction Heat Transfer **Credits: (3-0) 3**
- ME 619 Convection Heat Transfer **Credits: (3-0) 3**
- ME 620 Radiation Heat Transfer **Credits: (3-0) 3**

#### **Mechanical Systems**

- ME 623 Advanced Mechanical Vibrations **Credits: (3-0) 3**
- ME 680 Advanced Strength of Materials **Credits: (3-0) 3**
- MES 713 Advanced Solid Mechanics I **Credits: (3-0) 3**
- ME 770 Continuum Mechanics **Credits: (3-0) 3 OR**
- MES 770 Continuum Mechanics **Credits: (3-0) 3**

## **Manufacturing and Controls**

- ME 683 Advanced Mechanical System Control **Credits: (3-0) 3**
- ME 781 Robotics **Credits: (3-0) 3**
- ME 625 Smart Structures **Credits: (3-0) 3**

## **Additional Information**

The details of the actual course selections must be developed by the student, the student's academic advisor, and the student's committee.

Entering students usually have a bachelor's degree in mechanical engineering. Qualifying examinations may be required of entering students. A minimum GPA of 3.00 is expected for regular (non-probationary) admission. Applicants who are graduates of institutions that are not accredited by the Accreditation Board of Engineering and Technology (ABET) are required to sit for the Graduate Record Exam and have their scores submitted prior to consideration for admission.

## **Final Examination (MS Thesis Program)**

Upon completion of the thesis, mechanical engineering graduate students electing this option will be examined orally over the written thesis and coursework as prescribed in the Graduate section.

A mechanical engineering graduate student with an accumulated GPA of 3.4 or better in those courses in their graduate program will have their coursework exam combined with the thesis defense. For students having an accumulated GPA of less than 3.4 in courses in their graduate program, a separate focused coursework oral examination will be administered by the student's graduate committee. The GPA will be computed using midterm grades for the semester in which the student is currently enrolled. The coursework examination will examine primarily concepts and fundamentals of those courses selected, rather than the mechanics of problem solution and will, in general, attempt to establish the student's in-depth knowledge of the course content. The student's graduate committee will select specific courses from the student's graduate program in which the student has indicated possible deficiencies. The major professor will inform the student no less than three weeks prior to the examination what courses have been selected. However, it is the student's responsibility to secure this information from the major professor.

## **Final Examination (MS Non-Thesis Option)**

Mechanical engineering MS graduate students selecting a non-thesis option will be required to pursue a special investigation under the direction of a faculty member. The report on this study will be written and formal although not of thesis quality nor extent. Upon the completion of the special investigation and with the approval of the directing faculty member, the student will be given a formal oral examination over the investigation.

Rules concerning an oral examination over coursework taken by the student in their graduate program will be identical to the rules stipulated above for those students taking the thesis option.

## **Mining Engineering, M.S.**

### **Contact Information**

**Dr. Chuck Kliche**

Mining Engineering and Management Department

MI 231

(605) 394-2344

E-mail: Charles.Kliche@sdsmt.edu

### **Mining Engineering**

The Master of Science in Mining Engineering is designed to provide a program of advanced study in either management-oriented or technically-oriented disciplines for candidates planning a career in the mining, mine management or underground construction field. The available course work and current faculty expertise support the following emphasis areas:

1. Applied geomechanics, including advanced rock mechanics, rock slope stability, and tunneling;
2. Mining engineering management, including mineral economics and finance, and mining business management; and
3. General mining engineering.

The course delivery is geared towards both campus and hybrid-distance delivery modes.

### **Background Requirements**

The mining engineering coursework is geared primarily towards the working professional in the mining industry who requires distance delivery of the courses, although students can be admitted directly to the on-campus program. In either case, the student should have completed an appropriate undergraduate engineering degree. For those holding a non-mining engineering undergraduate degree the applicant should have significant experience in the mining or underground construction industry. Additionally, an undergraduate course in probability and statistics is highly recommended.

### **Curriculum**

The thirty-two credit hour non-thesis MS MinE degree consists of a program of acceptable graduate work culminating in the preparation, presentation and defense of a final project report. The interdisciplinary curriculum includes 12 core credits (4 courses) that are required for all students, 9 credit hours of specialization courses and 9 credit hours of elective courses approved by the student's major advisor. Additionally, the final project and report, normally completed in the student's last semester, is two credit hours.

### **The requirements for the MS MinE degree are as follows:**

- A program of at least 32 credits of course work (including 2 credit hours for the final project) which must include as required core courses:
  - MEM 550—Rock Slope Engineering or MEM 525—Advanced Rock Mechanics
  - MEM 510—Advanced Mineral Economics for Managers,
  - MEM 580—Advanced Explosives and Blasting and
  - MEM 610—Topics in Mineral Economics, Sustainability and Mine Regulation.
- At least 18 credit hours of approved graduate-level elective coursework (500 level courses and above).
- Meeting or exceeding prescribed academic standards.
- Preparation, presentation and successfully defending the required final project, which would normally be a practical project approved by the student's major advisor.
- Complying with all rules and regulations of the Graduate Office, which are presented elsewhere in this catalog.

### **Required Core Courses:**

- MEM 450/550 Rock Slope Engineering **Credits: (3-0) 3**  
**OR**
- MEM 425/525 Advanced Rock Mechanics **Credits: (3-0) 3**  
**AND**
- MEM 410/510 Advanced Mineral Economics for Managers **Credits: (3-0) 3**
- MEM 480/580 Advanced Explosives and Blasting **Credits: (3-0) 3**
- MEM 610 Topics in Mineral Economics, Sustainability and Mine Regulation **Credits: (3-0) 3**

## Recommended Elective Courses

Students may use approved graduate-level transfer courses from another institution for up to 6 credit hours of elective credit, provided they are included in the approved Program of Study.

All 500- and 600-level courses offered through the Mining Engineering and Management Department (MEM courses) are acceptable elective coursework.

The following lists acceptable out-of-department classes which can be used as electives for any of the three specializations (NOTE: Not all the following courses are taught via distance delivery methods):

- \* GEOE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- GEOE 615 Advanced Field Methods in Ground Water **Credits: (0-3) 3**
- GEOE 664/664L Advanced Ground Water/Lab **Credits: (2-1) 3**
- ENGM 661 Engineering Economics for Managers **Credits: 1 to 4** (Variable 4 credits)
- ENGM 620 Quality Management **Credits: (3-0) 3**
- ENGM 631 Optimization Techniques **Credits: (3-0) 3**
- ENGM 625 Innovation and Commercialization **Credits: (3-0) 3**
- ENGM 742 Engineering Management and Labor Relations **Credits: (3-0) 3**
- \* IENG 452 Introduction to Six Sigma **Credits: (1-0) 1**
- \* IENG 461 Six Sigma Greenbelt Exam **Credits: (1-0) 1**
- IENG 466/566 Project Planning and Control **Credits: (3-0) 3**
- CM 574 Construction Engineering and Management **Credits: (3-0) 3**
- CM 608 Construction Contracts **Credits: (3-0) 3**
- CM 665 Construction Equipment Management **Credits: (3-0) 3**
- CM 610 Construction Project Management **Credits: (3-0) 3**
- CM 710 Advanced Construction Management **Credits: (3-0) 3**
- CEE 447/547 Foundation Engineering **Credits: (3-0) 3**
- CEE 448/548 Applied Geotechnical Engineering **Credits: (3-0) 3**
- CEE 474/574 Construction Engineering and Management **Credits: (3-0) 3**
- CEE 634 Surface Water Hydrology **Credits: (3-0) 3**
- CEE 743 Advanced Soil Mechanics **Credits: (3-0) 3**
- CEE 745 Advanced Foundations **Credits: (3-0) 3**
- CEE 746 Stability of Soil and Rock Slopes **Credits: (3-0) 3**
- CEE 747 Earth and Earth Retaining Structures **Credits: (3-0) 3**

### Note(s):

\* Acceptable 400-level class with permission of major advisor.

## **Paleontology, M.S.**

### **Contact Information**

#### **Dr. Laurie Anderson**

Department of Geology and Geological Engineering  
Mineral Industries 303  
(605) 394-2461  
E-mail: Laurie.Anderson@sdsmt.edu.

### **Faculty**

Professors Anderson and Price; Assistant Professor Belanger, Pagnac and Sawyer; Associate Director and Instructor Shelton; Haslem Post-doctoral Fellow Boyd; Adjunct Professor Benton; Professors Emeritus Fox and Martin.

### **Paleontology**

The Department of Geology and Geological Engineering offers advanced study leading to an M.S. degree in paleontology. Resources available to graduate students in paleontology include the extensive collections of the Museum of Geology. The M.S. in paleontology has a strong emphasis on field-based research as well as courses in museum studies.

A student may enter this program with an undergraduate degree in geology, anthropology, one of the biological sciences, or other science disciplines, but for the latter majors, deficiencies must be completed as listed below. Students with more than three (3) deficiencies should plan to complete them prior to applying for admission.

All incoming students are expected to present one semester of college-level Physics and two semesters each of college-level Calculus and Chemistry as part of their undergraduate record. Deficiencies in these areas must be remedied by taking the necessary coursework prior to or in the first year of enrollment in the graduate program.

#### **All incoming students are expected to have completed courses in the following areas:**

Statistics  
Mineralogy  
Historical Geology  
Invertebrate Paleontology  
Petrology  
Structural Geology  
Stratigraphy and Sedimentation  
Field Geology

No graduate credit will be granted for making up undergraduate-level deficiencies.

The GRE exam is required of all applicants. The TOEFL exam is required for students whose native language is not English. Candidates for the M.S. degree must fulfill all degree requirements of the graduate office and of the program, including an oral comprehensive exam covering course material. The thesis option is the only option for the M.S. in paleontology.

### **Degree Requirements**

The M.S. thesis option requires 32 credits, including six to eight (6-8) credits of thesis research and twenty-four to twenty-six (24-26) credits of coursework.

The candidate's committee is responsible for assisting the student in developing a program of study that prepares the student for his/her intended field of study. GEOL 700 (Research Methods) is required the first fall semester of enrollment. In addition, the program of study must include at least one GEOL/GEOE/PALE course emphasizing field methods, one GEOL/GEOE/PALE course emphasizing computational methods, and one GEOL/GEOE/PALE course emphasizing the systematics of a taxonomic group. The student's advising committee determines the courses that meet these criteria.

The following courses are recommended for M.S. paleontology students, especially those completing thesis research in vertebrate paleontology or interested in pursuing a career in museums or in paleontology resource management.

- GEOL 417/517 Geospatial Databases **Credits: (3-0) 3**
- GEOL 419/519 Advanced Geospatial Analysis **Credits: (3-0) 3**
- GEOL 472/472L/572/572L Museum Conservation and Curation/Lab **Credits: (2-1) 3**

- GEOL 473/473L/573/573L Museum Preparation Techniques and Exhibit Design/Lab **Credits: (1-2) 3**
- GEOL 471/571 Field Paleontology **Credits: (0-2) 2**
- GEOL 474/574 Paleontological Resource Management **Credits: (3-0) 3**
- GEOL 604 Advanced Field Geology **Credits: (0-3) 3**
- GEOL 632 Rocky Mountain Stratigraphy **Credits: (3-0) 3**
- PALE 673/673L Comparative Osteology/Lab **Credits: (2-1) 3**
- PALE 676/676L Vertebrate Paleontology/Lab **Credits: (3-1) 4**
- PALE 678/678L Vertebrate Biostratigraphy/Lab **Credits: (3-1) 4**

**Additional Information**

All thesis samples, specimens, and their documentation collected while a registered student must be curated into the collections of the Museum of Geology.

## Physics, M.S.

### Contact Information

**Dr. Andre G. Petukhov**

Department of Physics

Electrical Engineering/Physics 223

(605) 394-2364

E-mail: Andre.Petukhov@sdsmt.edu

### Faculty

Professors Foygel, Petukhov, Sobolev; Associate Professor Corey; Assistant Professor Bai.

### Physics

The mission of physics graduate program is to provide students with quality graduate instruction and research experience suitable in many physics-related careers. Required coursework in physics along with elective courses selected from other disciplines such as mathematics, computer science, chemistry and engineering support a number of career options in industry, education and applied research. Graduates with this degree may also pursue a Ph.D. degree in physics. Areas of research concentration include astrophysics, condensed matter, materials science, nuclear and elementary particle physics, and theoretical physics.

### Available Options for Degrees

A (thesis) and B (non-thesis). Option A requires a thesis based on research, while Option B substitutes additional coursework and a research paper/project for the thesis requirement. The non-thesis options are deemed appropriate for students who do not require Ph.D. preparation in physics in order to be successful in their careers. Examples of career tracks not requiring study in physics beyond the master's level include medical physics, science education at the k-12 and "community college" level as well as various industrial applications. While deemed less appropriate for students advancing to doctoral study in physics, the non-thesis options are a viable and even preferred course of study for some students.

**Students should expect that completion of an M.S. degree take two academic years of full-time study.**

### Degree requirements

**M.S. Physics Option A** requires 19 credit hours of required core courses, 6 credit hours of electives, and 7 credit hours for thesis which leads to total of 32 credit hours.

**M.S. Physics Option B** requires 19 credit hours of required core courses, 11 credit hours of electives, and 2 credit hours for research/design paper which leads to total of 32 credit hours.

### Required Core Courses

- PHYS 721 Electrodynamics I **Credits: (3-0) 3**
- PHYS 723 Electrodynamics II **Credits: (3-0) 3**
- PHYS 743 Statistical Mechanics **Credits: (3-0) 3**
- PHYS 751 Theoretical Mechanics **Credits: (3-0) 3**
- PHYS 771 Quantum Mechanics I **Credits: (3-0) 3**
- PHYS 773 Quantum Mechanics II **Credits: (3-0) 3**

**Subtotals: 19**

### Electives

- PHYS 433/533 Nuclear and Elementary Particle Physics **Credits: (3-0) 3**
- PHYS 439/539 Solid State Physics **Credits: (3-0) 3**
- PHYS 481/581 Mathematical Physics **Credits: See Notes Below**
- MES 603 Condensed Matter Physics **Credits: (4-0) 4**
- PHYS 683 Mathematical Physics II **Credits: (3-0) 3**
- PHYS 691 Independent Study **Credits: 1 to 3**
- PHYS 692 Topics **Credits: 1 to 3**
- PHYS 739 Condensed Matter Physics I **Credits: (3-0) 3**
- PHYS 749 Condensed Matter Physics II **Credits: (3-0) 3**

- PHYS 775 General Relativity **Credits: (3-0) 3**
- PHYS 779 Group Theory **Credits: (3-0) 3**
- PHYS 781 Nuclear and Particle Physics **Credits: (3-0) 3**
- PHYS 783 Quantum Field Theory **Credits: (3-0) 3**
- PHYS 785 Astrophysics and Cosmology **Credits: (3-0) 3**
- PHYS 787 Research Credits: 1-9 \*
- PHYS 788 Master's Research Problems/Projects Credits: 1-5 \*\*
- PHYS 791 Independent Study **Credits: 1 to 3**
- PHYS 792 Topics **Credits: 1 to 3**
- PHYS 798 Thesis **Credits: 1 to 9**

**Subtotal: 29-58**

#### **Curriculum Notes**

\* Offered by SDSU

\*\* Offered by SDSU/USD

*Mines Matters: The National Science Foundation selected the former Homestake gold mine as the site for a multipurpose Deep Underground Science and Engineering Laboratory (DUSEL). To learn more about the history of Homestake and DUSEL visit <http://www.lbl.gov/nsd/homestake>.*

## Doctor of Philosophy

### Atmospheric and Environmental Sciences, Ph.D.

#### Contact Information

**Dr. William J. Capehart, Ph.D. Program Coordinator**

Department of Atmospheric Sciences

Mineral Industries 213

(605) 394-1994

E-mail: William.Capehart@sdsmt.edu

#### Faculty

Professors Davis, Detwiler, Duke, Fontaine, Fox, Kenner, Price and Stetler; Associate Professors Capehart, Kliche, Riley, Stone and Sundareshwar; Assistant Professors Benning and French; Instructor Farley; Adjunct Professors Stamm and Bothwell; Adjunct Research Scientist Bunkers; Emeritus Professors Helsdon, Hjelmfelt and Smith.

#### Program Description

The Atmospheric and Environmental Sciences program aims to unravel the complex interactions between all the earth's components, such as the biosphere, the atmosphere and oceans, as well as the influence of human activity on the global environment. These interactions occur across many spatio-temporal scales and can profoundly affect living organisms, the atmosphere around them and the ecosystem. The atmosphere and biosphere are fundamentally coupled on a variety of time-scales and support a complex set of bi-directional interactions. Managing wildfire potential, for example, includes understanding atmospheric dynamics, precipitation patterns, vegetation distribution and condition, topographic factors, and more. Similarly, in terrestrial ecosystems, rapid exchange of CO<sub>2</sub>, water and energy between the atmosphere and the land surface may dominate bi-directional interactions on short time-scales, whereas, on long time-scales, the interactions involve changes in ecosystem structure and composition in response to changes in climate. The key to success lies in training scientists to form interdisciplinary teams that can simultaneously tackle the broad range of processes needed to achieve understanding and prediction of such complex phenomena. Measuring, monitoring, and modeling earth and atmospheric systems increasingly demands an interdisciplinary approach, because problems in earth processes impacting society often cannot be solved by studying the atmosphere, hydrosphere, lithosphere, and/or biosphere in isolation.

The Atmospheric and Environmental Sciences Ph.D. program links expertise in atmospheric science, biogeochemistry, geology, hydrology, water quality and water resources to address regional and local issues that may also be nationally or globally significant. The fundamental objective lies in developing the ability to address linkages between earth system components and land management practices in a way that benefits decision-making at regional and national levels. We use the Black Hills of South Dakota and the surrounding Great Plains as a natural laboratory for the development of methodologies to link fundamental observations of the environment across a range of temporal and spatial scales, and integrate them with state-of-the-art modeling, visualization, and analysis.

Key interrelated research themes drive the research and teaching program, building on ongoing research and disciplinary strengths already present at the School of Mines, including meteorology, biogeochemistry, ecology, geology, climatology, hydrology, remote sensing, and geographic information systems.

#### Specific examples include:

- Physical meteorology and storm processes, including impacts on hydrology and wildfire issues.
- *In situ* atmospheric measurements of storms, aerosols, trace gas concentrations, and more using specially adapted storm-penetrating aircraft.
- Wildfire dynamics and associated issues related to fire prevention, suppression, and post-fire mitigation.
- Carbon cycling and the potential effects of local and regional climate change, including the frequency and severity of storms, drought cycles, and wildfire potential.
- Nutrient transformations in aquatic and terrestrial ecosystems, including Black Hills Forests and coastal salt marshes.
- Water quality and quantity as it impacts regional growth and environmental systems.
- A Geographic Information System (GIS) laboratory as well as state-of-the-art computers equipped with modeling and remote sensing analysis software.
- The Museum of Geology, located on campus and housing over 300,000 specimens, serves as a resource for paleontological instruction. Many School of Mines faculty members who are actively involved in the AES Ph.D. program have externally funded research projects. These projects provide research assistantship opportunities for AES students. In addition to graduate research assistantships, support is also possible through graduate teaching assistantships and various fellowships and scholarships. AES students are strongly encouraged to work with their advisors and faculty colleagues to apply for research funding or fellowships to support their studies.

## Program Requirements

Degree candidates in AES are expected to complete an approved multidisciplinary program of coursework and also perform original research in a focused area. A minimum total of 80 credit hours beyond the bachelor's degree is required. Students entering the AES program with a previous M.S. degree in a relevant discipline are allowed to apply a maximum of 24 course credit hours in an appropriate field toward the course credit requirement and 6 thesis research credits toward the research-credit requirement. There is no language requirement in the AES program. However, all AES students are expected to be proficient in speaking, understanding, and writing the English language. Graduate students who are enrolled full time in the AES program should be able to complete their degree requirements and graduate within three to four years starting with a master's degree, and four to five years starting from a bachelor's degree. The time required to complete the degree will vary depending on the transfer of previously earned credits, coursework recommendations specified by the student's committee, and individual research requirements.

### The following key learning outcomes will be developed in all students:

- A core of basic and specialized scientific and technical knowledge;
- An understanding of the basic scientific tools of measuring, monitoring, and modeling;
- The ability to apply these tools to understand atmospheric, hydrologic and land-surface interactions;
- The professional skills crucial to research, including obtaining and reviewing research literature, proposing research problems, critically evaluating their own work and the work of others, and communicating in writing and orally with their colleagues;
- The understanding and application of professional methods and ethics in their work; and
- The ability to form interdisciplinary teams to solve complex problems.

Students entering the program will normally already possess a foundational degree (typically the M.S. degree) in atmospheric sciences, meteorology, geology, hydrology, or environmental sciences/engineering. Students will build on this foundation by pursuing elective courses that prepare them for advanced work in their chosen specialty. The student and his/her committee are charged to prepare a course of study that will help the student become proficient in a specific research area. Great emphasis is placed on the independent origination of a research problem that will yield a new, original scientific insight.

## Ph.D. in Atmospheric and Environmental Studies

	<b>Credit Hours</b>
M.S. academic core (24 cr)	
and research (6 cr)	30
Required academic courses	10
Elective academic courses	13
Research credits	27
<b>Total required for the degree</b>	<b>80</b>

### The required academic courses include:

- AES 790 Seminar **Credits: (1-0) 1**
- AES 792 Topics **Credits: 1 to 3**
- AES 808 Fundamental Problems in Engineering and Science **Credits: (3-0) 3**

### Departmental Elective in Measuring/Modeling of Earth Systems

Students must complete at least one course in measuring and/or modeling techniques, to be selected by the student's committee. An array of courses are offered at the School of Mines to fulfill this 3 credit elective course requirement. These courses are offered by the Departments of Civil and Environmental Engineering, Geology and Geological Engineering, Atmospheric Sciences, Chemistry, Chemical and Biological Engineering, and Mathematics and Computer Sciences, and by other departments on campus as well. Listed below are examples of courses that might be included as electives in an AES program of study. These lists are intended as examples and are not intended to limit a student and committee as they construct an individual program.

### Potential elective courses for AES:

- ATM 401/501 Atmospheric Physics **Credits: (3-0) 3**
- ATM 406/506 Global Environmental Change **Credits: (3-0) 3**
- ATM 403/503 Biogeochemistry **Credits: (3-0) 3**
- ATM 405/505 Air Quality **Credits: (3-0) 3**
- ATM 515/515L Earth Systems Modeling/Lab **Credits: (2-1) 3**

- ATM 520/520L Remote Sensing for Research/Lab **Credits: (2-1) 3**
- ATM 430/530 Radar Meteorology **Credits: (3-0) 3**
- ATM 540 Atmospheric Electricity **Credits: (3-0) 3**
- ATM 455/455L/555/555L Synoptic Meteorology II/Lab **Credits: (2-1) 3**
- ATM 460/560 Atmospheric Dynamics **Credits: (3-0) 3**
- ATM 603 Biosphere-Atmosphere Interactions **Credits: (3-0) 3**
- ATM 612 Atmospheric Chemistry **Credits: (3-0) 3**
- ATM 625/625L Scaling in Geosciences/Lab **Credits: (2-1) 3**
- ATM 643 Precipitation Physics and Cloud Modification **Credits: (3-0) 3**
- ATM 644/644L Numerical Dynamics and Prediction/Lab **Credits: (2-1) 3**
- ATM 660 Atmospheric Dynamics II **Credits: (3-0) 3**
- ATM 670 Boundary Layer Processes **Credits: (3-0) 3**
- ATM 673 Mesometeorology **Credits: (3-0) 3**
- CEE 634 Surface Water Hydrology **Credits: (3-0) 3**
- CEE 421/521 Aqueous Geochemistry **Credits: (3-0) 3**
- CEE 426/526 Environmental Engineering Physical/Chemical Process Design **Credits: (3-0) 3**
- CEE 427/527 Environmental Engineering Biological Process Design **Credits: (3-0) 3**
- CEE 528L Advanced Treatment Plant Design
- CEE 433/533 Open Channel Flow **Credits: (3-0) 3**
- CEE 692 Topics **Credits: 1 to 3 OR**
- GEOE 692 Topics **Credits: 1 to 3**
- CEE 739/739L Techniques of Surface Water Resource and Water Quality Investigations I **Credits: (3-0) 3**
- GEOL 416/416L/516/516L Introduction to GIS/Lab **Credits: (2-1) 3**
- GEOL 417/517 Geospatial Databases **Credits: (3-0) 3**
- GEOL 419/519 Advanced Geospatial Analysis **Credits: (3-0) 3**
- GEOL 633/633L Sedimentation/Lab **Credits: (2-1) 3**
- GEOE 663/663L Ground-Water Geochemistry/Lab **Credits: (2-1) 3**
- GEOE 682 Fluvial Processes **Credits: (3-0) 3**

### **Additional Information**

Student progress and mastery will be measured using the usual instruments in a doctoral program. A written or oral qualifying exam is used to assess the student's mastery of the M.S. coursework. A comprehensive examination is given to evaluate the student's ability to formulate a research problem based on substantive literature review, and to test the student's knowledge in the area of specialty. It is given in two parts: 1) a written examination consisting of a review paper in the student's field of study and a research proposal, and 2) an oral examination to evaluate the research proposal and verify the student's understanding of the basic sciences and specialized field of study. The dissertation forms the final test of the student's ability to perform and communicate research. The student must prepare a doctoral dissertation and successfully complete a public defense covering the scientific validity of the work, as well as the student's basic and specialized knowledge in the field of study.

### **Management of the AES Program**

The AES program is managed by the Graduate Office. A program committee composed of 3-5 faculty representing different disciplines oversees the program, including setting policies and reviewing the curriculum. The program committee will also take measures to facilitate interaction by all faculty and students participating in the program. A program coordinator heads the program committee, and provides oversight of student affairs, including meeting with new and existing students, tracking student progress, and conducting orientations for new students.

The preceding committee is distinct from the graduate student advisory committees that provide guidance to individual AES students during the course of their academic studies. The graduate student's major professor serves as the head of this advisory committee.

## **Biomedical Engineering, Ph.D.**

### **Contact Information**

#### **Dr. Jon Kellar**

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Mineral Industries Building 112  
(605) 394-2343  
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### **Advisory Council**

Professors Bang, Buck, Kalanovic, Kerk, Kjerengtroen, Korde, Langerman and Weiss, Associate Professors Medlin and Muci; Assistant Professors Fong, Yoon and AML lab-Sears.

### **Biomedical Engineering**

Offered jointly with University of South Dakota (USD). Biomedical engineering (BME) is concerned with the application of engineering and science methodologies to the analysis of biological and physiological problems and to the delivery of health care. The biomedical engineer serves as an interface between traditional engineering disciplines and living systems and may work in either direction, applying the patterns of living organisms to engineering design or engineering new approaches to human health.

Both the master of science and doctor of philosophy degrees are cross-disciplinary degrees. The objective of the M.S. program is to prepare a student for research and development careers in biomedical industry and further research at the doctoral level. The Ph.D. program will prepare a student for a career as a researcher who advances the frontiers of biomedical science and engineering with attention to generating new ideas for commercialization.

Current focus areas of faculty activity within the program are (1) cardiovascular mechanics, pathology, and devices (heart valves, stents, etc.), (2) biomaterials (nanomaterials, bioadhesives, tissue engineering, etc.), (3) computational biomedical engineering (biomechanics, imaging, advanced modeling/simulations, etc.), and (4) assistive technology/rehabilitation engineering (advanced prosthetics, control, biomimetics, etc.). Students in the programs will be associated with one or more of several existing and newly formed research centers and laboratories, e.g., the Cardiovascular Research Institute, the Center for Accelerated Applications at the Nanoscale, the Center for Development of Light Activated Materials, the Computational Mechanics Laboratory, or the Direct Write Technology Laboratory.

Admission to either program will be based on the established graduate admission standards at the South Dakota School of Mines and Technology. The Graduate Record Examination (GRE), three letters of recommendation, and a GPA of 3.00 or better are expected of all applicants for the Ph.D. program. The TOEFL exam is required for students whose native language is not English. Students seeking exceptions warranted by special circumstances are requested to contact the biomedical engineering graduate program coordinator.

Students completing their M.S. degrees will graduate with a high level of competence in

- understanding of cardiovascular systems and devices;
- the application and characterization of various forms of biomaterials;
- the acquisition and processing of medical signals and images;
- the computation and simulation of phenomena in biomechanical systems; and
- transferring their understanding of biomaterials, biomechanics, and signal processing to the creation of new applications.

Students completing their Ph.D. degrees will graduate with a higher level of expertise in transferring their understanding of one of the program focus areas - cardiovascular mechanics/pathology/devices, biomaterials, computational biomedical engineering, or rehabilitation engineering/assistive technology to the creation of new knowledge and applications.

In addition, doctoral students will possess a high level of expertise in their specialized area of research. This competency will be developed through focused research objectives which culminate in the doctoral dissertation. Graduates of the programs will also demonstrate

- the ability to communicate effectively in written and oral presentations,
- intellectual honesty when working with data and ideas, and
- the ability to make an original contribution to their field.

Courses are offered at both SDSM&T and USD campuses, and students may elect either campus as their campus of residence. Courses offered at SDSM&T are relayed to students at USD by video, and vice versa.

Students who have already completed an M.S. in Biomedical Engineering or a related field are eligible for admission to the Ph.D. program. All other applicants will be admitted to the M.S. program and will be considered for the Ph.D. program upon successful completion of the master's degree.

## **Financial Support**

The Biomedical Engineering program has a limited number of Teaching Assistantships and Research Assistantships. All students admitted to the program are automatically considered for financial support.

## **Ph.D. Curriculum Requirements**

- BME 601 Biomaterials **Credits: (3-0) 3**
- BME 602 Anatomy and Physiology for Engineers **Credits: (3-0) 3**
- BME 603 Molecular Biology for Engineers **Credits: (3-0) 3**
- BME 608 Biomedical Engineering **Credits: (3-0) 3**
- BME 610 Experimental Design and Data Analysis in Biological Engineering **Credits: (3-0) 3**
- BME 790 Biomedical Engineering Seminar **Credits: 6**
- BME Dissertation **Credits: 30**
- \*BME Electives **Credits: 12**
- \*\*Addictional Electives **Credits: 21**

**Total: 84**

## **Note(s):**

Elective courses in the area of the student's intended research are to be selected in consultation with the student's advisory committee.

\*A list of possible BME electives can be found in the course description section of this catalog.

\*\*Each Ph.D. program of study is individually designed to meet the goals fo the student. Courses from a variety of areas, including materials and metallurgical engineering, mechanical engineering, chemistry, electrical and computer engineering, and mathematics and computer science, may be used to fulfill the elective requirements in a manner intended to complement the student's research.

Each student is also required to pass a comprehensive examination and defend the dissertation. There is no language requirement for the BME Ph.D. program. Detailed information on examination policies, admission to candidace, and defense of dissertation may be found in the Graduate Education section of this catalog.

## Chemical and Biological Engineering, Ph.D.

### Contact Information

#### Dr. Jan Puszynski

Department of Chemical and Biological Engineering  
Chemistry/Chemical Engineering Bldg C224  
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<http://cbe.sdsmt.edu>

### Faculty

Professors Bang, Dixon, Puszynski, Salem and Winter; Associate Professors Gilcrease, Menkhous and Sani; Assistant Professors Benjamin, Hadley and Shende.

### Program Advisory Council

Professors Bang, Dixon, Puszynski (Program Coordinator) and Winter; Associate Professor Gilcrease; Assistant Professor Benjamin.

### Chemical and Biological Engineering

The Department of Chemical and Biological Engineering (CBE) offers, in addition to B.S. and M.S. degrees in chemical engineering, a Ph.D. degree in chemical and biological engineering. The Ph.D. program provides the chemical and biological engineering Ph.D. graduate a core educational experience in transport phenomena, chemical kinetics, biochemical engineering, chemical thermodynamics, and biotechnology. This knowledge base, along with key electives, provides graduate students the training to participate in biochemical and petrochemical processing, bio-based energy technologies, including biomass and biofuels; catalysis; bio-based and bio-compatible materials; bioremediation; emerging energy technologies; synthesis and functionalization of nanomaterials, and processing of polymers and composite materials. These areas are aligned with the expertise of our faculty members. The current research interest of the faculty can be found on the departmental website <http://cbe.sdsmt.edu>.

The State of South Dakota is recognized as a leader and major producer of ethanol from starch in the United States. Hence the State of South Dakota is well positioned to play an important role in development of new bio-based technologies and value-added agricultural products. This Ph.D. program directly supports the **National Science Foundation Industry/University Cooperative Research Center (NSF I/UCRC) for BioEnergy Research and Development (CBeRD)**. This unique national center focused on bio-based energy and chemical feedstocks, is comprised of four universities, including the SDSM&T, North Carolina State University, State University of New York - Stony Brook, University of Hawaii, and more than 30 industries and state and federal laboratories. Students participating in CBeRD I/UCRC Center research are working on projects of current and immediate interest to the industrial sponsors. Students also have the opportunity to participate in more fundamental research being pursued through the **2010 Center for Bioprocessing Research and Development (CBRD)** at the South Dakota School of Mines and Technology and the South Dakota State University. The CBRD center focus is to develop the fundamental understanding and technologies to convert lignocellulose to fuels and key building block chemicals. The research foci of the of these two research centers — pretreatment, conversion, extremophiles, separations, and process simulation and economic analysis — relies on the fundamental underpinnings taught in the Chemical and Biological Engineering Ph.D. program.

The Ph.D. program is also a strong supporter of State-focused areas in advanced materials, polymers, composites, and nanotechnology. The **Composites and Polymer Engineering Laboratory (CAPE)** is a key resource utilized by our students <http://cape.sdsmt.edu/>. Opportunities exist for CBE Ph.D. students to participate in cutting-edge research funded by the National Science Foundation, the Department of Energy, the Department of Defense, and industrial collaborators.

The Ph.D. Program in chemical and biological engineering is administered by a graduate Program Coordinator and Program Advisory Council consisting of appointed faculty members actively involved in the program. The Program Advisory Council is responsible for the curriculum and program policies.

### Curriculum

The current curriculum is designed to provide the CBE Ph.D. graduate with the depth and breadth of engineering knowledge to become a leader in their chosen focus area. To facilitate this, each student is asked to complete a program of study plan that will provide the framework for the student's coursework and research. This should be filed with the Program Coordinator before the midterm of the second semester in residence. The CBE Ph.D. Advisory Council must approve all programs of study. Detailed information on examination policy, admission to candidacy, and defense of dissertation are included in the Chemical and Biological Engineering Ph.D. Program Handbook.

Students entering the program with B.S. or M.S. degrees from disciplines other than Chemical or Biochemical Engineering will be required to take several selected courses in Chemical Engineering at the undergraduate level, to provide a firm understanding of engineering principles.

The Graduate Record Examination (GRE), three letters of recommendation, and a GPA of 3.00 or better are required of all applicants for the Ph.D. program. The TOEFL exam is required for students whose native language is not English.

All CBE Ph.D. candidates are required to successfully complete the required minimum credits and earn a grade of "C" or better, except for a final grade of "S" in CBE 898. However a 3.00 GPA must be maintained to receive graduate research assistantships (GRA).

**Below is the summary of the basic required courses:**

<b>Category</b>	<b>Credits</b>
Required courses <sup>1</sup> (minimum 6 credits from Chemical Engineering and 6 credits from Biological Engineering focus areas) selected from the two focus area lists	24
Required seminar	2
Minimum required research credits	30
Minimum electives <sup>1,2</sup>	12
<b>TOTAL</b>	<b>80</b>

**Curriculum Notes**

<sup>1</sup> Students entering with a M.S. degree in Chemical Engineering or a closely related discipline may apply a maximum of twenty-four (24) course credit hours toward the required and elective course requirements subject to approval of the Chemical and Biological Engineering Ph.D. Program Advisory Council.

<sup>2</sup> Elective courses may be selected from the two focus area lists, from the example elective list, or from other SDSM&T courses as a part of a student's program of study, subject to approval of his/her major professor and graduate committee.

**Focus Area — Chemical Engineering**

Students pursuing a Ph.D. in Chemical and Biological Engineering must take the 500 and above level courses, not the 400 level courses.

- CBE 444/544 Reactor Design **Credits: (3-0) 3**  
**OR**
- CBE 728 Heterogeneous Kinetics **Credits: (3-0) 3**
- CBE 450/550 Systems Analysis Applied to Chemical Engineering **Credits: 2 to 3**
- CBE 612 Transport Phenomena: Momentum **Credits: (3-0) 3**
- CBE 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- CBE 621 Advanced Chemical Engineering Thermodynamics I **Credits: (3-0) 3**
- CBE 616 Computations in Transport Phenomena **Credits: (3-0) 3**
- CBE 714 Transport Phenomena: Mass **Credits: (3-0) 3**

**Focus area — Biological Engineering**

Students pursuing a Ph.D. in Chemical and Biological Engineering must take the 500 and above level courses, not the 400 level courses.

- CBE 484/584 Fundamentals of Biochemical Engineering **Credits: (3-0) 3**
- CBE 484L/584L Biochemical Engineering Laboratory **Credits: (0-1) 1**
- CBE 603 Molecular Biology for Engineers **Credits: (3-0) 3**
- CBE 735 Bioseparations **Credits: (3-0) 3**
- CBE 741 Microbial and Enzymatic Processing **Credits: (3-0) 3**
- CBE 792 Topics **Credits: 1 to 4**

**Required courses (Seminar and Research)**

Two (2) credits of CBE 890 Seminar and a minimum of thirty (30) credits of CBE 898D Dissertation are required.

- CBE 890 Seminar **Credits: (0.5-0) 0.5**
- CBE 898D Dissertation **Credits: 1 to 12**

**Example elective courses**

Students pursuing a Ph.D. in Chemical and Biological Engineering must take the 500 and above level courses, not the 400 level courses.

- CBE 424/524 Molecular Modeling and Simulation **Credits: (3-0) 3**
- CBE 455/555 Pollution Phenomena and Process Design **Credits: (3-0) 3**
- CBE 474/574 Polymer Technology **Credits: 2 to 3**
- CBE 474L/574L Experimental Polymer Technology **Credits: (0-1) 1**
- CBE 475/575 Advances in Processing and Nanoengineering of Polymers **Credits: (2-0) 2**

- CBE 476/576 Organosilicon Polymer Chemistry and Technology **Credits: (1-0) 1**
- CBE 791 Independent Study **Credits: 1 to 4**
- CBE 792 Topics **Credits: 1 to 4**
- CBE 890 Seminar **Credits: (0.5-0) 0.5**
- CBE 894 Internship **Credits: 1 to 6**
- CHEM 460/560 Biochemistry **Credits: (3-0) 3**
- CHEM 482/582 Environmental Chemistry **Credits: (3-0) 3**
- MES 712 Interfacial Phenomena **Credits: (3-0) 3**
- NANO 701 Nano Materials **Credits: (3-0) 3**
- ENGM 631 Optimization Techniques **Credits: (3-0) 3**
- ENGM 720 Statistical Process Control **Credits: (3-0) 3**

## **Geology and Geological Engineering, Ph.D.**

### **Contact Information**

#### **Dr. Laurie Anderson**

Department of Geology and Geological Engineering  
Mineral Industries 303  
(605) 394-2461  
E-mail: Laurie.Anderson@sdsmt.edu

### **Geology Faculty**

Professors L. Anderson, Duke, Paterson, Price and Uzunlar; Associate Professor Masterlark; Assistant Professors Belanger, Pagnac and Terry; Professors Emeritus Fox, Lisenbee, Martin and Redden; Adjunct Professors Benton and McCormick; and Haslem Post-doctoral Fellow Boyd.

### **Geological Engineering Faculty**

Professors Davis and Stetler; Assistant Professors Katzenstein and Sawyer; Professor Emeritus Rahn; Adjunct Faculty M. Anderson, Iles, Long and Roggenthen.

### **Geology and Geological Engineering**

The Department of Geology and Geological Engineering offers advanced study leading to an M.S. degree in geology and geological engineering or a Ph.D. degree in geology and geological engineering. Students must elect to pursue either a Geology Specialization or a Geological Engineering Specialization, each of which has different background requirements and program requirements. The available coursework and current faculty expertise support the following areas of concentration. Students complete courses determined by the student's committee based on the intended field of study in:

1. Energy and Mineral Resources
2. Environmental/Exploration Geophysics
3. Ground Water / Environmental Studies
4. Mineral Deposits/Mineralogy/Petrology
5. Sedimentation/Stratigraphy
6. Paleontology\*
7. Structural Geology/Tectonics
8. Geomechanics/Engineering Geology

\* **Ph.D. only. Students concentrating in Paleontology at the Master's level should apply for the separate M.S. in Paleontology.**

### **Background Requirements for M.S. and Ph.D.**

The Graduate Record Examination (GRE) is required of all applicants. The TOEFL exam is required for students whose native language is not English.

### **Geology Specialization**

1. All incoming students are expected to present a full year each of college-level calculus, physics, and chemistry as part of their undergraduate record.
2. All incoming students are expected to have completed courses in the following areas.
  - Physical Geology
  - Mineralogy
  - Stratigraphy and Sedimentation
  - Petrology
  - Structural Geology
  - Field Geology

Deficiencies in these areas must be remedied by taking the necessary coursework prior to or in the first year of enrollment in the graduate program. Students with more than three (3) course deficiencies should complete them prior to applying for admission.

### **Geological Engineering Specialization**

1. All incoming students are expected to present three semesters of calculus and one semester of differential equations, as well as two semesters each of physics and chemistry, as part of their undergraduate record.
2. All incoming students are expected to have completed courses in the following areas:

- Physical Geology or Geology for Engineers
- Mineralogy
- Stratigraphy and Sedimentation
- Structural Geology
- Statics
- Mechanics of Materials
- Fluid Mechanics

Deficiencies in these areas must be remedied by taking the necessary coursework prior to or in the first year of enrollment in the graduate program.

Students with more than three (3) course deficiencies should complete them prior to applying for admission.

### **Doctor of Philosophy Program**

Admission to the Ph.D. program in Geology and Geological Engineering is normally limited to qualified students who have already earned an M.S. degree in geology, geological engineering, paleontology, or a related field. Students holding an M.S. but with extensive undergraduate deficiencies may be placed into the M.S. program in Geology and Geological Engineering until these deficiencies are remedied. Students with a B.S. degree who apply to the Ph.D. program will be admitted to the M.S. program in Geology and Geological Engineering until they have accumulated sufficient course credits for an M.S. degree. Students placed into the M.S. under one of these two circumstances will be admitted to the Ph.D. program after passing the qualifying exam.

### **Qualifying Exam**

All Ph.D. students are expected to take a qualifying exam to demonstrate their potential for independent research. Students entering with a B.S. degree will take the examination in the semester immediately following the completion of 24 credits of graduate coursework. Students placed in the M.S. due to undergraduate deficiencies must take the qualifying exam in the semester immediately following completion of all deficiencies. Students entering with a completed M.S. degree will take the qualifying exam before the end of their second semester in residence.

To pass the qualifying exam, the student must 1) complete all undergraduate deficiency requirements, 2) submit a valid Ph.D. Program of Study to the department head; 3) complete a literature search and paper on a topic related to the student's area of concentration; and 4) present and defend the paper in an oral examination by the department faculty. The paper should reflect a sustained effort and culminate in an analysis of potentially significant research problems. The identified problems need not match the eventual dissertation topic.

### **Curriculum**

A minimum of eighty (80) credit hours are required beyond the B.S. degree. At least fifty (50) of these credits must be for coursework. Up to twenty-four (24) course credits and six (6) research credits from the M.S. degree can be applied toward the total required credits if the student's committee agrees.

The candidate's committee is responsible for assisting the student in developing a program of study that prepares the student for his/her intended field as well as provides general knowledge for the discipline. It is recommended that six (6) to twelve (12) hours of coursework be taken outside the department. Students must choose between the Geology Specialization and the Geological Engineering Specialization.

### **Geology Specialization**

GEOL 700 Research Methods is required the first fall semester of enrollment. GEOL 808 Fundamental Problems in Engineering and Science also is required. In addition, the program of study must include at least one GEOL/GEOE/PALE course emphasizing field methods, one GEOL/GEOE/PALE course emphasizing analytical methods, and one GEOL/GEOE/PALE course emphasizing computational methods. The student's advising committee determines the courses that meet these criteria.

### **Geological Engineering Specialization**

All Ph.D. students in the Geological Engineering specialization are expected to focus in one of the three areas of groundwater/environmental, geomechanics, or energy/mineral resources.

### **Required of all GEOE students:**

The candidate's committee is responsible for assisting the student in developing a program of study that prepares the student for his/her intended focus.

GEOL 700 Research Methods is required the first fall of enrollment. GEOL 808 Fundamental Problems in Engineering and Science also is required. In addition, the program of study must include at least one GEOL/GEOE course emphasizing field methods, one GEOL/GEOE course emphasizing

analytical methods and one GEOL/GEOE course emphasizing computational methods. The student's advising committee determines the courses that meet these criteria.

### **Dissertation Proposal Defense**

The dissertation proposal is part of the comprehensive examination. All Ph.D. students are required to prepare a research proposal for the work to be accomplished for the dissertation. The proposal is due one month prior to the comprehensive examination, so that the candidate's committee may review the proposal to assure that it is defensible. If not, then the student will have an opportunity to resubmit, although this may alter the final date of the comprehensive examination.

### **Comprehensive Examination: Summary of Rules and Organization**

When the student's program of coursework has been substantially completed and dissertation proposal prepared, he/she will undertake the comprehensive examination for admission to candidacy. This examination should normally occur after the student has spent four semesters in the Ph.D. program, but must take place at least four months prior to the final defense. The comprehensive examination will consist of written and oral examinations covering the student's field of study and related subjects. It will be prepared by the student's advisory committee, with potential suggestions from any faculty member from whom the student has taken a graduate course. The oral examination is open to any faculty member, but must include the candidate's full committee.

If the student has not completed all requirements for the Ph.D. degree by the fifth year following the comprehensive examination, his/her active status will be automatically terminated and the comprehensive examination must be repeated.

- . No later than two (2) months prior to the examination date the student must make a request to the student's committee to take the Comprehensive Examination. The dissertation research proposal must be submitted at least one month prior to the examination date.
- . The examinations will consist of four parts, all of which must be completed within one working week. The examination may be scheduled for spring and fall semesters only, but not during the week of final examinations or the last week of classes.
- . The written examinations will be graded prior to the oral examination.
- . The oral examination will last approximately three hours. It will begin with an oral presentation of the dissertation proposal by the student, who will then undergo an oral examination by the committee that may include questions concerning the proposal, the written exam topics, and any relevant subject area related to the student's research.
- . The written examination will consist of three parts: one general, and two specific topics. Each part of the written examination will be three (3) hours in length.

General (written)	25%
Specific Topic (written)	25%
Specific Topic (written)	25%
Oral Examination	25%

### **Geology Ph.D. Specialization**

The General part will include General Geology. Specific topics will be chosen from the following list:

- Structural Geology
- Sedimentation/Stratigraphy
- Paleontology
- Igneous/Metamorphic Petrology
- Economic Geology/Mineral Exploration
- Crystal Chemistry/Mineralogy
- Geomorphology
- Geophysics

### **Geological Engineering Ph.D. Specialization**

**The General part will include:**

- Geological Engineering
- Geology
- Fundamentals of Engineering

**Specific topics will be chosen from the following list:**

- Ground Water
- Engineering Geology

- Petroleum Engineering
- Mineral Exploration/Production
- Hydrology and Hydraulic Engineering
- Geophysical Exploration
- Geochemistry
- Geomorphology
- Rock Mechanics
- Geotechnical Engineering

A student may substitute successful completion of the Fundamentals of Engineering (F.E.) examination for one of these three (3) parts. A student also may propose hybrid fields with other disciplines if approved by his or her graduate committee.

## **Materials Engineering and Science, Ph.D.**

### **Contact Information**

#### **Dr. Jon J. Kellar**

Department of Materials and Metallurgical Engineering

Mineral Industries 112

(605) 394-2343

E-mail: Jon.Kellar@sdsmt.edu

### **Advisory Council**

Advisory Council members are from the Departments of Civil and Environmental Engineering, Mechanical Engineering, Materials and Metallurgical Engineering, Physics, and Chemistry.

### **Materials Engineering and Science**

The doctor of philosophy program in materials engineering and science (MES) offers a student the opportunity to expand his/her knowledge and understanding of the science and technology of materials production, behavior, and applications. The student will undertake multidisciplinary approaches, combining the basic elements of both engineering and science, to the solution of materials-related problems. Because such problems are found in every science and engineering discipline, the degree applicant has considerable flexibility in the selection of the department in which to pursue dissertation research, within the confines of the applicant's academic preparation and interests. Candidates will study either a science or engineering emphasis within the MES Ph.D. program. For example, research emphasis may be placed on improving processes for the production of metallic, polymeric, ceramic, or other structural or electronic materials. Alternatively, the degree candidate may investigate mechanisms for improving material properties, which in turn, could lead to new or better applications. Classroom and individualized instruction will provide the necessary theory to complement such creative activities.

### **Example areas of specialization include but are not limited to**

- Activities of Multicomponent Systems
- Computational Modeling
- Polymer Synthesis
- Concrete Technology
- Corrosion Inhibition
- Development of Multiphase Materials
- Fiber Reinforced Composites
- Geotechnology
- Magnetic Nanocomposites
- Nanoscale Electronic Materials
- Polymer Matrix Composites
- Reaction Kinetics
- Semiconductor Materials and Devices
- Strengthening Mechanisms
- Surface Chemistry of Flotation
- Thermophysical Properties
- Thin Films

The program is administered directly by the Dean of Graduate Education and sponsored programs, with the head of the MES Ph.D. advisory council serving as program coordinator. The advisory council currently comprises faculty members from the Departments of Civil and Environmental, Mechanical, Materials and Metallurgical Engineering, and the Departments of Physics, and Chemistry.

The Graduate Record Examination (GRE), three letters of recommendation, and a GPA of 3.00 or better are required of all applicants for the MES Ph.D. program. The TOEFL exam is required for students whose native language is not English.

All candidates for the MES Ph.D. program are required to successfully complete the following minimum credits and earn a grade of "C" or better, except for a final grade of "S" in MES 800:

Category	Credits
Analytical Mathematics	3
Numerical Mathematics	3
Program Major Emphasis (Engineering or Science)	44-54
Dissertation Research	20-30
Total beyond the B.S. degree	80

### General Program Requirements

(Minimum program requirements: 80 credits)

#### M.S. Degree (24 credits)

Programs-major courses may be used to satisfy coursework hour requirements for analytical mathematics, numeral mathematics, or fundamental science courses taken in the M.S. program of study (subject to approval).

##### Analytical Mathematics (3 credits)

- ME 673 Applied Engineering Analysis I **Credits: (3-0) 3**
- PHYS 481/581 Mathematical Physics **Credits: See Notes Below**

##### Numerical Mathematics (3 credits)

- MATH 447/547 Design of Experiments **Credits: (3-0) 3**
- ME 773 Applied Engineering Analysis II **Credits: (3-0) 3**
- MET 614 Advanced Metallurgical Simulation Techniques **Credits: (3-0) 3**
- MEM 433/433L/533/533L Computer Applications in Geoscience Modeling/Lab **Credits: (3-1) 4**

#### Program Emphasis (30 credits)

Two program emphasis areas are available: materials science and materials engineering. See sections below.

##### Research (20 credits)

- MES 898 Dissertation **Credits: Credit to be arranged.**
- MES 790/890 Seminar **Credits: (1-0) 1**

##### Additional research credits

A maximum of 10 additional research credits may be included within the hours specified for the program major, subject to approval by the student's advisory committee. The courses listed in Sections II and III below are suggested courses for the science of engineering emphasis, but students are not limited to this selection. Students may take courses out of each emphasis when developing their programs of study.

#### Science Emphasis Requirements

(Minimum program requirements: 30 credits)

##### Thermodynamics of Solids (3 credits)

- MES 712 Interfacial Phenomena **Credits: (3-0) 3**
- PHYS 743 Statistical Mechanics **Credits: (3-0) 3**
- CBE 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- CBE 714 Transport Phenomena: Mass **Credits: (3-0) 3**
- MES 728 Heterogeneous Kinetics **Credits: (3-0) 3**

##### Crystal Structure/Chemistry of Solids (3 credits)

- MES 603 Condensed Matter Physics **Credits: (4-0) 4**

- MES 604 Chemistry of Materials **Credits: (4-0) 4**
- PHYS 771 Quantum Mechanics I **Credits: (3-0) 3**

#### **Bulk or Surface Analysis (3 credits)**

- NANO 703/703L Instrumentation and Characterization of Nano-Materials/Lab **Credits: (3-1) 4**

#### **Fundamental Engineering Mechanics (6 credits)**

Courses from the engineering emphasis section can also be used to fulfill this requirement.

- ME 425 Probabilistic Mechanical Design **Credits: (3-0) 3**
- MET 450/550 Forensic Engineering **Credits: (3-0) 3**
- MET 440/540 Mechanical Metallurgy **Credits: (3-0) 3**
- ME 443 Composite Materials **Credits: (3-0) 3 OR**
- MET 443 Composite Materials **Credits: (3-0) 3**
- MET 625 Strengthening Mechanisms in Metals **Credits: (3-0) 3**

#### **Dissertation Related Topics (12 credits)**

#### **Engineering Emphasis Requirements**

(minimum program requirements: 30 credits)

##### **Analytical Mechanics**

- ME 623 Advanced Mechanical Vibrations **Credits: (3-0) 3**
- ME 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- MES 713 Advanced Solid Mechanics I **Credits: (3-0) 3**
- MES 770 Continuum Mechanics **Credits: (3-0) 3**

##### **Elasticity/Plasticity**

- CEE 743 Advanced Soil Mechanics **Credits: (3-0) 3**
- MES 713 Advanced Solid Mechanics I **Credits: (3-0) 3**
- MEM 450/550 Rock Slope Engineering **Credits: (3-0) 3**

##### **Failure Analysis Fracture Mechanics**

- ME 715 Advanced Composite Materials **Credits: (3-0) 3**

#### **Fundamental Materials Science (6 credits)**

Courses from the science emphasis section can also be used to fulfill this requirement.

- CHEM 420/520 Organic Chemistry III **Credits: (3-0) 3**
- CHEM 452/552 Inorganic Chemistry **Credits: (3-0) 3**
- CHEM 426/526 Polymer Chemistry **Credits: (3-0) 3**
- MES 603 Condensed Matter Physics **Credits: (4-0) 4**
- MES 601 Fundamentals of Materials Engineering **Credits: (4-0) 4**
- MES 604 Chemistry of Materials **Credits: (4-0) 4**
- CBE 474/574 Polymer Technology **Credits: 2 to 3**
- PHYS 439/539 Solid State Physics **Credits: (3-0) 3**
- MET 445/545 Oxidation and Corrosion of Metals **Credits: (3-0) 3**

#### **Additional Information**

An assessment of the student's qualifications will be undertaken early in their program. The assessment is comprised of performance in pre-determined courses and a dissertation proposal. Further information is available in the School of Mines materials engineering and science Ph.D. Handbook.

Each student is also required to pass a comprehensive examination. There is no language requirement for the MES doctoral program.

For program supervision purposes, the MES Ph.D. program coordinator is the graduate advisor until the major professor is appointed. The major professor is the person responsible for the student's dissertation research. The graduate office representative on the student's dissertation committee must be selected from outside of the department with which the major professor is affiliated, and should also be a member of the MES Ph.D. Advisory Council. The MES Ph.D. Advisory Council must approve all programs of study. It is not necessary that the student be associated with the department of affiliation of his or her major professor. The detailed information on examination policy, admission to candidacy, and defense of dissertation are included in the School of Mines Materials Engineering and Science Ph.D. Handbook.

## **Mechanical Engineering, Ph.D.**

### **Contact Information**

#### **Dr. Michael Langerman**

Department of Mechanical Engineering  
Civil Mechanical 172  
(605) 394-2408  
E-mail: Michael.Langerman@sdsmt.edu

#### **Lisa Carlson, MBA**

Associate Director  
Recruitment and Graduate Programs  
Civil Mechanical 131  
(605) 394-5261  
E-mail: Lisa.Carlson@sdsmt.edu

### **Faculty**

Professors Abata, Dolan, Kalanovic, Kjerengtroen, Korde, Muci-Kuchler and Langerman; Associate Professor Bedillion; Assistant Professors Ellingsen, Kingsbury, Shahbazi, Simmons and Widener; Professors Emeritus Buck, Chiang, Gnirk, Krause, Pendleton, and Snyder.

### **Mechanical Engineering**

The Department of Mechanical Engineering offers two graduate degrees the master of science and the doctor of philosophy degree. The primary goals of the graduate program are to develop the scholastic ability, independent creativity, and professional competence of an individual to a higher level than is possible in an undergraduate program.

The graduate program offers opportunities for higher education and research in manufacturing, solid mechanics, transport phenomena, computational mechanics, vibrations, controls and robotics, experimental mechanics, fracture mechanics, composite materials, and advanced materials processing. The graduate program features courses in continuum mechanics, computational methods in transport phenomena, advanced heat transfer, advanced fluid mechanics, engineering analysis, advanced solid mechanics, integrated manufacturing systems, applied intelligent control, theory of materials behavior, and advanced mechanical system control.

The mechanical engineering department is one of the largest programs on campus and has well-equipped laboratories. Several faculty members within the department are associated with the Computational Mechanics Laboratory (CML), where high-end workstations are available for pursuing research and design in modeling. Several faculty members are associated with the Center for Advanced Manufacturing and Production (CAMP), where research in advanced manufacturing, advanced composites, and advanced design methodologies is conducted. The department has a strong collaborative relationship with the Arbogast Advanced Materials Processing (AAMP) center and the Additive Manufacturing Laboratory (AML).

Other labs include the Fluid Mechanics and Heat Transfer Lab, which houses a Mach 3 supersonic wind tunnel, Vibrations Lab, Neural Networks and Controls Lab, Micromechanics Lab, Advanced Dynamics Lab, and a small Ballistics Lab. The campus fosters interdisciplinary research, and state-of-the-art equipment such as an electron microscope, atomic force microscope, x-ray diffractometer, Raman spectrometer, laser Vibration Pattern Imager, FADAL VMC40 Vertical Machining Center, Bridgeport Romi CNC lathe, Coordinate Measuring Machine, Injection Molding Machine, IBM 7540 Industrial Robot, and Universal Testing Machines are available in the department or on campus. Graduate research laboratories also include equipment for modern digital controls and machine vision, thermal image analysis, high-speed imaging and experimental mechanics.

**The following discussion assumes** students are entering the program with a Bachelor's of Science degree. Students entering with a Master of Science degree will design their program of study in accordance with their graduate committee input.

Students entering the PhD program will be required to submit a plan of study and choose an advisor by the mid-term of the second semester of coursework. The degree requirements include a minimum of 80 credit hours beyond the Bachelor of Science degree. The 80 credit hours include 50 credit hours of coursework (see below) and 30 credit hours of research (ME 898). The program of study allows the student to take 12 credit hours in a program outside the mechanical engineering department (see below).

In addition to the successful completion of the curriculum, the program of study requires passing a qualifying exam, submitting a research topic proposal, passing a comprehensive exam, and successfully defending the dissertation.

## Curriculum

### Required Courses

- ME 673 Applied Engineering Analysis I **Credits: (3-0) 3**
- ME 773 Applied Engineering Analysis II **Credits: (3-0) 3**

**Total: 6**

### Coursework: Choose 32 credits from below (or equivalent courses):

- ME 612 Transport Phenomena: Momentum **Credits: (3-0) 3**
- ME 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- ME 616 Computations in Transport Phenomena **Credits: (3-0) 3**
- ME 618 Conduction Heat Transfer **Credits: (3-0) 3**
- ME 619 Convection Heat Transfer **Credits: (3-0) 3**
- ME 620 Radiation Heat Transfer **Credits: (3-0) 3**
- ME 623 Advanced Mechanical Vibrations **Credits: (3-0) 3**
- ME 625 Smart Structures **Credits: (3-0) 3**
- ME 680 Advanced Strength of Materials **Credits: (3-0) 3**
- ME 683 Advanced Mechanical System Control **Credits: (3-0) 3**
- ME 691 Independent Study **Credits: 1 to 3**
- ME 692 Topics **Credits: 1 to 3**
- ME 713 Advanced Solid Mechanics I **Credits: (3-0) 3**
- ME 715 Advanced Composite Materials **Credits: (3-0) 3**
- ME 770 Continuum Mechanics **Credits: (3-0) 3 OR**
- MES 770 Continuum Mechanics **Credits: (3-0) 3**
- ME 781 Robotics **Credits: (3-0) 3**
- ME 896 Field Experience **Credits: (0-3) 3 (TBD)**
- EE 651 Digital Control Systems **Credits: (3-0) 3**
- EE 652 Nonlinear and Optimal Control Systems **Credits: (3-0) 3**
- ME 736 Advanced Finite Element Methods **Credits: (3-0) 3**

**Total: 32**

### Credits Outside Department (if applicable)

- MATH/PHYS/EE/CEE/ChE/MES/BME/NANO Credits: 12

**Total: 12**

### Dissertation

- ME 898D Dissertation **Credits: Credit to be arranged.**

**Total: 30**

## Nanoscience and Nanoengineering, Ph.D.

### Contact Information

**Dr. Steve Smith**

Nanoscience and Engineering

(605) 394-5268

E-mail: Steve.Smith@sdsmt.edu

<http://nano.sdsmt.edu>

### Advisory Council

Professors Boyles, Kjerengtroen, Petukhov and Smith; Miller Professor Whites; Associate Professors Ahrenkiel, Fong, Yang, and Zhu; Assistant Professors Anagnostou and West; Research Faculty Hong and Sears.

### Nanoscience and Nanoengineering

The Nano Science and Engineering Ph.D. (Nano SE Ph.D.) Program at the South Dakota School of Mines and Technology is an interdisciplinary Ph.D. program focusing on the science and engineering of nanomaterials. The goal of nanoscience and nanotechnology is to manipulate matter at the atomic and "nano" length scales (dimensions from a few to 100's of atomic radii), e.g. the molecular to mesoscopic levels, where new materials and phenomena have been discovered. The ability to engineer systems at these length scales will require professionals with a broad understanding of fundamental principles and the ability to cross-over into other fields. The nano program provides the training to allow scientists and engineers to address these challenges, and the opportunity for students to engage in such research at the School of Mines while pursuing the Ph.D.

The Nano SE Ph.D. program offers a research-intensive degree focused on nanoscience and nanotechnology, with an emphasis on nano-scale materials. A multi-disciplinary core curriculum is taken by students from diverse science and engineering backgrounds. These "core" courses are intended to introduce students to contemporary topics in nanoscience and nanotechnology, and to initiate a cross-disciplinary approach to research and learning.

These courses can usually be completed in one, or at most two years. In addition to this core, students entering with an M.S. degree are required to take at least two electives outside the student's traditional area of training. Students entering at the B.S. level will be expected to pursue, or take coursework equivalent to, an M.S. degree, in addition to the nano core curriculum.

Students from traditional science and engineering backgrounds enter the program with well-defined research interests and affiliate themselves with a research group and a faculty mentor. Current nano program participants draw from the Departments of Chemistry and Physics, and Chemical, Electrical, Materials and Metallurgical, and Mechanical Engineering. Students with traditional training in these areas participate in cross-disciplinary research with a nano focus. Examples of active research areas are: synthesis and characterization of nanocomposite materials, photo-activated nano-inks for direct write applications, nano-energetic materials, polymer chemistry, theory of spintronic devices, and structural and optical characterization of nano-materials for solar energy, bio-fuels and other forms of renewable energy.

The Nano SE Ph.D. program builds on traditional science and engineering disciplines, and offers a "core" curriculum which introduces students from varying science and engineering backgrounds to contemporary topics in nanoscience and nanotechnology. Students are expected to obtain graduate level training in a traditional discipline, designated as the "program major emphasis", and take a minimum of 6 elective credits outside their own area.

Students entering the program with an M.S. may apply up to 24 transfer credits toward fulfilling the program major emphasis requirements. More information is available in the Nano SE Ph.D. Program Handbook.

Students with an M.S. degree in science or engineering are eligible for admission. However, students with a B.S. degree only will also be considered for admission when the student has proven to possess exceptional qualifications. The Graduate Record Examination (GRE), three letters of recommendation, and a GPA of 3.00 or better are required of all applicants for the Ph.D. program. The TOEFL exam is required for students whose native language is not English.

All candidates for the Ph.D. program are required to successfully complete the following minimum credits and earn a grade of "C" or better, except for a final grade of "S" in NANO 898:

The program of study must be filed with the graduate office, and approved by the Nano SE Ph.D. program director before midterm of the second semester of residence, and again before the qualifying exam.

### Below is the summary of the required course of study.

#### Requirements

- NANO 701 Nano Materials **Credits: (3-0) 3**
- NANO 702 Theory and Application of Nanoscale Materials **Credits: (3-0) 3**
- NANO 703/703L Instrumentation and Characterization of Nano-Materials/Lab **Credits: (3-1) 4**

- NANO 890 Seminar **Credits: (1-0) 1**
- Program Major Emphasis Credits: 26-36
- Dissertation Research Credits: 30-40

**Total: 80**

### **General Program Requirements**

(Minimum program requirements: (80 credits))

#### **M.S. Degree (24 credits)**

Students entering the Ph.D. program with a previous M.S. degree in a relevant discipline are allowed to apply a maximum of 24 semester course credit hours toward the course credit requirements subject to approval of the Dean of Graduate Education.

The following is a list of electives for each focus area of the program. Graduate level courses which serve the needs of our other graduate programs are also available as electives.

- NANO 445/545 Introduction to Nanomaterials **Credits: (3-0) 3**
- NANO 504 Nanophotonics **Credits: (3-0) 3**
- NANO 604 Nanophotonic Materials **Credits: (3-0) 3**
- NANO 677 Printed Electronics: Materials and Processes **Credits: (3-0) 3**
- NANO 704 Crystallography and Structure of Nanomaterials **Credits: (3-0) 3**
- NANO 705 Nanoelectronics **Credits: (3-0) 3**
- NANO 706 Diffraction Methods for Nanomaterials Research **Credits: (3-0) 3**
- NANO 707 Defects in Nanomaterials **Credits: (3-0) 3**
- NANO 708 Nanomaterials for Photovoltaics **Credits: (3-0) 3**
- NANO 712/712L Electromagnetic Properties of Heterogeneous Materials/Lab **Credits: (2-1) 3**
- NANO 715 Polymeric Nanomaterials **Credits: (3-0) 3**
- NANO 717 Nanochemistry **Credits: (3-0) 3**
- NANO 791 Independent Study **Credits: 1 to 3**
- NANO 792 Topics **Credits: 1 to 3**
- MES 601 Fundamentals of Materials Engineering **Credits: (4-0) 4**
- MES 603 Condensed Matter Physics **Credits: (4-0) 4**
- MES 604 Chemistry of Materials **Credits: (4-0) 4**
- ME 612 Transport Phenomena: Momentum **Credits: (3-0) 3 OR**
- CBE 612 Transport Phenomena: Momentum **Credits: (3-0) 3**
- ME 613 Transport Phenomena: Heat **Credits: (3-0) 3 OR**
- CBE 613 Transport Phenomena: Heat **Credits: (3-0) 3**
- CBE 714 Transport Phenomena: Mass **Credits: (3-0) 3**
- PHYS 721 Electrodynamics I **Credits: (3-0) 3**
- PHYS 743 Statistical Mechanics **Credits: (3-0) 3**
- PHYS 771 Quantum Mechanics I **Credits: (3-0) 3**
- PHYS 773 Quantum Mechanics II **Credits: (3-0) 3**
- MES 712 Interfacial Phenomena **Credits: (3-0) 3**
- MES 713 Advanced Solid Mechanics I **Credits: (3-0) 3**
- MES 728 Heterogeneous Kinetics **Credits: (3-0) 3**
- MES 770 Continuum Mechanics **Credits: (3-0) 3**

### **Additional Information**

For program supervision purposes, the nano SE Ph.D. program director is the graduate advisor until the major professor is appointed. The major professor is responsible for the student's dissertation research. The graduate office representative on the student's dissertation committee must be selected from outside of the department with which the major professor is affiliated, and should also be a member of the Nano Ph.D. Advisory Council.

It is not necessary that the student be associated with the department of affiliation of his or her major professor. Detailed information on examination policy, admission to candidacy, and defense of dissertation are included in the School of Mines nano science and engineering Ph.D. Program Handbook.

## **Minors**

### **Minors - General Information**

Students interested in pursuing a specific minor offered by SDSM&T should contact the coordinator of that minor for more specific information on the application process and the appropriate forms.

- No undergraduate degree program requires a minor.
- Regental undergraduate minors consist of 18-24 semester credit hours.
- No fewer than nine (9) semester credit hours in a minor must be taken at School of Mines.
- A cumulative grade point average of 2.00 or better must be attained in the coursework defining the minor.
- The specific courses required for a minor in each department and program offering a minor can be found in the section of this catalog where that program is described.
- Notification of intent to seek a minor is to be in effect no later than the time of registration for the first semester of the senior year (90 or more credit hours completed) on a form available in the Registrar and Academic Services (RAS) office. This form must be approved and signed by the head of the department from which the degree will be awarded, and the head of the department from which the minor will be awarded.

## **Atmospheric Sciences Minor**

### **Contact Information**

**Dr. Andrew Detwiler (Head)**

Department of Atmospheric Sciences

Mineral Industries 205

(605) 394-2291

E-mail: Andrew.Detwiler@sdsmt.edu

### **Undergraduate minor in Atmospheric Sciences**

A minor in atmospheric sciences is offered to any student enrolled in any undergraduate degree program that allows minors at the School of Mines. For some majors this would require an additional semester or more of study beyond the normal four years. A minimum of 18 credits in atmospheric science coursework must be earned.

### **Two courses**

- ATM 301 Introduction to Atmospheric Sciences **Credits: (3-0) 3**
- ATM 403/503 Biogeochemistry **Credits: (3-0) 3** are required for the minor.

## Computer Science Minor

### Contact Information

#### Dr. Kyle Riley

Department of Mathematics and Computer Science

McLaury 308

(605) 394-2471

E-mail: Kyle.Riley@sdsmt.edu

A minor in the Department of Mathematics and Computer Science must be approved by the student's major department. The Office of the Registrar and Academic Services has forms that should be completed and signed by the department heads from both departments involved in this minor. The minor in computer science requires the completion of 21 credit hours.

### The core coursework includes

- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- CSC 250 Computer Science II **Credits: (4-0) 4**
- CSC 251 Finite Structures **Credits: (4-0) 4**
- CSC 300 Data Structures **Credits: (4-0) 4**
- At least 6 credit hours from an approved list.

### The approved list of courses for the minor:

- CSC 314/314L Assembly Language/Lab **Credits: (2-1) 3**
- CSC 317 Computer Organization and Architecture **Credits: (3-0) 3**
- CSC 372 Analysis of Algorithms **Credits: (3-0) 3**
- CSC 410/510 Parallel Computing **Credits: (3-0) 3**
- CSC 412/512 Cryptography **Credits: (3-0) 3**
- CSC 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3**
- CSC 416/416L/516/516L Introduction to Autonomous Systems/Lab **Credits: (2.5-0.5) 3**
- CSC 421/521 Graphical User Interfaces with Object-Oriented Programming **Credits: (3-0) 3**
- CSC 433/533 Computer Graphics **Credits: (3-0) 3**
- CSC 440/440L Advanced Digital Systems/Lab **Credits: (3-1) 4**
- CSC 445/545 Introduction to Theory of Computation **Credits: (3-0) 3**
- CSC 447/547 Artificial Intelligence **Credits: (3-0) 3**
- CSC 448/548 Machine Learning **Credits: (3-0) 3**
- CSC 449/549 Pattern Recognition **Credits: (3-0) 3**
- CSC 456 /456L Operating Systems/Lab **Credits: (3-1) 4**
- CSC 461 Programming Languages **Credits: (3-0) 3**
- CSC 463/563 Data Communications **Credits: (4-0) 4**
- CSC 464/564 Introduction to Digital Image Processing and Computer Vision **Credits: (3-0) 3**
- CSC 470 Software Engineering **Credits: (3-0) 3**
- CSC 476 Theory of Compilers
- CSC 484 Database Management Systems **Credits: (3-0) 3**

## Environmental Engineering Minor

### Contact Information

#### Dr. James Stone

Program Coordinator

Department of Civil and Environmental Engineering

Civil/Mechanical 314

(605) 394-2443

E-mail: James.Stone@sdsmt.edu

Environmental engineers design systems and solve pressing global problems in all areas related to the environment and public health: sustainable design of drinking water treatment and wastewater treatment, and solid hazardous waste disposal systems; development of air quality monitoring and pollution prevention programs; design of site remediation and mining reclamation programs; and development of ecosystem protection and restoration efforts, among others. Students may pursue an environmental engineering education as an emphasis area in the B.S. civil engineering degree program, and/or pursue an environmental engineering minor.

**Students from any discipline at the School of Mines may pursue a minor in environmental engineering by completing 18 credit hours of coursework at described below.**

#### Required core courses:

- CBE 217 Chemical Engineering Material Balances **Credits: (3-0) 3**
- CEE 326 Environmental Engineering I **Credits: (3-0) 3**
- CEE 327/327L Environmental Engineering II **Credits: (2-1) 3**
- GEOE 421/521 Aqueous Geochemistry **Credits: (3-0) 3**
- BIOL 341 Microbial Processes in Engineering and Natural Sciences **Credits: (3-0) 3**
- Elective course

**In addition, students select one 3-credit elective course from the list below.** To ensure that enrollees gain the broad and interdisciplinary background expected in the environmental engineering discipline, the elective must be taken from a discipline outside the student's major field of study.

- CBE 455/555 Pollution Phenomena and Process Design **Credits: (3-0) 3**
- CEE 426/526 Environmental Engineering Physical/Chemical Process Design **Credits: (3-0) 3**
- CHEM 326 Organic Chemistry I **Credits: (3-0) 3**
- CHEM 482/582 Environmental Chemistry **Credits: (3-0) 3**
- GEOE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- IENG 331 Safety Engineering **Credits: (3-0) 3**
- MEM 405 Mine Permitting and Reclamation **Credits: (3-0) 3**
- MET 220 Mineral Processing and Resource Recovery **Credits: (3-0) 3**
- MET 220L Mineral Processing and Resource Recovery Laboratory **Credits: (0-1) 1**

## **Geology Minor**

### **Contact Information**

**Dr. Laurie Anderson**

Department of Geology and Geological Engineering

Mineral Industries 303

(605) 394-2461

E-mail: Laurie.Anderson@sdsmt.edu

### **Geology Courses**

**Other science and engineering majors may pursue a minor in geology by completing eighteen (18) credit hours of geology courses including the following:**

- GEOL 201 Physical Geology **Credits: (3-0) 3**
- GEOL 201L Physical Geology Laboratory **Credits: (0-1) 1**
- GEOL 212/212L Mineralogy and Crystallography/Lab **Credits: (2-1) 3**
- GEOL 331/331L Stratigraphy and Sedimentation/Lab **Credits: (2-1) 3**
- GEOL 341/341L Igneous and Metamorphic Petrology/Lab **Credits: (2-1) 3**
- GEOE 322/322L Structural Geology/Lab **Credits: (2-1) 3**

### **Note(s):**

GEOE 221/221L and one additional geology elective credit may be substituted for GEOL 201/GEOL 201L. No other substitutions are permitted for this minor.

## **Geospatial Technology Minor**

### **Contact Information**

#### **Dr. Laurie Anderson**

Department of Geology and Geological Engineering  
Mineral Industries 303  
(605) 394-2461  
E-mail: Laurie.Anderson@sdsmt.edu

Geospatial Technology is a rapidly expanding field that covers the management and analysis of spatial data from many sources, such as satellites, airborne remote sensing, geographic information systems (GIS), global positioning systems (GPS), surveying, and more. It has many applications in the sciences, engineering, business, planning, and transportation. Other science and engineering majors may pursue a Minor in Geospatial Technology by completing eighteen (18) credit hours of courses, including GEOL 416/416L/516/516L, GEOL 417/517, GEOL 419/519, GEOL 420/520. Six additional credits taken from any of the groups below complete the minor. Up to three credits of a senior capstone, research, or design project with a significant proportion of geospatial content may be substituted for one elective, with permission of the program director, Dr. Maribeth Price. E-mail: Maribeth.Price@sdsmt.edu

#### **One of these surveying courses may be applied to the minor:**

- CEE 206/206L Engineering Surveys I/Lab **Credits: (2-1) 3**
- MEM 201L Surveying for Mineral Engineers **Credits: (0-2) 2**

#### **One of these statistics courses may be applied to the minor:**

- MEM 307 Mineral Exploration and Geostatistics **Credits: (3-0) 3**
- MATH 281 Introduction to Statistics **Credits: (3-0) 3**
- MATH 381 Introduction to Probability and Statistics **Credits: (3-0) 3**
- MATH 442 Engineering Statistics **Credits: (4-0) 4**

#### **One of these programming courses may be applied to the minor:**

- GEOE 211/211L Earth Systems Engineering Analysis/Lab **Credits: (1-1) 2**
- CEE 284 Applied Numerical Methods **Credits: (3-0) 3**
- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**

#### **Any of these courses may be applied to the minor:**

- GEOE 475/475L Ground Water/Lab **Credits: (2-1) 3**
- CEE 437/437L/537/537L Watershed and Floodplain Modeling/Lab **Credits: (2-1) 3**
- CSC 250 Computer Science II **Credits: (4-0) 4**
- GEOL 376 Geospatial Field Methods **Credits: (0-3) 3**
- CEE 284 Applied Numerical Methods **Credits: (3-0) 3**

## Materials Science - Metals Minor

### Contact Information

**Dr. Michael K. West**

Department of Materials and Metallurgical Engineering

Mineral Industries 101

(605) 394-1283

E-mail: Michael.West@sdsmt.edu

This minor is designed for students in engineering and science disciplines that desire focused training in the field of materials science with special emphasis on metals. Students completing the minor in materials science-metals will demonstrate the following outcomes:

1. **A proficiency in materials science concepts covering metals and alloys;**
2. **The ability to develop and improve new metals/alloys;**
3. **The ability to predict and evaluate the performance of metals and alloys.**

Given the redundancy in the B.S. metallurgical engineering core curriculum, the minor in materials science-metals is not available to those students who receive a B.S. degree in metallurgical engineering. A minor in materials science-metals must be approved by the student's major department. The Office of the Registrar and Academic Services has forms that should be completed and signed by the department heads from both departments involved in this minor.

### The requirements for a minor in materials science - Metals are

- MET 232 Properties of Materials **Credits: (3-0) 3**
- MET 330 Physics of Metals **Credits: (3-0) 3**
- MET 332 Thermomechanical Processing **Credits: (3-0) 3**
- MET 443 Composite Materials **Credits: (3-0) 3**

### Two classes from

- MET 430/430L Welding Engineering and Design of Welded Structures/Lab **Credits: (2-1) 3**
- MET 440/540 Mechanical Metallurgy **Credits: (3-0) 3**
- MET 445/545 Oxidation and Corrosion of Metals **Credits: (3-0) 3**

**Total: 18 Credits**

### Curriculum Notes

MET 330, MET 332, MET 440/540, MET 443 and MET 445/545 are offered in alternate years, so plans for a materials science-metals minor should be made early.

## **Mathematics 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)

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.

## Occupational Safety Minor

### Contact Information

**Dr. Carter Kerk**

Industrial Engineering

IER 309

(605) 394-6067

E-mail: Carter.Kerk@sdsmt.edu

The minor in occupational safety is offered to students pursuing any B.S. degree program.

### Application Procedures

Students should contact the program coordinator for the application procedure and appropriate forms.

### Certification Check

Once an application is filed, it is included in the degree audit form. It is the responsibility of the student's advisor to certify certification completion along with the final degree audit.

### The minimum math and science course requirements are

- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- MATH 123 Calculus I **Credits: (4-0) 4**
- PHYS 111 Introduction to Physics I **Credits: (3-0) 3 OR**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- MATH 281 Introduction to Statistics **Credits: (3-0) 3 OR**
- MATH 381 Introduction to Probability and Statistics **Credits: (3-0) 3 OR**
- MATH 441 Engineering Statistics Credits: 4

### Required courses are

- IENG 321/321L Ergonomics/Human Factors Engineering/Lab **Credits: (2-1) 3**
- IENG 331 Safety Engineering **Credits: (3-0) 3**
- IENG 341
- PSYC 331 Industrial and Organizational Psychology **Credits: (3-0) 3 OR**
- POLS 407 Environmental Law & Policy **Credits: (3-0) 3**
- Senior Design or Senior Project in home department

### A minimum of 6 credit hours:

- BIOL 121 Basic Anatomy **Credits: (3-0) 3**
- BIOL 121L Basic Anatomy Lab **Credits: (0-1) 1**
- BIOL 123 Basic Physiology **Credits: (3-0) 3**
- BIOL 123L Basic Physiology Lab **Credits: (0-1) 1**
- ENVE 7326
- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- CHEM 480
- CP 297/397/497 Cooperative Education **Credits: 1 to 3**<sup>1</sup>
- IENG 491 Independent Study **Credits: 1 to 3**<sup>1</sup>
- ME 380
- MEM 203 Introduction to Mine Health and Safety **Credits: (1-0) 1**
- PE 105 Wellness & Physical Fitness **Credits: (1-0) 1**

**Curriculum Notes**

Thus, a total of at least 21 credit hours is needed for an occupational safety minor. A minor in occupational safety must be approved by the student's major department and the minor coordinator on a form available at the Office of the Registrar and Academic Services. Additional information may be found at the department website: <http://ie.sdsmt.edu>.

<sup>1</sup> Projects must be pre-approved and have significant safety content.

## **Physics Minor**

### **Contact Information**

**Dr. Andre G. Petukhov**

Department of Physics

Electrical Engineering/Physics 223

(605) 394-2364

E-mail: Andre.Petukhov@sdsmt.edu

A minor in physics requires a minimum of 18 hours of courses in physics, which must include PHYS 213, and at least 15 hours of physics courses numbered higher than PHYS 213. All minors in physics must be approved by the department and must conform to the institutional policies and guidelines for minors.

## **Robotics Minor**

### **Contact Information**

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

Department of Mathematics and Computer Science

McLaury 308

(605) 394-2471

E-mail: Kyle.Riley@sdsmt.edu

The South Dakota School of Mines and Technology offers a minor in robotics, which is a great way to enhance any program of study to prepare graduates for a workplace that has become highly automated. A minor in robotics must be approved by the student's major department along with the approval of the Department Head for Mathematics and Computer Science.

### **The core coursework includes**

- CSC 150/150L Computer Science I/Lab **Credits: (2-1) 3**
- CSC 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3 OR**
- CENG 415/415L/515/515L Introduction to Robotics/Lab **Credits: (2-1) 3**
- CSF 416 **OR**
- CENG 416

### **Along with**

- CSC 300 Data Structures **Credits: (4-0) 4 OR**
- CSC 405/505 Survey of Data Structures and Algorithms **Credits: (3-0) 3**

### **Additional 6 credits from courses on an approved list**

The minor is then complete with an additional 6 credits from courses on an approved list. The approved list of courses for the minor:

- CSC 447/547 Artificial Intelligence **Credits: (3-0) 3**
- CSC 449/549 Pattern Recognition **Credits: (3-0) 3**
- CSC 456 /456L Operating Systems/Lab **Credits: (3-1) 4**
- CSC 464/564 Introduction to Digital Image Processing and Computer Vision **Credits: (3-0) 3**

## Sustainable Engineering Minor

### Contact Information

#### Dr. Jennifer Benning

Program Coordinator

Department of Civil and Environmental

Engineering, Civil/Mechanical 237A

(605) 394-2425

E-mail: Jennifer.Benning@sdsmt.edu

**Sustainable engineering** describes a new approach for solving complex classes of social problems that result from the rising competition for increasingly limited supplies of resources, water and land. Sustainable engineering seeks to transform engineering practice to meet these challenges. Interdisciplinary in nature and application, sustainable engineering involves the application of life cycle assessment and other innovative techniques to determine the long term implications of a proposed design solution with the ultimate goal of minimizing overall environmental impacts from products, services, businesses, communities and nations, as well as create engineering solutions that are fair and just in a global societal context.

**Students may pursue a minor in sustainable engineering by completing 18 credit hours of coursework that includes two required courses.**

### Required courses

- CEE 325 Introduction to Sustainable Design **Credits: (3-0) 3**
- CEE 425/525 Sustainable Engineering **Credits: (3-0) 3**

### Engineering Electives

Six elective credit hours are selected from the following list of engineering courses with sustainability content, with a minimum of three credits outside their major.

- CEE 326 Environmental Engineering I **Credits: (3-0) 3**
- CEE 337 Engineering Hydrology **Credits: (3-0) 3**
- CBE 455/555 Pollution Phenomena and Process Design **Credits: (3-0) 3**
- IENG 352 Creativity and Innovation **Credits: (1-0) 1**
- IENG 431/531 Industrial Hygiene **Credits: (3-0) 3**
- IENG 451/451L Operational Strategies/Lab **Credits: (2-1) 3**
- IENG 475/475L Computer-Controlled Manufacturing Systems and Robotics **Credits: (2-1) 3**
- ME 492 Topics **Credits: 1 to 5**
- MET 220 Mineral Processing and Resource Recovery **Credits: (3-0) 3**
- MET 310 Aqueous Extraction, Concentration, and Recycling **Credits: (3-0) 3**
- MET 321/321L High Temperature Extraction, Concentration, and Recycling/Lab **Credits: (3-1) 4**
- MEM 120 Introduction to Mining, Sustainable Development and Introductory Management **Credits: (2-0) 2**
- MEM 405 Mine Permitting and Reclamation **Credits: (3-0) 3**

### Science or mathematics electives

Three elective credit hours are selected from the following list of science or mathematics courses with sustainability content.

- ATM 403/503 Biogeochemistry **Credits: (3-0) 3**
- ATM 405/505 Air Quality **Credits: (3-0) 3**
- ATM 406/506 Global Environmental Change **Credits: (3-0) 3**
- BIOL 311 Principles of Ecology **Credits: (3-0) 3**
- BIOL 341 Microbial Processes in Engineering and Natural Sciences **Credits: (3-0) 3**
- GEOL 351 Earth Resources and the Environment **Credits: (3-0) 3**
- GEOG 400 Cultural Geography **Credits: (3-0) 3**
- MATH 451 Math Modeling **Credits: (3-0) 3**

### Humanities/Social Science Electives

Finally, three elective credit hours are selected from the following list of humanities/social science courses with sustainability.

- ANTH 210 Cultural Anthropology **Credits: (3-0) 3**

- ENGL 300 The Literary Experience of Nature **Credits: (3-0) 3**
- HUM 200 Connections: Humanities & Technology **Credits: (3-0) 3**
- POLS 250 World Politics **Credits: (3-0) 3**
- POLS 407 Environmental Law & Policy **Credits: (3-0) 3**

These course requirements provide students with the broad, cross-disciplinary background that leads to the type of interdisciplinary, systems thinking that is essential for developing sustainable solutions.

**Minors from Other South Dakota Regental Institutions**

SDSM&T degree seeking students may complete requirements for any minor at any Regental university (Black Hills State University, Dakota State University, Northern State University, South Dakota State University or the University of South Dakota) that has been approved to grant that minor.

This minor will be recorded on the transcript in conjunction with the degree/minor from the South Dakota School of Mines and Technology. (BOR Policy 2:2)

**For information about the minors offered in the Regental system, the contact person for each university is listed below.**

Black Hills State University - Contact Ramona Collins (605-642-6577) or Ramona.Collins@bhsu.edu

Dakota State University - Contact Sandy Anderson ((605-256-5144 or Sandy.Snderson@dsu.edu

Northern State University - Contact Cherie Sauer (605-626-7768) or sauerc@northern.edu

South Dakota School of Mines and Technology - Contact Kathy Crawford (605-394-1288) or Kathryn.Crawford@sdsmt.edu

South Dakota State University - Contact Bailey Davis (605-688-4488) or Bailey.Davis@sdstate.edu

University of South Dakota - Contact Larry Hudson (605-677-5339) or Larry.Hudson@usd.edu

## Certificates

### Construction Management Certificate

#### Contact Information

Dr. Scott Amos  
Department of Civil and Environmental Engineering  
C/M 123  
(605) 394-1694  
E-mail: Scott.Amos@sdsmt.edu

#### Construction Management

The Construction Management Certificate is designed to provide a program of advanced study for candidates anticipating a managerial career in the construction industry. In addition to course delivery in a hybrid distance mode, flexibility is built into the program to provide an optimum educational experience to working students.

#### Background Requirements

The construction management coursework is geared towards the working professional. The successful applicant will have a background in business, science, engineering, technology or a related field with at least one semester of calculus and a course in probability and statistics.

Practicing engineers or students seeking to enhance their marketability for upper level management positions in various construction related industries may be initially interested in the 12-hour certificate in Construction Management. Successful completion of four certificate courses with grades of "B" or better will qualify the student for further studies leading to the Master of Science (MS) degree in Construction Management.

#### Approved Certificate Courses

Choose any four from the following:

- CM 608 Construction Contracts **Credits: (3-0) 3**
- CM 610 Construction Project Management **Credits: (3-0) 3**
- CM 619 Construction Company Management **Credits: (3-0) 3**
- CM 665 Construction Equipment Management **Credits: (3-0) 3**
- CM 574 Construction Engineering and Management **Credits: (3-0) 3**
- CM 706 Managing Sustainable Projects **Credits: (3-0) 3**
- CM 710 Advanced Construction Management **Credits: (3-0) 3**
- CM 715 Advanced Materials and Methods **Credits: (3-0) 3**

## Engineering Management and Leadership Certificate

### Contact Information

**Dr. Jennifer Karlin**

Industrial Engineering

IER 302

(605) 394-3467

E-mail: Jennifer.Karlin@sdsmt.edu

### Program Information

Industry wants to hire engineers who are not only competent in their discipline, but also have a beginning understanding of engineering management and leadership. As defined by the American Society for Engineering Management, this discipline is "the art and science of planning, organizing, allocating resources, and directing and controlling activities which have a technological component." This certificate is an opportunity for engineering students to graduate ready to meet the challenges unique to leadership in the engineering environment.

Students should contact the program coordinator for the application procedure and appropriate forms.

### Certification Check

Once an application is filed, it is included in the degree audit form. It is the responsibility of the student's advisor to certify certification completion along with the final degree audit.

### Certificate Requirements

- IENG 302 Engineering Economics **Credits: (3-0) 3**
- IENG 366 Engineering Management **Credits: (3-0) 3**

### Elective Courses (6 credits required)

- IENG 215 Cost Estimating for Engineers I **Credits: (1-0) 1**
- IENG 216 Cost Estimating for Engineers II **Credits: (1-0) 1**
- IENG 217 Cost Estimating for Engineers III **Credits: (1-0) 1**
- IENG 352 Creativity and Innovation **Credits: (1-0) 1**
- IENG 353 Commercialization of New Technology **Credits: (1-0) 1**
- IENG 354 Marketing Technology Innovations **Credits: (1-0) 1**
- IENG 355 Financing Technology Innovations **Credits: (1-0) 1**
- IENG 356 Technology Start Ups **Credits: (1-0) 1**
- IENG 451/451L Operational Strategies/Lab **Credits: (2-1) 3**
- PSYC 331 Industrial and Organizational Psychology **Credits: (3-0) 3**
- MEM 466 Mine Management **Credits: (2-0) 2**

## Occupational Safety Certificate

### Contact Information

#### Dr. Carter Kerk

Industrial Engineering

IER 309

(605) 394-6067

E-mail: Carter.Kerk@sdsmt.edu

### Program Summary

The graduate level Occupational Safety Certificate at SDSM&T is designed to respond to a business need across all sectors (including general industry, construction, mining, health care, service, etc.) that places occupational safety at the highest level of organizational priorities. This certificate is open to any graduate student at SDSM&T. (For undergraduate students, refer to the Occupational Safety Minor.)

### Program Description

The Occupational Safety Certificate program is designed to enable students to enhance their graduate degree with a concentration of occupational safety related courses. While the certificate could enrich any graduate degree, it would be particularly well-suited for Biomedical Engineering, Chemical Engineering, Civil and Environmental Engineering, Construction Management, Engineering Management, and Mechanical Engineering.

Courses are offered on-campus and it is possible to complete the certificate through distance offerings. The core course and core electives provide a foundation in the identification, evaluation, and control of hazards relating to safety, industrial hygiene, and ergonomics. These courses will provide students with knowledge of regulatory aspects (OSHA, MSHA, EU, etc.), standards (ISO,ANSI,OHSAS, NIOSH, etc.), program development and evaluation, as well as professional licensing, certification, and ethnics.

### Application Procedures

Students should contact the program coordinator for the application procedure and appropriate forms.

### Certification Check

Once an application is filed, it is included in the degree audit form. It is the responsibility of the student's advisor to certify certification completion along with the final degree audit.

### Required Courses

- ENGM 650 Safety Management **Credits: (3-0) 3**

### Core Electives

- BME 606 Occupational Biomechanics **Credits: (3-0) 3**
- ENGM 655 Ergonomics for Managers **Credits: (3-0) 3**
- IENG 431/531 Industrial Hygiene **Credits: (3-0) 3**

### Other Electives

- ATM 405/505 Air Quality **Credits: (3-0) 3**
- BME 602 Anatomy and Physiology for Engineers **Credits: (3-0) 3**
- CBE 455/555 Pollution Phenomena and Process Design **Credits: (3-0) 3**
- CP 697 Cooperative Education **Credits: 1 to 3**<sup>A</sup>
- ENGM 791 Independent Study **Credits: 1 to 3**<sup>A</sup>
- MEM 440/540 Advanced Mine Ventilation and Environmental Engineering **Credits: (3-0) 3**

### Notes

Note A: With significant safety content and pre-approved by the certificate coordinator.

Nine (9) Total Credit Hours = 3 (required course) + 3 (one of the core electives) + 3 (combined additional core electives and other elective credits).

A Certificate of Occupational Safety must be approved by the student's graduate advisor and the certificate coordinator on a form available at the Office of the Registrar and Academic Services or from the certificate coordinator. Additional information may be found at the Industrial Engineering Department website ie.sdsmt.edu.

## Six Sigma Greenbelt Certificate

### Contact Information

#### Dr. Dean Jensen

Industrial Engineering

IER 308

(605) 394-1278

E-mail: Dean.Jensen@sdsmt.edu

### Program Information

Lack of Six Sigma Greenbelt Certification is limiting the job opportunities for our otherwise highly qualified students. Six Sigma certification is strongly valued by many organizations in industry for its standardized problem solving process and adherence to statistically rigorous quality tools.

The concepts that make up the Six Sigma philosophy and tools are already contained within the industrial engineering curriculum. The certification program would increase recognition from employers that students in South Dakota are acquiring these skills.

### Application Procedures

Students should contact the program coordinator for the application procedure and appropriate forms.

### Certification Check

Once an application is filed, it is included in the degree audit form. It is the responsibility of the student's advisor to certify certification completion along with the final degree audit.

### Program Requirements

- IENG 381 Introduction to Probability and Statistics **Credits: (3-0) 3**  
**OR**
- MATH 281 Introduction to Statistics **Credits: (3-0) 3**
- IENG 486 Statistical Quality and Process Control **Credits: (3-0) 3**  
**OR**
- ENGM 620 Quality Management **Credits: (3-0) 3**
- IENG 452 Introduction to Six Sigma **Credits: (1-0) 1**  
**OR**
- IENG 451/451L Operational Strategies/Lab **Credits: (2-1) 3**
- IENG 463 Six Sigma Greenbelt Project **Credits: (1-0) 1**
- IENG 461 Six Sigma Greenbelt Exam **Credits: (1-0) 1**

## **Technology Innovation Certificate**

### **Contact Information**

**Dr. Stuart D. Kellogg**

Industrial Engineering

IER 301

(605) 394-1271

E-mail: Stuart.Kellogg@sdsmt.edu

### **Program Information**

The Technology Innovation Certificate program is designed to provide the background and requisite instruction for students interested in introducing a new product or innovation to the marketplace. As such, this program is ideal for students interested in entrepreneurial endeavors or for employment with companies that promote a strong intrapreneurial culture.

The Technology Innovation Certificate is available for both undergraduate and graduate students. The program provides flexibility in course offerings by making use of a variety of courses already available either on this campus or elsewhere in the state system. In addition, every attempt has been made to modularize and invert courses required to meet core requirements. Specifically, all core requirements may be completed through 1 or 2 credit offerings. In some cases, core offerings feature classroom inversion which allows some content to be available through online offerings supplemented with hands and creative problems solving exercises in the classroom.

Philosophically, the program is based on the holistic learner development model which incorporates whole brain thinking, multi-disciplinary team problem solving exercises, and, where ever possible, real world applications in innovation or product development.

### **Application Procedures**

Students should contact the program coordinator for the application procedure and appropriate forms.

### **Certification Check**

Once an application is filed, it is included in the degree audit form. It is the responsibility of the student's advisor to certify certification completion along with the final degree audit.

## Other Programs

### Bachelor of Science Graduation Requirements

#### General Education Core Requirements

General education core requirements must be completed within the first sixty-four (64) credits. Requests for exceptions to these general education requirements must be approved by the student's advisor and by the Vice President for Academic Affairs/Provost. The required core is listed below.

#### Goal #1

Students will write effectively and responsibly and understand and interpret the written expression of others.

Student Learning Outcomes: As a result of taking courses meeting this goal, a student will

1. Write using standard American English, including correct punctuation, grammar, and sentence structure;
  2. Write logically;
  3. Write persuasively, with a variety of rhetorical strategies (e.g., expository, argumentative, descriptive);
  4. Incorporate formal research and documentation in their writing, including research obtained through modern, technology-based research tools.
- Each course meeting this goal includes the following student outcomes: Required: #1, #2, #3, and #4

#### Credit Hours: 6 hours

#### Courses:

- ENGL 101 Composition I **Credits: (3-0) 3**
- ENGL 201 Composition II **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**<sup>1</sup>

#### Curriculum Notes

<sup>1</sup> Engineering and sciences students at School of Mines take this six credit sequence in the sophomore and junior years. Both courses develop written and speech communications in an integrated fashion in the context of the major. Students must finish the entire sequence, as well as ENGL 101, to satisfy the requirements of Goal #1 and Goal #2.

#### Goal #2

Students will communicate effectively and responsibly through speaking and listening.

Student Learning Outcomes: Courses satisfying this goal will require students to

1. Prepare and deliver speeches for a variety of audiences and settings;
2. Demonstrate speaking competencies including choice and use of topic, supporting materials, organizational pattern, language usage, presentational aids, and delivery;
3. Demonstrate listening competencies by summarizing, analyzing, and paraphrasing ideas, perspectives and emotional content.

#### Credit Hours: 3 hours

#### Courses:

- ENGL 279 Technical Communications I **Credits: (3-0) 3**<sup>1</sup>
- ENGL 289 Technical Communications II **Credits: (3-0) 3**<sup>1</sup>
- SPCM 101 Fundamentals of Speech **Credits: (3-0) 3**

#### Curriculum Notes

<sup>1</sup> Technical Communications I and II develop written and speech communications in an integrated fashion in the context of the major. Students must finish the entire sequence, as well as ENGL 101, to satisfy the requirements of Goal #1 and Goal #2.

#### Goal #3

Students will understand the organization, potential, and diversity of the human community through study of the social sciences.

Student Learning Outcomes: As a result of taking courses meeting this goal, students will

1. Identify and explain basic concepts, terminology and theories of the selected social science disciplines from different spatial, temporal, cultural, and/or institutional contents.
2. Apply selected social science concepts and theories to contemporary issues;
3. Identify and explain the social or aesthetic values of different cultures.

In addition, as a result of taking course meeting this goal, students will be able to demonstrate a basic understanding of at least one of the following:

- The origin and evolution of human institutions;
- The allocation of human or natural resources within societies;
- The impact of diverse philosophical, ethical or religious views.

Each course meeting this goal includes the following student learning outcomes:

Required: #1, #2, and #3

At least one of the following: #4, #5, or #6

### **Credit Hours: 6 hours in two disciplines**

#### **Courses:**

- ANTH 210 Cultural Anthropology **Credits: (3-0) 3**
- GEOG 101 Introduction to Geography **Credits: (3-0) 3**
- GEOG 210 World Regional Geography **Credits: (3-0) 3**
- GEOG 212 Geography of North America **Credits: (3-0) 3**
- HIST 151 United States History I **Credits: (3-0) 3**
- HIST 152 United States History II **Credits: (3-0) 3**
- POLS 100 American Government **Credits: (3-0) 3**
- POLS 250 World Politics **Credits: (3-0) 3**
- PSYC 101 General Psychology **Credits: (3-0) 3**
- SOC 100 Introduction to Sociology **Credits: (3-0) 3**
- SOC 150 Social Problems **Credits: (3-0) 3**
- SOC 250 Courtship and Marriage **Credits: (3-0) 3**

#### **Goal #4**

Students will understand the diversity and complexity of the human experience through study of the arts and humanities.

Student Learning Outcomes: As a result of taking courses meeting this goal, students will

1. Demonstrate knowledge of the diversity of values, beliefs, and ideas embodied in the human experience;
2. Identify and explain basic concepts of the selected disciplines within the arts and humanities. In addition, as a result of taking courses meeting this goal, students will be able to do at least one of the following:
  - Identify and explain the contributions of other cultures from the perspective of the selected disciplines within the arts and humanities;
  - Demonstrate creative and aesthetic understanding;
  - Explain and interpret formal and stylistic elements of the literary or fine arts;
  - Demonstrate foundational competency in reading, writing, and speaking a non-English language.

Each course meeting this goal includes the following student learning outcomes: Required: #1, #2 At least one of the following: #3, #4, #5, or #6

### **Credit Hours: 6 hours in two disciplines or in a sequence of foreign language courses)**

#### **Courses:**

- ART 111/111A Drawing I **Credits: (3-0) 3**
- ART 112/112A Drawing II **Credits: (3-0) 3**
- ARTH 211 History of World Art I **Credits: (3-0) 3**
- CHIN 101 Introductory Chinese I **Credits: (4-0) 4**
- CHIN 102 Introductory Chinese II **Credits: (4-0) 4**
- ENGL 210 Introduction to Literature **Credits: (3-0) 3**
- ENGL 212 World Literature II **Credits: (3-0) 3**

- ENGL 221 British Literature I **Credits: (3-0) 3**
- ENGL 222 British Literature II **Credits: (3-0) 3**
- ENGL 241 American Literature I **Credits: (3-0) 3**
- ENGL 242 American Literature II **Credits: (3-0) 3**
- ENGL 250 Science Fiction **Credits: (3-0) 3**
- GER 101 Introductory German I **Credits: (4-0) 4**
- GER 102 Introductory German II **Credits: (4-0) 4**
- HIST 121 Western Civilization I **Credits: (3-0) 3**
- HIST 122 Western Civilization II **Credits: (3-0) 3**
- HUM 100 Introduction to Humanities **Credits: (3-0) 3**
- HUM 200 Connections: Humanities & Technology **Credits: (3-0) 3**
- MUS 100 Music Appreciation **Credits: (3-0) 3**
- PHIL 100 Introduction to Philosophy **Credits: (3-0) 3**
- PHIL 200 Introduction to Logic **Credits: (3-0) 3**
- PHIL 220 Introduction to Ethics **Credits: (3-0) 3**
- PHIL 233 Philosophy and Literature **Credits: (3-0) 3**
- SPAN 101 Introductory Spanish I **Credits: (4-0) 4**
- SPAN 102 Introductory Spanish II **Credits: (4-0) 4**

### **Goal #5**

Students will understand and apply fundamental mathematical processes and reasoning.

Student Learning Outcomes: As a result of taking courses meeting this goal, students will

1. Use mathematical symbols and mathematical structure to model and solve real world problems;
2. Demonstrate appropriate communication skills related to mathematical terms and concepts;
3. Demonstrate the correct use of quantifiable measurements of real world situations.

Each course meeting this goal includes the following student learning outcomes: Required: #1, #2, and #3

### **Credit Hours: 3 hours**

#### **Courses:**

- MATH 102 College Algebra **Credits: (3-0) 3**
- MATH 115 Precalculus **Credits: (5-0) 5**
- MATH 120 Trigonometry **Credits: (3-0) 3**
- MATH 123 Calculus I **Credits: (4-0) 4**
- MATH 125 Calculus II **Credits: (4-0) 4**
- MATH 225 Calculus III **Credits: (4-0) 4**
- MATH 281 Introduction to Statistics **Credits: (3-0) 3**

### **Goal #6**

Students will understand the fundamental principles of the natural sciences and apply scientific methods of inquiry to investigate the natural world.

Student Learning Outcomes: As a result of taking courses meeting this goal, students will

1. Demonstrate the scientific method in a laboratory experience;
2. Gather and critically evaluate data using the scientific method;
3. Identify and explain the basic concepts, terminology and theories of the selected natural sciences;
4. Apply selected natural science concepts and theories to contemporary issues.

Each course meeting this goal includes the following student learning outcomes:

Required: #1, #2, #3, and #4.

### **Credit Hours: 6 hours**

**Courses:**

- BIOL 151 General Biology I **Credits: (3-0) 3**
- BIOL 151L General Biology I Lab **Credits: (0-1) 1**
- BIOL 153 General Biology II **Credits: (3-0) 3**
- BIOL 153L General Biology II Lab **Credits: (0-1) 1**
- CHEM 106 Chemistry Survey **Credits: (3-0) 3**
- CHEM 106L Chemistry Survey Lab **Credits: (0-1) 1**
- CHEM 108 Organic and Biochemistry **Credits: (4-0) 4**
- CHEM 108L Organic and Biochemistry Lab **Credits: (0-1) 1**
- CHEM 112 General Chemistry I **Credits: (3-0) 3**
- CHEM 112L General Chemistry I Lab **Credits: (0-1) 1**
- CHEM 114 General Chemistry II **Credits: (3-0) 3**
- CHEM 114L General Chemistry II Lab **Credits: (0-1) 1**
- GEOL 201 Physical Geology **Credits: (3-0) 3**
- GEOL 201L Physical Geology Laboratory **Credits: (0-1) 1**
- PHYS 111 Introduction to Physics I **Credits: (3-0) 3**
- PHYS 111L Introduction to Physics I Laboratory **Credits: (0-1) 1**
- PHYS 113 Introduction to Physics II **Credits: (3-0) 3**
- PHYS 113L Introduction to Physics II Laboratory **Credits: (0-1) 1**
- PHYS 211 University Physics I **Credits: (3-0) 3**
- PHYS 213 University Physics II **Credits: (3-0) 3**
- PHYS 213L University Physics II Laboratory **Credits: (0-1) 1**

**Goal #7**

Students will recognize when information is needed and have the ability to locate, organize, critically evaluate, and effectively use information from a variety of sources with intellectual integrity.

Student Learning Outcomes: As a result of taking courses meeting this goal, students will

1. Determine the extent of information needed;
2. Access the needed information effectively and efficiently;
3. Evaluate information and its sources critically;
4. Use information effectively to accomplish a specific purpose;
5. Use information in an ethical and legal manner.

Each course meeting this goal includes the following student learning outcomes: Required: #1, #2, #3, #4, and #5

**Credit Hours: 9 hours****Courses:**

- ENGL 101 Composition I **Credits: (3-0) 3**
- SPCM 101 Fundamentals of Speech **Credits: (3-0) 3**
- ENGL 201 Composition II **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**<sup>1</sup>

**General Education Globalization/Global Issues and Writing Intensive Requirements**

In addition to the seven system-wide general education requirements described above, all students will achieve learning outcomes focused on advancing their writing skills and their knowledge of global issues. Each academic program has designated one or more classes (the equivalent of one credit hour of study) as meeting each of these requirements. The syllabi of the courses designated state the requirement(s) met and explain how student achievement of the outcomes are assessed and factored into the course grade.

**Globalization/Global Issues Goal Statement**

Students will understand the implications of global issues for the human community and for the practice of their disciplines.

**Student Learning Outcomes:** As a result of taking courses meeting this goal, students will

1. Identify and analyze global issues, including how multiple perspectives impact such issues; and
2. Demonstrate a basic understanding of the impact of global issues on the practice of their discipline.

### **Writing Intensive Goal Statement**

Students will write effectively and responsibly in accordance with the needs of their own disciplines.

**Student Learning Outcomes:** As a result of taking courses meeting this goal, students will

1. Produce documents written for technical, professional, and general audiences within the context of their disciplines;
2. Identify, evaluate, and use potential sources of information from within their disciplines for writing assignments that require research and study; and,
3. Use instructor feedback throughout the semester to improve the quality of their writing.

### **Systemwide General Education Requirements Checklist**

For your convenience, below is a link to the **Board of Regents Systemwide General Education Requirements Checklist** which contains a list of courses being currently offered within the system which will meet the individual general education goals.

[registrar.sdsmt.edu/docs/146588.pdf](http://registrar.sdsmt.edu/docs/146588.pdf)

### **Pre General Education Courses in English and Mathematics**

Pre-general education courses include

- ENGL 033 Basic Writing **Credits: 1 to 3**
- MATH 021 Basic Algebra **Credits: (3-0) 3**
- MATH 101 Intermediate Algebra **Credits: (3-0) 3**

### **Completion of Pre General Education Courses**

1. Students placed in pre general education courses must enroll in and complete the courses within the first 30 credits hours attempted.
2. If a student does not complete the pre general education course(s) within the first 30 credit hours attempted, a registration hold is placed on the student's record.

During the next 12 credit hours attempted, the student must enroll in and complete the pre general education course(s).

3. If the pre general education course(s) is not completed within the first 42 credit hours attempted, the only course(s) in which a student may enroll is the pre general education course(s); and the student's status is changed from degree seeking to non degree seeking.
4. Students transferring from non-Regental institutions must enroll in pre-general education courses during the first 30 attempted Regental credit hours. These students may enroll in other courses concurrently with the pre-general education courses. If the student does not complete the pre-general education courses during the first 30 Regental credit hours attempted during the next 12 credit hours attempted, the student must enroll in and complete the pre-general education course(s). If the student does not successfully complete the pre-general education course(s) within 42 attempted Regental credit hours, the only course(s) in which a student may enroll in the pre-general education course(s); and the student's status is changed from degree seeking to non-degree seeking. The Vice President for Academic Affairs/Provost may grant an exception. Credit hours for the pre general education courses are included in the total number of credit hours attempted.

The grades assigned for courses numbered less than 100 will be RI, RS and RU.

### **Other Curricular Requirements**

#### **A. Humanities and social sciences requirements:**

All courses numbered 300 and above are upper level courses.

This subject area must include six credits in humanities and 6 credits in social sciences. The number required for each major is listed in the department section of the catalog. Students majoring in engineering must complete at least three of these credits at an advanced level.

#### **Humanities**

##### **Art:**

- ART 111/111A Drawing I **Credits: (3-0) 3**
- ART 112/112A Drawing II **Credits: (3-0) 3**

- ARTH 211 History of World Art I **Credits: (3-0) 3**
- ARTH 321 Modern and Contemporary Art **Credits: (3-0) 3**
- ARTH 491 Independent Study **Credits: 1 to 9**
- ARTH 492 Topics **Credits: 1 to 6**

#### **English:**

- ENGL 210 Introduction to Literature **Credits: (3-0) 3**
- ENGL 212 World Literature II **Credits: (3-0) 3**
- ENGL 221 British Literature I **Credits: (3-0) 3**
- ENGL 222 British Literature II **Credits: (3-0) 3**
- ENGL 241 American Literature I **Credits: (3-0) 3**
- ENGL 242 American Literature II **Credits: (3-0) 3**
- ENGL 250 Science Fiction **Credits: (3-0) 3**
- ENGL 300 The Literary Experience of Nature **Credits: (3-0) 3**
- ENGL 330 Shakespeare **Credits: (3-0) 3**
- ENGL 343 Selected Authors **Credits: (1-0) 1**
- ENGL 350 Humor in American Culture **Credits: (3-0) 3**
- ENGL 360 Studies in European Literature **Credits: (3-0) 3**
- ENGL 374 Studies in American Literature **Credits: 1 to 3**
- ENGL 383 Creative Writing **Credits: (3-0) 3**
- ENGL 391 Independent Study **Credits: 1 to 3**
- ENGL 392 Topics **Credits: 1 to 3**

#### **Foreign Language:**

- CHIN 101 Introductory Chinese I **Credits: (4-0) 4**
- CHIN 102 Introductory Chinese II **Credits: (4-0) 4**
- GER 101 Introductory German I **Credits: (4-0) 4**
- GER 102 Introductory German II **Credits: (4-0) 4**
- SPAN 101 Introductory Spanish I **Credits: (4-0) 4**
- SPAN 102 Introductory Spanish II **Credits: (4-0) 4**

#### **History:**

- HIST 121 Western Civilization I **Credits: (3-0) 3**
- HIST 122 Western Civilization II **Credits: (3-0) 3**

#### **Humanities:**

- HUM 100 Introduction to Humanities **Credits: (3-0) 3**
- HUM 200 Connections: Humanities & Technology **Credits: (3-0) 3**
- HUM 291 Independent Study **Credits: 1 to 4**
- HUM 292 Topics **Credits: 1 to 3**
- HUM 350 American Social History **Credits: (3-0) 3**
- HUM 375 Computers in Society **Credits: (3-0) 3**
- HUM 491 Independent Study **Credits: 1 to 4**
- HUM 492 Topics **Credits: 1 to 3**

#### **Music:**

- MUAP 200 Applied Music-Voice **Credits: 1 to 4**
- MUAP 201 Applied Music-Voice **Credits: 1 to 4**
- MUS 100 Music Appreciation **Credits: (3-0) 3**
- MUS 110 Basic Music Theory I **Credits: 2 to 4**
- MUS 217 Music in Performance I **Credits: (3-0) 3**

- MUS 317 Music in Performance II **Credits: (3-0) 3**

#### **Philosophy:**

- PHIL 100 Introduction to Philosophy **Credits: (3-0) 3**
- PHIL 200 Introduction to Logic **Credits: (3-0) 3**
- PHIL 220 Introduction to Ethics **Credits: (3-0) 3**
- PHIL 233 Philosophy and Literature **Credits: (3-0) 3**

#### **Social Sciences**

##### **Anthropology:**

- ANTH 210 Cultural Anthropology **Credits: (3-0) 3**

##### **Geography:**

- GEOG 101 Introduction to Geography **Credits: (3-0) 3**
- GEOG 210 World Regional Geography **Credits: (3-0) 3**
- GEOG 212 Geography of North America **Credits: (3-0) 3**
- GEOG 400 Cultural Geography **Credits: (3-0) 3**
- GEOG 492 Topics **Credits: 1 to 3**

##### **History:**

- HIST 151 United States History I **Credits: (3-0) 3**
- HIST 152 United States History II **Credits: (3-0) 3**
- HIST 492 Topics **Credits: 1 to 4**

##### **Political Science:**

- POLS 100 American Government **Credits: (3-0) 3**
- POLS 250 World Politics **Credits: (3-0) 3**
- POLS 350 International Relations **Credits: (3-0) 3**
- POLS 407 Environmental Law & Policy **Credits: (3-0) 3**
- POLS 492 Topics **Credits: 1 to 3**

##### **Psychology:**

- PSYC 101 General Psychology **Credits: (3-0) 3**
- PSYC 319 Teams and Teaming **Credits: (1-0) 1**
- PSYC 323 Human Develop Through the Lifespan **Credits: (4-0) 4**
- PSYC 331 Industrial and Organizational Psychology **Credits: (3-0) 3**
- PSYC 391 Independent Study **Credits: 1 to 3**
- PSYC 392 Topics **Credits: 1 to 3**
- PSYC 451 Psychology of Abnormal Behavior **Credits: (3-0) 3**
- PSYC 461 Theories of Personality **Credits: (3-0) 3**

##### **Sociology:**

- SOC 100 Introduction to Sociology **Credits: (3-0) 3**
- SOC 150 Social Problems **Credits: (3-0) 3**
- SOC 250 Courtship and Marriage **Credits: (3-0) 3**
- SOC 351 Criminology **Credits: (3-0) 3**
- SOC 391 Independent Study **Credits: 1 to 3**
- SOC 392 Topics **Credits: 1 to 3**
- SOC 411 Licit and Illicit Drugs **Credits: (3-0) 3**
- SOC 420 Alcohol Use and Abuse **Credits: (3-0) 3**

**B. All degree candidates must complete**

- ENGL 101 Composition I **Credits: (3-0) 3**
- ENGL 279 Technical Communications I **Credits: (3-0) 3**
- ENGL 289 Technical Communications II **Credits: (3-0) 3**

These courses cannot be used to meet the humanities and social sciences requirements.

**D. Electives:**

Free Electives vary with the individual department. Any course may be selected which is at freshman level or higher (i.e. 100 level or higher). ROTC credits may be accepted, depending on the number of degree electives available in each department.

**E. Science Electives:**

Courses may be selected —from biology, chemistry, geology, physics, or atmospheric science.

## Admission - Undergraduate

### Authorization for Individual Institutional Policies

Each university may adopt specific admission regulations, consistent with law and the requirements set by the Board of Regents, as may be required for each school or program to assure acceptable student preparation and enrollment levels. A copy of such regulations and any subsequent amendments shall be filed with the Executive Director and shall be subject to review by the Board of Regents.

### Admissions Requirements

The Board of Regents (BOR) requires that all students meet the minimum course requirements for admission to the South Dakota School of Mines and Technology. These are described below under South Dakota Board of Regents Minimum Undergraduate Admissions Requirements. In addition, The Board of Regents approved the following requirements for admission to the School of Mines:

**School of Mines will automatically accept for admission students who:**

obtain an ACT composite score of at least 25 AND obtain an ACT math subscore of at least 25 (or SAT-I equivalent score)

**OR**

obtain a high school GPA of at least 3.50 on a 4.0 scale AND have taken four years of higher-level mathematics (i.e., algebra, geometry, trigonometry, calculus)

School of Mines will **review and consider for acceptance** students who meet BOR requirements

**AND**

obtain an ACT composite score of at least 21 (or equivalent SAT-I score)

**OR**

obtain an ACT math subscore of at least 21 (or equivalent SAT-I score)

**OR**

achieve a high school GPA of at least 2.75 on a 4.0 scale.

All applicants not meeting the admission requirements listed above will be reviewed by the Admissions Committee. The committee considers high school curriculum (special consideration is given to math and science coursework), grades, and test scores.

### South Dakota Board of Regents Minimum Undergraduate Admissions Requirements

#### A. Baccalaureate Degree Admissions for High School Graduates

For admission to baccalaureate degree programs, high school graduates must:

meet the minimum course requirements with an average grade of C (2.0 on a 4.0 scale);

**OR**

demonstrate appropriate competencies in discipline areas where course requirements have not been met;

**AND**

rank in the top 60 percent of their high school graduating class;

**OR**

obtain an ACT composite score of 18 (SAT-I score of 870) or above;

**OR**

obtain a high school GPA of at least 2.6 on a 4.0 scale.

School of Mines ACT CODE - 3922

School of Mines SAT CODE – 6652

### Minimum Course Requirements

All baccalaureate or general studies students under twenty four (24) years of age, including students transferring with fewer than twenty-four (24) credit hours, must meet the following minimum high school course requirements:

Four years of English - Courses with major emphasis upon grammar, composition, or literary analysis. One year of debate instruction may be included to meet this requirement.

Three years of advanced mathematics - algebra, geometry, trigonometry or other advanced mathematics including accelerated or honors mathematics (algebra) provided at the 8th grade level; not included are arithmetic, business, consumer, or general mathematics or other similar courses.

Three years of laboratory science — Courses in biology, chemistry, or physics in which at least one (1) regular laboratory period is scheduled

each week. Accelerated or honors science (biology, physics, or chemistry) provided in the 8th grade shall be accepted. Qualifying physical science or earth science courses (with lab) shall be decided on a case-by-case basis.

Three years of social studies — History, economics, sociology, geography, government — including U.S. and South Dakota, American Problems, etc.

At the time of admission to a South Dakota Board of Regents university, it is expected that students will have basic keyboarding skills and have had experience in using computer word processing, database and spreadsheet packages, and in using the Internet or other wide-area networks. These expectations may be met by high school coursework or demonstrated by some other means. Incoming students that are assessed and found deficient in this area may be required to complete specific computer skills courses.

One year of fine arts for students graduating from South Dakota high schools – Art, theatre, or music (appreciation, analysis, or performance). Documented evidence of high school level noncredit fine arts activity will be accepted for students graduating from high schools in states that do not require completion of courses in fine arts for graduation.

### **Alternate Criteria for Minimum Course Requirements**

Students who do not successfully complete four years of English may meet minimum course requirements through one of the following:

An ACT subtest score of 18 or above;

An Advanced Placement Language and Composition or Literature and Composition score of 3 or above.

Students who do not successfully complete three years of advanced mathematics may meet minimum course requirements through one of the following:

An ACT mathematics subtest score of 20 or above;

An Advanced Placement Calculus AB or Calculus BC score of 3 or above.

Students who do not successfully complete three years of laboratory science may meet minimum course requirements through one of the following:

An ACT science reasoning subtest score of seventeen (17) or above;

An Advanced Placement Biology, Chemistry, or Physics B score of 3 or above.

Students who do not successfully complete three years of social studies may meet minimum course requirements through one of the following:

An ACT Social Studies/Reading subtest score of seventeen (17) or above;

An Advanced Placement Microeconomics, Macroeconomics, Comparative or United States Government and Policies, European or United States History, or Psychology score of 3 or above.

Students graduating from South Dakota high schools that do not successfully complete one year of fine arts may demonstrate fine arts knowledge or competency through the following:

An Advanced Placement History of Art, Studio Art drawing, or general portfolio or Music Theory score of 3 or above.

### **Non-Traditional Students**

For purposes of admission, a degree seeking student who has attained the age of 24 and has not previously attended any post-secondary institution is classified as a non-traditional student. Non-traditional students who are high school graduates or have completed the general equivalency diploma (GED) will be admitted.

### **Non-High School Graduates**

- Students who are not high school graduates and have obtained an ACT composite score of 21, ACT English sub-test score of at least 21, mathematics sub-test score of at least 21, and social studies/reading and science reasoning sub-test scores of at least 21, and meet any university determined requirements for admission will be admitted.  
OR
- Students who are not high school graduates and have completed the general equivalency diploma (GED) with total cumulative standard test scores for all five test items totaling 2250 with all test scores in the upper 50th percentile.
- Non-traditional students who do not fit within the above categories will be considered for admission based on life experience and other evidence of success. Applications will be reviewed by the SDSM&T Admissions Committee. An applicant accepted under this section will be placed on a one semester probationary status. The Admissions Committee reserves the right to impose additional conditions.

### **Regents Scholars**

South Dakota high school graduates completing the following high school courses with no final grade below a "C" (2.0 on a 4.0 scale) and an average grade of "B" (3.0 on a 4.0 scale) shall be designated as Regents Scholars and shall be eligible to receive a Regents Scholar Diploma upon request by a high school administrator to the Department of Education and Cultural Affairs. High school graduates designated as Regents Scholars automatically are admitted to all six public universities. (Regent Scholars still need to submit the admission application.)

- **4 units of English:** Courses with major emphasis upon grammar, composition, or literary analysis; one year of debate instruction may be included to meet this requirement.

- **4 units of algebra** or higher mathematics: algebra, geometry, trigonometry, or other advanced mathematics including accelerated or honors mathematics (algebra) provided at the eighth grade level; not included are arithmetic, business, consumer or general mathematics, or other similar courses.
- **4 units of science including 3 units of approved laboratory science:** Courses in biology, chemistry, or physics in which at least one (1) regular laboratory period is scheduled each week. Accelerated or honors science (biology, physics, or chemistry) provided in the eighth grade shall be accepted. Qualifying physical science or earth science courses (with lab) shall be decided on a case-by-case basis.
- **3 units of social studies:** History, economics, sociology, geography, government—including U.S. and South Dakota, American Problems, and so on.
- **2 units of a modern (including American Sign Language) or classical language**
- **1 unit of fine arts:** Effective fall 2002 for students graduating from South Dakota high schools in: Art, theatre, or music appreciation, analysis, or performance.
- **1/2 unit of computer science:** Students will have basic keyboarding skills and have had experience in using computer word processing, database and spreadsheet packages, and in using the Internet or other wide-area networks.

### **Readmission Procedures**

A student who has interrupted attendance by two (2) or more semesters must submit an application for readmission and pay the application fee. Any student not under academic or disciplinary suspension will be automatically readmitted. Applications from students to have their academic or disciplinary suspension overturned or terminated early must be forwarded to the university's Academic Appeals Committee.

### **Undergraduate Transfer Admission**

#### **A. Transfers to Baccalaureate Programs**

Students under twenty-four (24) years of age transferring into baccalaureate degree programs with fewer than twenty-four (24) transfer credit hours must meet the baccalaureate degree admission requirements. Students with twenty-four (24) or more transfer credit hours with a GPA of at least 2.75 are automatically accepted into baccalaureate degree programs. Transfer students with GPAs less than 2.75 will be considered on a case-by-case basis by the SDSM&T Admissions Committee. If students are applying for federal financial aid, they must meet federal guidelines for transfer students.

#### **Technical Institute and Community College Credits**

Technical Institute courses are designed to prepare students to enter the workforce for careers requiring less than a baccalaureate degree. Acceptance of these courses for credit at the South Dakota public universities is strictly the function of the receiving institution. Students who wish to transfer credits to a South Dakota public university for programs other than the Bachelor of Applied Technical Science degree not available through the School of Mines should contact the Admissions Office of that desired university for an evaluation of their program objectives and technical institute transcript. An individual evaluation of course credits will be made by the receiving public university in accordance with institutional and Board of Regents' policy.

Total transfer credit for work at a junior, community college (2 year), and/or two-year technical college may not exceed one-half of the hours required for completion of the baccalaureate degree at the accepting institution. Students who have completed more than the acceptable semester hours of junior, community, or technical college work may apply completed, transferable courses to specific course requirements and thereby may not be required to repeat the courses. The semester hours of credit for those additional courses may not be applied toward the minimum credit hours required for the degree.

#### **B. Students who Transfer to Associate Programs**

Students younger than twenty-four (24) years of age transferring into associate degree programs with fewer than 12 transfer credit hours must meet the associate degree admission requirements. Students with 12 or more transfer credit hours with a GPA of at least 2.0 may transfer into associate degree programs. If students are applying for federal financial aid, they must meet federal guidelines for transfer students.

#### **C. Students from Accredited Colleges or Universities**

At the discretion of each university, students may be accepted by transfer from other colleges within or outside of the state; preferential consideration shall be given to applicants from institutions which are accredited by their respective regional accrediting association. Advanced standing shall be allowed within the framework of existing rules in each college.

#### **D. Students from Non-Accredited Colleges**

A university may refuse to recognize credits from a non-accredited college or may admit the applicant on a provisional basis and provide a means for the evaluation of some or all of the credits. The validation period shall be no less than one (1) semester and no longer than one (1) academic year.

E. An applicant for admission to the South Dakota School of Mines and Technology is considered a transfer applicant if he/she has enrolled for any college level work, full or part-time, since graduation from high school. The applicant must be in good standing and eligible to return to all colleges/universities attended. In general, a 2.75 or greater GPA in courses attempted at other institutions is expected. Applicants from accredited institutions ordinarily are granted credit toward their degree for work satisfactorily completed at the previous institutions, provided such courses are equivalent or comparable to those required in the program an applicant is considering at School of Mines. Credits from institutions which are not accredited by a regional accrediting association will be provisional and subject to validation. No credit is allowed for remedial courses.

**F. Former Students**

A student returning to the institution or a student who has attended another higher education institution in the Board of Regents system is required to pay the application fee and, he or she must also submit an application for readmission and other required documents if he or she has interrupted attendance by two (2) or more semesters. A former student shall be considered as a transfer student if he or she has attended another institution during the period of interruption of attendance.

**G. Suspended Students**

A transfer applicant under academic suspension from the last college attended shall not be considered for admission during the period of suspension or, if suspended for an indefinite period, until one (1) semester has passed since the last date of attendance at the previous school. A system transfer student must first be reinstated to their previous institution prior to seeking admission to the School of Mines.

**H. Disciplined Students**

A transfer applicant under disciplinary suspension shall not be considered for admission until a clearance and a statement of the reason for suspension is filed from the previous institution. The university shall take into account the fact of the previous suspension in considering the application.

**Special (Non-degree Seeking) Students**

A prospective student at South Dakota School of Mines and Technology who wishes to be classified as a special student must complete the Application for Non-degree Seeking Students. Non-degree seeking students are ineligible for all federal financial aid programs. Non-degree seeking students must submit an official copy of their previous college transcript(s) if necessary to verify prerequisites.

**Nursing at the School of Mines**

South Dakota School of Mines and Technology offers courses that meet requirements for nursing at South Dakota State University (4-year baccalaureate degree B.S.N.) and the University of South Dakota (2-year associate degree A.D.N.).

Students interested in earning a nursing degree from SDSU or USD need to apply to the degree granting university. For more information visit: <http://sdmines.sdsmt.edu/nursing>.

**Dual Enrollment of High School Students**

A high school student wishing to take courses at School of Mines should begin by contacting the Admissions Office at School of Mines and then the Principal's Office or Guidance Office at the high school he or she currently attends to receive the high school's approval to participate. This approval should accompany the School of Mines Admissions Application. Please refer to the legislative SDCL 13-28-37, enacted by the South Dakota Legislature in 1990. This bill states the following: "Postsecondary enrollment—Responsibility for cost—Failing grade eliminates eligibility. Any student in grades ten, eleven and twelve may apply to an institution of higher education or a postsecondary vocational education institution as a special student in a course or courses offered at the institution of higher education or postsecondary vocational education institution. The student shall obtain the school district's approval of the post-secondary course or courses prior to enrolling. If approved, the student shall receive full credit toward high school graduation as well as post-secondary credit for each postsecondary course. The resident school district may pay all or part of the tuition and fees for a course approved for credit toward high school graduation in accordance with this section. The student is responsible for any tuition and fees not paid by the resident school district and for any other costs involved with attending a postsecondary institution. If a failing grade is received in a postsecondary course under this section, the student receiving the failure is no longer eligible to enroll for post-secondary courses under this section."

**Additional Admissions Policies and Practices**

Institutions authorized by the Board of Regents to offer graduate study programs may admit students selected according to regulations established by each faculty. A graduate student will be defined as one who has been accepted into a graduate school.

All entering students seeking an associate or baccalaureate degree must provide valid Enhanced ACT scores or must take the ACT COMPASS examination in the areas of writing skills, mathematics, and reading. All non-degree seeking students enrolling in English and mathematics courses must provide Enhanced ACT scores or must take the ACT COMPASS examination in the areas of writing skills and mathematics.

Students transferring within the South Dakota Board of Regents system will be allowed to transfer their placement test scores and continue their sequence of courses in English and/or mathematics.

The placement process will be consistent for all Regental institutions.

## Applications and Procedures

### Application for Tuition and Fee Reductions and Scholarships Established by the Legislature

Students should contact the Admissions Office for information on eligibility for tuition and fee reductions and scholarships established by the Legislature.

### Application Submission

An applicant for admission must submit the required application for admission and the necessary official transcript or transcripts and other required documents to the Office of Admissions (501 E. Saint Joseph Street, Rapid City, SD 57701).

### Records Required

Applicants who are twenty-one (21) years of age or younger must submit Enhanced ACT (or SAT-I) results, an official high school transcript, if a high school graduate, or proof of GED and an official transcript for all previous college work as part of their application. Applicants who are older than twenty-one (21) years of age and who do not have valid ACT / SAT-I exam results, or who have not taken the exams are not expected to take the exam. However, they are required to submit an official high school transcript, if a high school graduate, and an official transcript for all college work.

Applicants should also submit any other records, data, or letters required to support eligibility for admission, including competency test scores. SAT scores will be converted to ACT equivalencies according to a conversion table approved by the Board of Regents. Note: An official transcript is one that bears the original seal and signature of the official in charge of records at that institution.

### Preadmission Immunization Requirements

In accordance with state law, every student (graduate and undergraduate) who has been admitted to a post-secondary institution - either public or private – in the state of South Dakota **who meets established criteria is obliged to demonstrate immunity to measles, mumps, and rubella.**

Relevant criteria (the key factors which drive the need for compliance) are delineated below:

Age: students born on or after January 1, 1957 must comply; those born prior to this date are excused.

Course schedule: students who register for two or more credit-bearing classes – and at least one course involves face-to-face contact on a weekly basis for multiple weeks – are obliged to comply. This includes participation at all campuses, centers (including University Center, Capital University Center, and West River Higher Learning Center), and off-campus meeting locations.

Academic background: students who have completed prior collegiate coursework *in the state of South Dakota* (initiated prior to July 1, 2008) are excused from compliance. Note: credits earned through distance learning, dual credit agreements, and exam/validation do not qualify.

Acceptable evidence of immunity to *each disease* includes:

Immunization record which specifies administration of two doses of vaccine; Medical laboratory report that verifies presence of disease-specific antibodies in the blood (i.e., positive blood titer); and /or, documentation of disease state as diagnosed by a qualified physician.

The law recognizes that special circumstances may preclude ability to demonstrate compliance as detailed above. Those students for whom vaccination presents a threat to health/well-being and those who adhere to a religious doctrine that opposes immunizations may petition for a permanent exemption or temporary waiver as appropriate. Forms are available at: <http://sdmines.sdsmt.edu/studentlife/forms>. Please note: the statute does *not* allow for philosophical objections.

### Freshman Checklist

- Submit application for admission.
- Enclose non-refundable application fee with application for admission (\$20.00).
- ACT or SAT I scores must be on file in the Admissions Office.
- Applicants must arrange to have an official copy of their high school transcript forwarded to the **Office of Admissions (501 E. Saint Joseph Street, Rapid City, SD 57701)**, after their junior year is complete and grades have been recorded. A final transcript will also be necessary in order to verify final class rank, graduation, and satisfaction of the minimum course requirements for admission to South Dakota Public Higher Education Institutions.
- Prospective freshmen desiring scholarship consideration must be accepted for admission prior to the first working day in February.

## Transfer Checklist

- Application for admission.
- Non-refundable application fee of \$20.00.
- An official transcript from each postsecondary institution attended. (Sent by the institution attended directly to the Office of Admissions (501 E. Saint Joseph Street, Rapid City, SD 57701))
- All applicants must submit a high school transcript, or other proof of graduation from high school; or, if not a high school graduate, they must submit copies of their high school equivalency/GED scores and an official transcript of high school work completed.
- Applicants younger than twenty-one (21) who have completed less than 24 semester credits of college work must submit official copies of SAT I or ACT scores in addition to the above documents.
- Applicants who will be less than 21 years of age at the beginning of the semester for which they are applying for admission, and who have completed less than 24 credit hours of college coursework must meet the minimum course requirements for admission to SD Public Higher Education Institutions. (See "South Dakota Board of Regents minimum Undergraduate Admission Requirements.")

Transfer applicants will be notified of their admission status at School of Mines shortly after all of the above documents have been submitted. No transfer credit evaluation will be made until "final" college/university transcripts are on file. Transfer credit evaluation is made by the Office of the Registrar and Academic Services in consultation with the head of the academic department in which the applicant intends to major.

## Undergraduate International Student Admissions

### To be considered for admission, international students must meet the following requirements:

1. Rank in the upper half of secondary school graduation class.
2. Have a 2.75 (B) grade average if transferring from a college or university in the United States.
3. Be proficient in English or attend and complete an approved intensive English as a Second Language (ESL) program.
4. SAT or ACT scores OR submit recommendation letters from two teachers or professors familiar with the students' academic work.
5. Be financially self-sustaining. (Admission to School of Mines is not dependent on the ability to show adequate financing for education, but the I-20 will not be issued without this information.)

The following items are necessary to be considered for admission to the School of Mines. If you are admitted, the form I-20 or DS-2019 is necessary for admission to the United States for college attendance. The U.S. Embassy or Consulate website in your country will supply detailed information on the application process for the required student visas. This information may also be available from an EducationUSA office, which may be located near the Embassy or Consulate <http://www.educationusa.state.gov/>. The State Department offers general information on visa applications at: <http://travel.state.gov/>.

1. A completed application submitted prior to June 15 (fall) or November 1 (spring) and the State of South Dakota application fee of \$20.00. (The application will not be processed until the \$20.00 US fee is paid.) The deadline for the application is at least 10 weeks prior to the beginning of the term for which admission is desired if the student is outside the U.S.
2. Academic credentials (translated into English). All documents submitted to School of Mines to substantiate a request for admission must be certified by an official school or governmental seal as originals or certified copies. An academic department may require submission of academic credentials to an independent credential evaluation service, the charge for which will be paid by the student. School of Mines only accepts credential evaluations from specified organizations. Please contact the Admissions Office or the Ivanhoe Center at [Ivanhoe@sdsmt.edu](mailto:Ivanhoe@sdsmt.edu).
3. English proficiency for students from countries in which English is not the native language must be verified by the TOEFL (Test of English as a Foreign Language) examination that is available through the Educational Testing Service (ETS). The results must be sent to: International Admissions South Dakota School of Mines and Technology 501 E. Saint Joseph Street Rapid City, SD 57701-3995

A TOEFL score of 530 (paper-based), 197 (computer-based), or 71 (Internet based) or better is required for undergraduate applicants. Students who are admitted may be required to take an English proficiency or placement test upon arrival. Information on worldwide test centers for the TOEFL, as well as registration information, can be obtained by contacting any U.S. Embassy or Consulate or by writing to Test of English as a Foreign Language, ETS, Princeton, NJ 08540, or by visiting their website at: [www.toefl.org](http://www.toefl.org).

Other English proficiency examinations, such as the IELTS, will be considered on an individual basis.

4. SAT or ACT score, OR the applicant may submit recommendation letters from two (2) professors or instructors familiar with the academic performance of the applicant.

5. **Proof of Financial Responsibility.** Admission to School of Mines is not dependent on the ability to show adequate financing for education, but the I-20 will not be issued without this information. The United States Citizenship and Immigration Service (USCIS) requires that a U.S. college or university must verify that the student is able to pay all educational and incidental expenses before issuing the form I-20 or DS-2019.

The international applicant must provide a statement of finances (in English). This includes a financial (bank) statement from the student or sponsor, which must be verified by a bank official. The bank statement must show the actual amount—or more—that is available to the student. A statement that says "ample funds" is not acceptable. If the student has a financial sponsor, a letter or affidavit of support must accompany the financial statement. If the sponsor is a government agency, a letter of award and instructions for invoice procedures should be sent. International students are not eligible for School of Mines or federal loan programs and should not apply for such financial assistance.

6. International students must attend the school specified on their visa or they may be refused admittance to the United States. A student entering the United States for study must maintain his/her status. More information is available at the Ivanhoe International Center. Prospective students should not enter the United States on a B-1 or B-2 visitor's visa, as the USCIS will not approve a change to the F-1 student visa. International students must not, under any circumstances, enter the United States with a WT if they are planning to become a full-time student. The WT status cannot be changed or extended, under any circumstances, once the student is in the United States. U.S. government reporting requirements have been added for international students (F and J status) have increased in recent years. As a result of the regulations that became effective on January 1, 2003, the Family Educational Rights and Privacy Act (FERPA) is waived for F and J students in respect to these specific reporting requirements. The regulations will be strictly enforced by the appropriate bureau(s) within the US Department of Homeland Security (DHS) and information will be reported electronically to DHS via Student and Exchange Visitor Information System (SEVIS). The consequences to students for non-compliance with these regulations are severe. For more information, e-mail the Ivanhoe Center at [Ivanhoe@sdsmt.edu](mailto:Ivanhoe@sdsmt.edu) or go to <http://international.sdsmt.edu>.

Each international student (and any dependents accompanying him/her to the United States) is REQUIRED to enroll in the Major Medical Hospitalization/Surgical Insurance Plan provided through South Dakota School of Mines and Technology. No outside policies will be accepted as substitutes. The only exception to this rule is if the student is covered by his/her home country (documentation of this policy is required). Life insurance is also recommended.

### **Electronic University Consortium**

In fall 2000, the Electronic University Consortium (EUC) came online at: [www.WorldClassEducation.org](http://www.WorldClassEducation.org). The EUC provides a single connection point for distance education offerings from South Dakota School of Mines and Technology, as well as our sister institutions South Dakota State University, University of South Dakota, Dakota State University, Northern State University, and Black Hills State University. Students from throughout the world are able to register for and participate in classes offered via the Internet from any of these institutions. Courses offered by two-way interactive video and by correspondence are also listed on the EUC.

### **Current Reduced Tuition Programs for Non-Residents**

The current non-resident tuition rate is 150 percent of the resident rate: \$149.70 per credit hour compared to \$99.80. For more information, contact the Cashier's Office at (605) 394-2372 or e-mail [cashier@sdsmt.edu](mailto:cashier@sdsmt.edu).

Reduced tuition is available for non-resident first-time freshmen, new transfers, and international students. Those undergraduate students will qualify for a rate of 150 percent of what residents pay. Students already enrolled in the public university system prior to summer 2006 will not be eligible for the new non-resident rate. Tuition assistance is also available to National Guard members, ROTC cadets, South Dakota State Employees, certain elementary and secondary school teachers and vocational instructors, and persons 65 years of age or older. Graduate students who hold a state contract for an assistantship or fellowship may also be entitled to special reduced tuition and should contact the Graduate Education Office at (605) 394-1206.

For current tuition information see the website: [www.sdsmt.edu](http://www.sdsmt.edu).

### **Minnesota Reciprocity**

Students from Minnesota can currently come to the South Dakota School of Mines and Technology at a comparable rate to Minnesota resident tuition under the Minnesota Reciprocity agreement. To apply, or for more information: [www.sdbor.edu/policy/5\\_FinanceBusiness/documents/5-5-1.pdf](http://www.sdbor.edu/policy/5_FinanceBusiness/documents/5-5-1.pdf).

### **Resident and Nonresident Classification of Students**

#### **Purposes of Classification**

Each person who applies for admission to a university shall be classified as a resident or a nonresident for admissions and tuition and fees purposes (See Policy 2:3 Admissions and Policy 5:5 Tuition and Fees).

### **Information, Burden of Establishing Residency, Reclassification**

- A. The decision shall be based upon information provided by the student and all other relevant information.
- B. The institution is authorized to require such written documents, affidavits, verifications, or other evidence as are deemed necessary to establish the residence of the student, including proof of emancipation, adoption, or appointment of a guardian.
- C. Students have the burden of establishing residency by clear and convincing evidence.
- D. Students may appeal the original classification decision by written petition to a reviewing body appointed by the chief executive officer of the institution within thirty (30) days after registration for that semester. The recommendation of the reviewing body shall be submitted to the chief executive officer for a decision. The decision of the chief executive officer shall be final, but students who have been classified as nonresidents retain full rights to petition the executive director of the South Dakota Board of Regents for reclassification after they have remained in South Dakota continuously for 12 months.
- E. After twelve (12) months continuous presence in South Dakota, students who were initially classified as nonresidents may petition for reclassification.
- F. Petitions for reclassification shall be filed with the Executive Director, who shall act upon them. The Executive Director shall report his disposition of such petitions to the Board at its regularly scheduled meetings. These reports shall be summarized in a manner consistent with the Family Educational Rights and Privacy Act.
- G. If a petition for reclassification is granted, the reduced tuition rate shall become effective with the first semester or session following the date on which the petition is granted. Students who fail to request resident status prior to a particular semester or session or to pursue a timely appeal shall be deemed to have waived any claim for reduced tuition for that semester or session.
- H. A student or prospective student who knowingly provides false information or refuses to provide or conceals information for the purpose of improperly achieving resident student status is subject to the full range of penalties, including expulsion, provided for by the Board of Regents.

### **Establishing Bona Fide Residency**

For tuition purposes, residence means the place where a person has a permanent home, at which the person remains when not called elsewhere for labor, studies or other special or temporary purposes, and to which the person returns at times of repose. It is the place a person has voluntarily fixed as the person's permanent habitation with intent to remain in such place for an indefinite period. A person, at any one time, has but one residence and a residence is not lost until another is gained.

- A. The residence of an un-emancipated person younger than twenty-one (21) years of age follows that of the parents or of a legal guardian who has actual custody of the person or administers the property of the person. In the case of divorce or separation, if either parent meets the residence requirements, the person shall be considered a resident.

Students who enter the state for the predominant purpose of attending a Board institution and who are under the custody of a guardian in fact, that is, a person who has been designated in writing by the students' parents or legal guardian to serve as their attorney in fact for purposes related to the individual unemancipated student's affairs, may file a residency petition with the Board at the time of admission.

- B. A person shall be classified as a resident student if the person has continuously resided in South Dakota for at least 12 consecutive months immediately preceding the first scheduled day of classes of the semester or other session in which the individual registers in the Regental system; except that unemancipated students whose parents established their residence in South Dakota for reasons not predominantly related to qualifying their children for reduced tuition, may be classified as residents, notwithstanding the fact that they have not resided in South Dakota for the requisite 12 months prior to the first scheduled day of classes.

If it appears that the parents of a person properly classified as a resident student under the provisions of this section have removed their residence from South Dakota, the person shall be reclassified to the status of nonresident unless the parents have been residents for the 12 months immediately preceding such removal. However, no such reclassification is effective until the beginning of a semester next following the removal.

- C. Physical presence in South Dakota for the predominant purpose of attending an institution of higher education controlled by the Board does not count in determining the 12-month period of residence. Absence from South Dakota to pursue postsecondary education does not deprive a person of resident student status.
- D. A person once properly classified as a resident student shall be deemed to remain a resident student so long as remaining continuously enrolled in the Regental system until the person's degree shall have been earned, subject to the provisions of (B) above.
- E. International students whose visas permit them to establish domiciles in the United States or its territories or protectorates may qualify for resident tuition in the same manner as United States citizens.

## Factors to Be Considered When Determining Whether Students Have Entered South Dakota for the Predominant Purpose of Attending a Public University

- A. The following factors shall be considered relevant in evaluating a requested change in a student's nonresident status and in evaluating whether the person's physical presence in South Dakota is for the predominant purpose of attending an institution of higher education controlled by the Board:
- The residence of an un-emancipated student's parents or guardians;
  - The site of the source of the student's income;
  - To whom a student pays taxes, including property taxes;
  - The state in which a student's automobile is registered;
  - The state issuing the student's driver's license;
  - Where the student is registered to vote;
  - The marriage of the student to a resident of South Dakota;
  - Ownership of property in South Dakota and outside of South Dakota;
  - The residence claimed by the student on loan application, federal income tax returns, and other documents;
  - Admission to a licensed profession in South Dakota;
  - Membership in civic, community, and other organizations in South Dakota or elsewhere; and
  - The facts and documents pertaining to the person's past and existing status as a student.
- B. The existence of one or more of these factors does not require a finding of resident student status, nor does the nonexistence of one or more require a finding of nonresident student status. All factors shall be considered in combination, and resident student status may not result from the doing of acts which are required or routinely done by sojourners in testate or which are merely auxiliary to the fulfillment of educational purposes.
- C. The fact that a person pays taxes and votes in the state does not in itself establish residence.
- D. Students who do not meet the requirements of this policy may still be classified as residents if their situation presents unusual circumstances and their classification is within the general scope of this policy.

### Retention of Residence While in Military Service

In determining the residence status for tuition purposes, it is presumed that persons in military service who list South Dakota as their "home of record" and who, immediately upon release, return to South Dakota to enter college shall be classified as residents.

### Tuition and Fees - Undergraduate

#### Tuition and Fees

The following rates became effective May 7, 2012 and are subject to change by Board of Regents action. For current information see the website: [www.sdsmt.edu](http://www.sdsmt.edu).

<b>Tuition and Fees</b>	<b>Resident</b>	<b>Non-Resident</b>
Undergraduate on-campus per semester credit	\$129.90	\$194.75*
Graduate on-campus per semester credit	\$196.80	\$416.55
University Support Fee - per credit	\$ 90.30	\$ 90.30
General Activity Fee - per credit	\$ 34.10	\$ 34.10

\*New students and transfers for Academic Year 2007 or after

\* Does not include Minnesota rates. For more information, please refer to Minnesota Reciprocity information.

See accompanying text for the description of fees for engineering and science courses as well as labs.

<b>Resident Hall Rent - per semester</b>	<b>Resident</b>	<b>Non-Resident</b>
Single Occupancy	\$1,734.65	\$1,734.65
Double Occupancy	\$1,549.95	\$1,549.95
Quad	\$1,763.15	\$1,763.15
Deluxe Quad	\$1,904.85	\$1,904.85

\* For residency information, contact the Admissions Office or refer to Board of Regents Policy at: [www.sdbor.edu/policy/5\\_FinanceBusiness/](http://www.sdbor.edu/policy/5_FinanceBusiness/).

Reduced tuition is available for non-resident first-time freshmen, new transfers, and international students. Those undergraduate students will qualify for a rate of 150 percent of what residents pay. Students already enrolled in the public university system prior to summer 2006 will not be eligible for

the new non-resident rate. Reduced tuition is also elementary and secondary school teachers and vocational instructors, and persons 65 years of age or older. Graduate students who hold a state contract for an assistantship or fellowship may also be entitled to special reduced tuition and should contact the Graduate Education Office at (605) 394-1206.

\*Students from Minnesota can currently come to the South Dakota School of Mines and Technology at a comparable rate to Minnesota resident tuition under the Minnesota Reciprocity agreement. To apply, or for more information: [www.sdbor.edu/policy/5\\_FinanceBusiness/documents/5-5-1.pdf](http://www.sdbor.edu/policy/5_FinanceBusiness/documents/5-5-1.pdf).

## **Fees**

### **Application Fee**

Non-refundable charge upon initial application for admission. \$20 undergraduate and \$35 graduate.

### **General Activity Fee**

A fee is assessed for each state-funded course for activities such as student organizations, cultural events, homecoming, student government, student newspapers, wellness center, intramurals student health services, and the Surbeck Student Center operational and debt expenses. The allocation of general activity fees is recommended to the president by students on the General Activity Fee Committee, and the president is the approving authority on how these fees are spent.

### **University Support Fee**

A fee assessed for each state-funded course is used to purchase equipment, materials, and services in support of instructional programs. It is also used to provide necessary services such as financial aid, counseling, catalogs and bulletins, student testing, administration, operating and maintenance costs, and student information system software.

### **Engineering and Science Fee**

The Engineering and Science Fee is used for maintaining accredited professional programs in engineering and technology. This fee is used for such needs as maintaining state-of-the-art classrooms and laboratories, operating the required senior capstone group design projects, and maintaining the embedded learning outcomes assessment programs now required for accreditation.

### **Lab Fee**

\$54.80 is charged for each laboratory course. The fee helps support the added costs associated with maintaining the laboratories.

### **Credit by Examination Fee**

This \$90.75 fee is charged for each course in which a student seeks credit by examination.

### **International Student Fee**

All international students enrolled on campus with an F-1 or J-1 visa shall be charged the International Student Fee each semester they are enrolled. This includes degree-seeking students, English as a Second Language (ESL) students, and foreign students enrolled under a cooperative agreement with a foreign institution.

### **Vehicle Registration Fee**

All motor vehicles parked on campus must be registered with the Campus Safety Office. Contact this office at (605) 394-2251 for options, amounts, and appropriate display of parking permit or [www.sdsmt.edu/services/facilities](http://www.sdsmt.edu/services/facilities).

### **Transcript Fee**

A transcript of credits is an authentic copy of the student's academic record. One complete transcript of credits is provided without charge to each student upon graduation. After that the charge is \$5.00 each, and \$2.50 each copy thereafter per request.

### **Payment Process**

All tuition and fees are required to be paid in full or other financial arrangement made with the Cashier's Office no later than September 6, 2012 for fall 2012 classes and January 22, 2013 for spring 2013 classes. For the student's convenience, electronic bill and payment services are provided. If no financial arrangement is made by these dates, a late charge will be assessed on the next day. Examples of other financial arrangements may include payment plans, deferments for financial aid, or third party payments. (For a deferment for financial aid, contact the Financial Aid Office.) Since summer semester add/drop periods vary, check with the Cashier's Office for final financial arrangement dates for add/drop courses. If no financial arrangement is made, enrollments shall be cancelled.

## **Late Payment Charge**

If tuition and fees are not paid before established due dates, late payment charges will be assessed. If financial obligations are not met when due, student may be administratively withdrawn for the university.

## **Indebtedness**

A student who is indebted to the university and does not satisfy financial obligations when due may be withdrawn after notice from the university and will not be permitted to register or receive a transcript of grades or a diploma until the indebtedness is paid. This applies to indebtedness for university tuition, room, board, fees, financial aid, and fines, but not to student organizations. If a student's account is placed with a collection agency, the student will be responsible for all collection costs, attorney's fees, and any other costs necessary for the collections of any unpaid balance.

## **Debit Card System**

The South Dakota School of Mines Grubby Gold Card is a money management system activated through each student's ID card. This account is similar to a checking account or a debit card. When you present your card to make a purchase at participating locations, on and off-campus, the amount will be immediately deducted from your account. Currently, Grubby Gold is accepted at select beverage and snack machines in Surbeck Center and in the dorms, at the bookstore, Hardrocker Café, Java City, washers and dryers in the dorms, copy machines at Surbeck Center and select vendors off campus.

To add money to your Grubby Gold account or check account balances and account history, just create a Grubby gold account online. Look for the link at <http://grubbygold.sdsmt.edu>. Self-register by using your student ID number and your name as it is printed on your student ID. If your parents, family or friends know your student ID number, they can also add money to your Grubby Gold account by using the guest deposit feature online.

## **Refunds**

### **Withdrawal Refunds Information**

Students who withdraw, drop out, or are expelled from School of Mines within the add/drop period (first 10 percent of term, commonly referred to as the census date) receive a 100 percent refund of tuition and course-related fees. Students who withdraw, drop out, or are expelled from the university after the add/drop period for the enrollment period for which they are assessed charges may be entitled to a refund of tuition, fees, and other institutional charges calculated through 60 percent of the enrollment period. The refund shall be determined by computing the percentage of an enrollment period remaining after the date of withdrawal times the tuition, fees, and other institutional charges originally assessed the student.

### **A student's withdrawal date is**

- 1) When the student began the withdrawal process or officially notified School of Mines of intent to withdraw by contacting School of Mines Academic and the Office of Enrollment Service, or
- 2) The midpoint of the period for a student who leaves without notifying School of Mines; or
- 3) at School of Mines option, the student's last documented date of academically related activity.

Federal Financial Aid Recipients: The U.S. Department of Education requires institutions to use the Return of Title IV Funds policy for students withdrawing from school and who are receiving Federal Title IV student financial aid. Title IV funds refers to the federal financial aid programs authorized under the Higher Education Act of 1965 (as amended) and includes the following Federal Student Aid programs: Subsidized and Unsubsidized Stafford Loan, Parent PLUS Loan, Grad PLUS Loan, Perkins Loans, Pell Grant, Academic Competitiveness Grant (ACG), National Science and Mathematics to Retain Talent Grant (SMART), Supplemental Educational Opportunity Grant (SEOG) and any other Federal Aid program enacted by Congress. Students are advised to review the information located at: <http://sdmines.sdsmt.edu/finaid/withdrawal>.

## **Financial Aid - Undergraduate**

### **Overview**

The following information is intended to be a brief overview of the financial aid process and programs at the School of Mines. More up to date and detailed information is available on our website at: <http://sdmines.sdsmt.edu/finaid>.

Students at the School of Mines benefit from over \$16 million in various forms of financial assistance from both within and outside the university, it is clear that many college students find it necessary to supplement their personal and family financial resources in order to attend college. The South Dakota School of Mines and Technology administers a comprehensive financial aid program to enable capable, qualified, and needy students to finance their college education with both need-based aid (grants, subsidized loans, and work-study) and non-need based aid (scholarships, outside agency assistance, unsubsidized loans, private alternative loans, etc.). However, the student should still be prepared to pay for a portion of college costs through savings from employment, and parents of dependent students are expected to assist with the student's cost of education to the extent to which they are able.

The School of Mines gives priority on a first come, first served basis in the awarding of the Federal Perkins Loan, Federal Supplemental Educational Opportunity Grant (SEOG) and Federal Work-Study (FWS) to students who's Free Application for Federal Student Aid (FAFSA) has been received by the FAFSA processor on January 1 and thereafter until funds are exhausted. Students who are eligible for the Federal Pell Grant, Federal Direct Loan, Federal Direct Grad PLUS Loan or the Federal Direct Parent PLUS Loan are awarded without regard to when the FAFSA is received for the school year the FAFSA is filed. The Financial Aid Office generally begins the Federal Student Aid awarding process for new incoming freshman by mid to late April.

#### I. General eligibility requirements for awarding Federal Student Aid

- A. Must have applied for admission in a School of Mines degree program
- B. Complete a new **FAFSA** each year to determine eligibility for Federal Student Aid Programs.
- C. Be a U.S. citizen or eligible non-citizen.
- D. Not be in default on a federal student loan or owe a federal student grant repayment.
- E. Male students born after December 31, 1959, must register with Selective Service.
- F. Follow the steps for reviewing your award letter at: [sdmines.sdsmt.edu/finaid/award.notification](http://sdmines.sdsmt.edu/finaid/award.notification) and to finalizing the aid awarded to you at [sdmines.sdsmt.edu/finaid/finalizing.aid](http://sdmines.sdsmt.edu/finaid/finalizing.aid)
- G. Complete the online School of Mines *Additional Information Form* contained within the links in item F.
- H. Report to the Financial Aid Office any aid assistance received that is not listed on the award letter, which includes, but is not limited to scholarships, Voc-Rehab, BIA/Tribal Assistance, etc.
- I. Be enrolled as a full-time student to receive full amount of aid awarded (indicate enrollment status on the **Additional Information Form** noted above) and notify the Financial Aid Office if the planned and/or actual enrollment changes at any time.
- J. Must maintain Satisfactory Academic Progress toward the completion of a School of Mines degree. Students who meet or exceed the standards as stated at: <http://sdmines.sdsmt.edu/finaid/SAP> can be assured of continued eligibility until the completion of their degree.
- K. Complete the Attendance Confirmation via WebAdvisor at least two weeks prior to every semester of attendance at Mines.

#### II. Financial aid programs

The School of Mines is a full participant in the Federal Student Aid Programs. Specific information about each program is available at: <http://sdmines.sdsmt.edu/finaid>. The student's School of Mines aid ward on WebAdvisor identifies the aid he or she is being awarded and provides information for finalizing the processing of the award.

##### A. Grants are gift aid based on financial need.

1. **The Federal Pell Grant** is awarded to students who have not yet completed their first bachelor's degree and is based on a federal formula used to analyze the information provided on the FAFSA.
2. **Federal Supplemental Educational Opportunity Grant (SEOG)** is awarded to Pell Grant eligible students based on the availability of funds.

##### B. Student loans provide an opportunity for students to borrow money for educationally related expenses. However, like any loan, they must be repaid according to the provisions of the promissory note. First time loan recipients are required to complete Entrance Loan Counseling as shown at: <http://sdmines.sdsmt.edu/finaid/EntranceCounseling>.

1. **The Federal Direct Subsidized and Unsubsidized Loan** programs are obtained from the Federal Government as the lender. For the Subsidized Direct Loan, the Federal Government pays accrued interest on behalf of the student during periods of at least half-time enrollment or other eligible deferment periods. However, with the Unsubsidized Direct Loan, the Federal Government does not pay the accrued interest on behalf of the student while enrolled in school or during available deferment periods, with interest accrual beginning at disbursement. For both the Sub and Unsub Direct Loans, payment on the principal balance is required to begin six months after the student graduates or is no longer enrolled at least half-time. Current interest information is available on our website.
2. **The Federal Perkins Loan** is a Federal Loan program administered by the School of Mines. The interest rate is fixed at 5 percent and repayment begins nine months after graduation or at least half-time enrollment ends.
3. **The Federal Direct Grad PLUS Loan** is available to graduate students (masters and Ph.D.) who have exhausted their eligibility for the Subsidized and Unsubsidized Stafford and Direct Loan programs. Monthly payments begin 60 days after the final disbursement for any academic year with a current fixed rate of 7.9 percent.
4. **The Federal Direct Parent PLUS** is borrowed on behalf of the parent's dependent student. Monthly payments begin 60 days after the final disbursement for any academic year with a current fixed interest rate of 7.9 percent.

##### C. Work opportunities for part-time employment.

1. **Federal Work-Study awards** are based on financial need as determined by the results of the FAFSA and the awarding policy of the School of Mines. Employment opportunities are available both on and off campus with off-campus positions focused on community service.

2. **Other employment opportunities** submitted by local employers or the South Dakota Job Service are regularly posted in the Surbeck Student Center.

#### D. **Scholarships from the School of Mines**

In order to be considered for incoming freshman scholarships at the School of Mines, prospective students must have been accepted for admission no later than the first business day in February prior to the year they plan to attend. The online admission application available at: [www.GoToMines.com/admissions/apply](http://www.GoToMines.com/admissions/apply) is all that is needed for scholarship consideration. An additional option is available to students who are considering attending multiple South Dakota public universities is to file the common South Dakota Public Higher Education Undergraduate Application for Admission, available at <https://apply.sdbor.edu/>. Regardless of which application you submit, all incoming freshman accepted for admission will be competitively evaluated for incoming freshman scholarships. At the School of Mines, students apply for and are awarded a "scholarship" without regard for specific donor funding. The Foundation Office then assigns the scholarship recipients to the various donors based on the donor's criteria.

1. **Four-Year Support Scholarships**

The most prestigious scholarship assistance on campus provides assistance for incoming freshmen with renewable support for three years provided the recipient maintains full time enrollment (must enroll in a minimum of 12 School of Mines credit hours each semester), complete 24 credit hours per academic year, maintain a 3.0 or higher cumulative grade point average (CGPA), and is continuing progress toward completion of their degree.

2. **National Merit Finalists**

The School of Mines offers a \$3,000 scholarship renewable for three years to National Merit Finalists who notify the National Merit Corporation via the PSAT/NMSQT that the School of Mines is originally their first-choice college. Full time enrollment (must enroll in a minimum of 12 School of Mines credit hours each semester), complete a minimum of 24 credit hours per academic year, maintain a 3.00 or higher CGPA and continuing progress toward completion of their degree are requirements for renewal.

3. **Two-Year Support Scholarships**

The Tech Challenge scholarship is renewable for one year provided the recipient maintains full time enrollment (must enroll in a minimum of 12 School of Mines credit hours each semester), complete a minimum of 24 credit hours per academic year, maintain a 3.0 or higher CGPA and continuing progress toward completion of their degree.

4. **Annual Scholarship Support**

Although students are generally not required to complete an application for departmental scholarships, current students are required to complete an application for annual, non-renewable scholarships awarded by the University Scholarship Committee that are based on academic performance at the School of Mines and scholarship criteria. Information on availability of the online scholarship application is provided to students late in the fall semester for scholarships to be awarded for the following academic year. Scholarship recipients must maintain full time enrollment (must enroll in a minimum of 12 School of Mines credit hours) for each semester of the award and maintain the CGPA as required by the scholarship. If the scholarship is major specific, the recipient must maintain enrollment in the appropriate coursework needed for that major.

#### E. **Graduate Student Support**

Graduate students should contact the Graduate Education Office at the School of Mines regarding available fellowships.

### III. **Carefully review your billing statement**

The Student Accounts Office will send an e-mail notification to the student's Mines e-mail account informing him or her of availability to access their billing statement before each semester and whenever there is a change to the student's account. Please pay attention to the amount owed and the payment guidelines set by the Business Office. Be advised that aid that requires the student's endorsement on a check and Work-Study awards will not appear on the billing statement.

### IV. **Disbursement of aid**

With the exception of Federal Work-Study, which is paid monthly, and some scholarships, which are paid according to the wishes of the donor, financial aid is either credited to the student's account or disbursed by check at the beginning of each semester, or after aid eligibility is determined, whichever is later. If the aid applied to the student's account exceeds institutional costs, he or she will either receive a cash disbursement (refund check) in the mail or the funds can be deposited directly to the student's bank account via Direct Deposit. Students can contact the Student Accounts Office for further information on Direct Deposit option. In the event that there are delays in disbursing of aid, students should always have available enough money to meet immediate expenses they might incur at the beginning of each semester, such as the purchase of books and supplies.

### V. **Multi-Institution Students**

At times it may be necessary to take classes at one of the other South Dakota Board of Regents universities in order to complete the student's degree requirements. Other than to sign up for classes through their School of Mines log on to WebAdvisor, no special arrangements need to be made in order to include those classes in their enrollment status for financial aid purposes at School of Mines. However, if the student plans to take classes at a non-Board of Regents school, they must contact the Financial Aid Office to determine if classes taken there can be used to fulfill degree

requirements at the School of Mines and to determine their overall semester enrollment status.

School of Mines scholarship and fellowship recipients must receive prior approval from the Financial Aid Director in order to use non-School of Mines credit hours to meet the full time School of Mines credit hour requirement for scholarship and fellowship disbursement.

#### VI. **Correspondence Studies**

The School of Mines does not offer courses via correspondence. However, students are advised to discuss possible options with the Financial Aid Director for receiving assistance to help pay for this type of coursework taken at another eligible institution.

#### VII. **Summer financial aid and effect on eligibility for the coming school year**

Students who are interested in receiving aid for the summer must have completed the FAFSA for the coming school year. Their aid award will be based on a summer, fall, and spring academic year. As a result, receiving aid for the summer will directly impact the amount of aid available for the fall and spring semesters. Per South Dakota Board of Regents policy, the number of credit hours taken during the summer term needed to maintain a particular enrollment status (full, 3/4, 1/2 or less than half time) is the same as what it is for the fall and spring semesters. Generally, students must carry at least a half-time course load of 6 credits for undergraduate and 4.5 for graduate students] to be eligible for summer financial aid. A School of Mines Summer Aid Application, which is available after March 31, must be completed before the student will be considered for summer aid.

#### VIII. **Withdrawal and refunds**

Due to circumstances that may or may not be beyond the student's control, it may become necessary to withdraw from all classes prior to the end of a particular semester. Depending on the withdrawal date, the student may be entitled to a full or partial refund of tuition and fees, tablet PC rental, and if contracting with the university, for room and board.

A withdrawal is considered to be official when the student comes to the Office of the Registrar and Academic Services, Room 216 of the O'Harra Building to initiate the process. If that is not possible, he or she may call (800) 544-8162, Ext. 2400 or local at (605) 394-2400. In the event that the student leaves school without notifying the Office of the Registrar and Academic Services, or simply never attends classes and receives a 0.00 GPA for the semester, the university has the option of considering the withdrawal date to be 1) the midpoint of the period of enrollment; 2) the last documented date of academically related activity; or 3) if he or she did not notify the Office of the Registrar and Academic Services due to circumstances beyond his or her control, the date relative to that circumstance, whichever is later. It is important that a student clearly state that he or she is withdrawing from all classes. Dropping a class and withdrawing from all classes have a different impact on a student's status with the university. If enrolled at more than one campus within the South Dakota Board of Regents university system, he or she must inform The Office of the Registrar and Academic Services staff whether the intent is to withdraw from all campuses, or just from the School of Mines.

Students who have requested a Financial Aid Consortium Agreement between the School of Mines and a non-Board of Regent institution and are using those credit hours to determine their enrollment status for financial aid, must be withdrawing from both institutions in order for their withdrawal from the School of Mines to result in a refund calculation. Please review the withdrawal procedures outlined elsewhere in the college catalog. Information is also available on our website at: <http://sdmines.sdsmt.edu/finaid/withdrawal>. Examples are provided regarding what refund a student could expect to receive based on when he or she withdraws.

#### IX. **Additional Information**

Requests for additional information should be directed to the Financial Aid Office, South Dakota School of Mines and Technology, 501 E Saint Joseph St., Rapid City, SD 57701-3995, or call locally (605) 394-2274, or toll free (877) 877-6044 or via e-mail at [FinancialAid@sdsmt.edu](mailto:FinancialAid@sdsmt.edu).

#### **Policies/Definitions**

##### **Academic Amnesty**

The goal of academic amnesty is to respond to the academic needs of matured individuals as they develop newly identified potential. Through the application of academic amnesty, the student's prior academic record can be excluded from current work under certain conditions.

##### **Eligibility**

The student must:

1. be an undergraduate, full-time or part-time, degree-seeking student at one of the universities in the South Dakota Regental system.
2. not have been enrolled in any Regental university for a minimum of three calendar years (nine (9) consecutive terms including fall, spring, and summer) prior to the most recent admission to the home institution. Exceptions may be granted in rare cases only by the Board of Regents Senior Administrator upon recommendation by the Vice President for Academic Affairs.
3. have completed a minimum of twenty-four (24) graded credit hours taken at any Regental university with a minimum grade point average of 2.0 for the twenty-four (24) credit hours after the most recent admission to the home institution.
4. not have earned a baccalaureate degree from any university.

5. not have been granted any prior academic amnesty at any Regental university.
6. submit a formal Academic Amnesty Petition to his or her home university following the procedures established by that university.

### **Conditions:**

1. Academic amnesty does not apply to individual courses. Academic amnesty may be requested for either (a) all previous post-secondary education courses, or (b) all previous post-secondary education courses at a specific institution, or (c) a specified time period not to exceed one academic year (fall/spring).
2. Academic amnesty, if granted, shall not be rescinded.
3. Courses for which academic amnesty is granted will:
  - a. remain on the student's permanent record.
  - b. be recorded on the student's undergraduate transcript with the original grade followed by an asterisk (\*)
  - c. not be included in the calculation of the student's grade point average because no credit is given.
  - d. not be used to satisfy any of the graduation requirements of the current degree program.
4. Academic amnesty decisions will be made by the student's home institution and will be honored by all other institutions within the South Dakota Regental system.
5. Universities outside of the South Dakota Regental system are not bound by the academic amnesty decisions made by the South Dakota Regental system.
6. Regental graduate programs and graduate professional schools may consider all previous undergraduate coursework when making admissions decisions.

The form to appeal for academic amnesty can be found at the following URL: [registrar.sdsmt.edu/docs/145192.pdf](http://registrar.sdsmt.edu/docs/145192.pdf)

### **Academic Calendar**

Institutions of higher education, under control of the South Dakota Board of Regents, shall operate on a common academic calendar with common periods during the summer term and the fall and spring semesters at each institution when classes are not in session. Academic calendars shall be designed a minimum of two years in advance with annual extensions recommended to the Executive Director by the Council of Presidents and Superintendents no later than the May meeting. Academic Calendar

### **Academic Freedom (Student) Rights**

The School of Mines and the South Dakota Board of Regents have a longstanding commitment to protecting those freedoms of inquiry and learning that are essential to the expansion of knowledge and the correction of error. This includes protections for student freedom in learning. In its relevant parts, Board of Regents policy, which applies to the School of Mines and to all other public universities, provides the following:

- A. To secure student freedom in learning, faculty members in the classroom and in seminar should encourage free and orderly discussion, inquiry and expression of the course subject matter. Student performance may be evaluated solely on an academic basis, not on opinions or conduct in matters unrelated to academic standards.
- B. Students should be free to take reasoned exception to the data or views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.
- C. Each institution shall establish an academic appeals procedure to permit review of student allegations that an academic evaluation was tainted by prejudiced or capricious consideration of student opinions or conduct unrelated to academic standards. These procedures shall prohibit retaliation against persons who initiate appeals or who participate in the review of appeals.
- D. Students are responsible for maintaining standards of academic performance established for each course in which they are enrolled.  
[www.sdbor.edu/policy/1-Governance/documents/1-11.pdf](http://www.sdbor.edu/policy/1-Governance/documents/1-11.pdf).

The School of Mines policy implementation of item C above reads as follows:

### **Academic Recognition for Undergraduate, Part-Time Students**

Undergraduate, part-time students taking fewer than 12 credits per term may be designated for academic recognition for part-time students at the end of the fall and spring terms. The academic recognition for part-time students designation is determined by the home university. The academic recognition for part-time students designation does not appear on the transcript.

To be awarded the academic recognition for part-time students designation, students must meet the following guidelines:

- Students must have completed at least 12 credits hours prior to the current semester at one or more Regental institution.
- The student must have earned at least 3 and up to 11 credit hours of 100-699 level courses during the term.
- Students must achieve a System Term GPA of at least 3.50.
- Students with F, I, U, RI or RU grades are not eligible regardless of System Term GPA attained.

### **Academic Terms Defined**

The School of Mines operates a fall, spring, and summer term. Fall and spring shall operate on a semester basis. Summer term begins the day after spring semester ends and continues until the day before fall semester begins.

A semester shall consist of a minimum of 15 weeks. The number of class days in a given semester shall be inclusive of those days set aside for registration, assessment/performance testing and final examinations but exclusive of holidays and days set aside for new student orientation. New student orientation may be concurrent with or prior to registration.

Academic guidelines require that all courses offered for credit must involve a minimum of 15 contact hours over 3 instructional days for each credit hour awarded.

Courses offered by distance education should have equivalent standards, rigor, student outcomes, substance and assignments as courses offered by face-to-face means. Distance education courses may be scheduled on a semester basis and require that students complete learning experiences on a particular timeline (i.e. each week). The required length for a distance education course is determined by course expectations and scheduling. The student will conclude the course upon completion of course requirements. Typically, a one credit hour course lasting for a semester equates to 45 hours of effort by the student.

### **Add/Drop (Courses) Period**

The drop/add period is the time period during which students may adjust their academic schedule for the term without financial or academic consequences. The last day of the drop/add period for a course is designated as the census date for that course and is the official date for enrollment reporting. The end of the drop and add period for standard and non-standard courses offered in a semester shall be the date the first 10 percent of the term ends or the day following the first class meeting, whichever is later. When calculating 10 percent of the term, breaks of five or more days are not included when counting the total number of days but Saturdays, Sundays, and holidays are. Student registrations can only be added to courses after the end of the drop and add period by approval of the chief academic officer of the university.

### **Adding Courses Deadline**

1. Students may add daytime or night courses to their schedules through the first 10 percent of the term. When calculating 10 percent of the term, breaks of five or more days are not included but Saturdays, Sundays, and holidays are. This date is listed in the Academic Calendar, which is on the inside front cover of this catalog.
2. In exceptional circumstances, students may add daytime or night courses with the permission of the instructor and the department head responsible for the student's proposed additional course, through the 15th day of classes.
3. Students wishing to add daytime or night courses beyond the period specified above must file a written appeal with the Vice President for Academic Affairs/Provost (or their designee); the appeal must be signed by the student and approved by the instructor of the course involved and the student's advisor.
4. Students may add summer term courses through the first 10 percent of the term. When calculating 10 percent of the term, breaks of five (5) or more days are not included but Saturdays, Sundays, and holidays are.
5. In extreme circumstances, students may add summer school courses after this period with permission of the instructor and the Vice President for Academic Affairs (or their designee).
6. No student will be permitted to attend any class unless he/she is registered and listed on the class attendance roll.
7. Following fee assessment, the students are required to pay for all additional tuition and fees at the Student Accounts/Cashier's Office. Failure to pay may result in students being dropped from the sections that they added. It is the responsibility of the instructor in each class to check the class roll carefully during the first few weeks of each semester to be certain that all students attending a given class are listed on the class roll. Any student whose name does not appear on the class roll should not be permitted to attend that class and should be referred to the Office of the Registrar and Academic Services promptly for clarification of his or her status.
8. Students can add and drop courses by using WebAdvisor, a web interface to the Colleague Student Information System.

### **Alcohol and Drug Policy**

The South Dakota School of Mines and Technology and the South Dakota Board of Regents (4:27 Drug Free Environment and 3:4 Student Conduct Code) are committed to providing a drug free environment.

Furthermore, the School of Mines prohibits the possession of empty alcoholic beverage containers of any kind. Likewise, being in the presence of alcohol or other illicit substances, whether on campus or in the School of Mines managed residences, is also prohibited.

BOR alcohol and other drug policy violations are cumulative throughout a student's enrollment at South Dakota Board of Regents institutions (they stay on the student's discipline record and are transferable). The alcohol and other drug policy violations are not cumulative between academic years.

This policy does not replace nor restrict the Student Conduct Code (3:4) or the Drug Free Environment policy (4:27) as established by the South Dakota Board of Regents.

### **Procedure**

Any employee violating this prohibition shall be subject to appropriate disciplinary action, which may include termination of employment.

Students found in violation of the School of Mines policy for alcohol and other drugs may or may not also be in violation of BOR policy concerning alcohol and other drugs (BOR Policy 3.4.2.B.16). Interpretation is at the discretion of the student conduct administrator on a case by case basis. In the event a student is found responsible for a second violation of the School of Mines Policy IV-A-03 within the same academic year, it will be considered a violation of BOR Policy (3.4.2.B.16.) automatically.

Recognized student organizations are expected to report underage drinking at their sponsored events or on their property to the student conduct administrator for remedial action with individual students. Failure to report via the campus student conduct process may result in action being taken against the student organization.

At a minimum, students who violate the School of Mines alcohol or other drug policy will be sanctioned as follows:

1. 1<sup>st</sup> violation—a \$50 fine, completion of the *Choices* interactive journal; if under 21, parental notification will include a copy of the letter of sanction being sent to the student's parent/legal guardian.
2. 2<sup>nd</sup> violation—a \$100 fine, completion of a brief alcohol assessment and any recommended consequences from the assessment, one-year disciplinary probation; if under 21, parental notification.
3. 3<sup>rd</sup> violation—probable suspension for at least a semester; in extenuating circumstances, student may stay enrolled but must complete an approved treatment program; if under 21 parental notification.

### **Anti-Harassment Policy**

It is the policy of South Dakota School of Mines and Technology that harassment not be tolerated. It distracts the harasser, the victim, and others from the tasks of the workplace and academic environment; it undermines morale and the psychological well-being of the victim; and it leads to expensive litigation and to possible liability. The university has no tolerance for harassment, whether it occurs on or off campus, during or after normal business hours, at work-related social functions, or during business-related travel. Any employee or student violating this policy will be subject to disciplinary action up to and including termination or dismissal. The South Dakota School of Mines and Technology Anti-Harassment policy IV-A-20, the South Dakota Board of Regents Sexual Harassment policy 1:17, and the South Dakota Board of Regents Human Rights Complaint Procedure 1:18 can be reviewed in their entirety at: <http://sdmines.sdsmt.edu/hr/rules>, or contact the Affirmative Action Officer/Title IX-EEO Coordinator in the Human Resources Office.

### **Attendance Policy**

Every student is expected to attend each lecture or laboratory session for which he or she is scheduled. The faculty has allowed no system of authorized "cuts." A student who fails to attend classes regularly must satisfy such requirements as the instructor in a course may prescribe.

### **Audited Courses and Registrations for No Credit**

The outside preparation of auditors is entirely voluntary. Their participation in classroom discussions and examinations, and the minimum attendance requirements are subject to arrangements with the instructor of the course being audited. Failure to meet these arrangements will be cause for changing the grade in the course from "AU" to "W." An auditor is allowed neither credit nor a grade for the course even if the auditor satisfactorily passes the final examination of the course. An audited course cannot count toward the definition of a full-time load for purposes of securing financial aid nor for establishing eligibility to compete in intercollegiate contests. An audited course may not be used to qualify for a reduced tuition rate, but will be counted toward any upper limits on the number of credit hours a student may carry, and will be counted in determining requirements for paying campus fees.

A course taken for no credit but with a grade will be treated the same as an audited course except that the student will be expected to prepare and participate in the course to the same extent as all other students. The grade awarded will not be counted in the student's grade point average.

The request to audit a course or to enroll with no credit must be made at the time of the drop and add period by written petition to the Office of the Registrar and Academic Services. The petition has no effect on the tuition charges for a course.

The form to request an audit can be found at the following URL: [interact.hpcnet.org/sdsmtforms/audit.htm](http://interact.hpcnet.org/sdsmtforms/audit.htm)

### **Undergraduate Pass-Fail Option**

1. Any undergraduate student with a minimum cumulative GPA of 2.00 at South Dakota School of Mines and Technology is eligible to elect one free elective course per semester on a pass or fail basis. Courses taken under the Pass/Fail option cannot be used to satisfy the sixteen (16) credit hours of humanities/social science requirement for the bachelor of science degree.
2. The student shall notify the Office of the Registrar and Academic Services in writing of his or her request that the course be graded on a pass or fail basis. Only the Office of the Registrar and Academic Services and the student's advisor are to be notified of the intention of the student to be graded on a pass or fail basis. A student will have the option during the drop and add period of each semester to change from pass or fail to traditional grading, or vice versa.
3. The instructor will report the student's grade based on the college's regular grading system. If a grade of "D" or better is recorded, the student will receive a "Satisfactory," a grade of "U" will be recorded as a "Fail," and the "U" grade will count in calculating credits attempted.

4. Credits earned under this option may be used toward a student's graduation requirements, if appropriate and applicable, but only if a grade of "S" is recorded. A passing grade will be recorded as "S" and will not be used in the calculation of the student's GPA. A course taken on a pass or fail basis will not be converted, after a grade has been recorded, to a traditional grade for the purpose of improving a GPA.
5. The pass or fail option shall apply only to the student's first registration in a course.  
The form to request the pass/fail option can be found at the following URL: [interact.hpcnet.org/sdsmtforms/passfail.htm](http://interact.hpcnet.org/sdsmtforms/passfail.htm)

### **Campus Clearing Policy**

All graduating students are responsible for return of all college property, library books, keys, etc., and payment of all financial obligations to the college before their diplomas will be released.

### **Catalog of Graduation for Undergraduate Students**

- The catalog of graduation begins with the summer term and ends with the subsequent spring term.
- Every student is required to have a catalog of graduation. New and transfer students are assigned the catalog in effect at the time of their initial enrollment at the university from which they are seeking a degree. Students may elect a catalog of graduation that is later than their initial catalog but may not elect a catalog of graduation that is earlier than their initial catalog.
- In order to receive a degree, a student must meet the program requirements listed in his/her catalog of graduation.
- Students who discontinue enrollment at any Regental university for more than two consecutive semesters are assigned the catalog in effect at the time of their re-enrollment as their catalog of graduation.
- Students are considered to be in continuous enrollment for purposes of the catalog of graduation so long as any break in enrollment at any Regental university is for two or fewer consecutive semesters (excluding summer) and students maintain their degree seeking status at the same Regental university.
- Students who change their degree seeking status from one Regental university to another Regental university are assigned the catalog of graduation that corresponds to the term they are admitted to their new degree granting university.
- Students who are not currently enrolled and who petition to graduate based on coursework previously completed at a Regental university are assigned the catalog in effect during the term they wish to graduate.

### **Cheating (Academic Integrity) Policy**

High standards of academic honesty and intellectual integrity are essential to the success of our students and the institution. The campus community will not tolerate acts of dishonesty in any academic activities at School of Mines. Such acts jeopardize not only the individual student, but also the integrity and dignity of the institution and its members.

The South Dakota Board of Regents has clearly defined those acts that constitute violations of academic integrity (BOR Policy 3.4.2.B.1). These acts include, but are not limited to, cheating, fraud, plagiarism, or knowingly furnishing false information within the academic arena. These acts of dishonesty violate the ethical values the university works to instill in all members of the campus community.

Faculty and administrators should consistently communicate the importance of academic integrity and ethical principles to our students. In addition, all members of the campus community should take reasonable steps to anticipate, deter, and confront acts of dishonesty in all areas of academics — research, assignments, and exams. The instructor of record for each course is responsible for clarifying the academic integrity standards for that course within the course syllabus.

The consequences for any act of academic dishonesty shall be at the discretion of the instructor of record, subject to due process as outlined in BOR policy 3.4.3A. Sanctions may range from requiring the student to repeat the work in question to failure in the course. To ensure fairness to all involved and to conform to South Dakota Board of Regents policies, sanctions may be imposed only in accordance with the following procedure. In the following, the term "student conduct officer" refers to the person appointed by the senior student affairs officer to consider cases of academic dishonesty, as described in BOR Policy 3:4. Among other responsibilities, the Student Conduct Office is expected to maintain university-wide records on all actions related to student academic dishonesty.

An instructor who intends to hold a student accountable for an act of academic dishonesty must provide written notification to the student and the Student Conduct Office within ten working days of the time the alleged violation becomes known to the instructor. The written notification must include a description of the alleged violation, the sanction(s) the instructor intends to impose, a statement notifying the student that he or she may request an informal meeting with the instructor, and a statement describing the student's due process rights. This notice may be in the form of an email or the instructor of record may use the Academic Integrity Reporting Form available on the School of Mines website.

Resolution of the allegation may be achieved in one of three ways:

1. The student admits responsibility and accepts the consequence(s) in writing. There shall be no subsequent proceedings.
2. The student requests a meeting with the instructor of record within 10 working days of receiving the notification or within the first 10 working days of the following semester, whichever is appropriate. At the request of either the student or the instructor of record, a student conduct officer

may be present. The purpose of the meeting would be to dispose of the matter through mutual consent by the parties involved. If mutual agreement can be reached, there shall be no subsequent proceedings. If mutual agreement cannot be reached, the matter is referred for formal disposition.

3. The matter is resolved through formal disposition and therefore referred to the Student Conduct Office. Please refer to BOR Policy 3:4 for specific procedures that will be followed for formal disposition.

### **Classification of Undergraduate Students**

All undergraduate students will be assigned one of the following admissions categories:

1. Regular: An admitted, enrolled student, who is pursuing a degree at the School of Mines.
2. Special: An enrolled student who has not been admitted, and is not pursuing a degree, will be permitted to accumulate more than thirty (30) hours only on an exceptional basis. Special students do not qualify for federal student aid or institutional scholarships. An Admissions Office review is required in order for a student to move from one admissions category to another.

Freshman, sophomore, junior, or senior classification of undergraduate students is based on accumulated credits for courses passed:

0 to 29.99 credits - Freshman

30 to 59.99 credits - Sophomore

60 to 89.99 credits - Junior

90 or more credits - Senior

A full-time undergraduate student is defined as a student who is enrolled in at least twelve (12) credit hours during an academic term. An academic term is defined as fall, spring, and summer. A student on a cooperative education assignment who is registered for CP (Co-Op) credit shall be considered to have full-time status.

See the graduate student general information section of this catalog for the definition of a full-time and half-time graduate student.

### **COMPASS Placement Exams (English and Mathematics)**

A mandatory placement procedure for mathematics and English is used at all Regental universities in the state. The instruments and criteria used for other mandatory placement are at the discretion of each institution.

The ACT is the required initial test used to place students who attend a South Dakota regental university into their mathematics and English courses. A student can be placed in classes via the ACT sub-scores for math and English, or, for more accurate placement, using the ACT COMPASS test, which is administered at South Dakota universities such as the School of Mines. The COMPASS test is administered on a computer and takes approximately 30 to 40 minutes for each section (math, writing, and reading). Students who need to take the COMPASS test should sign up for and attend a COMPASS Day (dates are listed below) by going to the New Student Checklist from the Mines homepage or contact the Registrar and Academic Services Office at (605) 394-2400.

Students will need to take all or part of the COMPASS test if:

1. They have not taken the ACT within five years from date of enrollment and have not taken and passed any college level English or math courses.
2. They scored above 24 on their ACT math.
3. They scored a 24 or less on their ACT math and want to challenge their course placement. Students have the option of taking the higher of the two scores, but are warned that a deficiency warrants serious contemplation and students should consider the class that best reflects the requirements of math success. At School of Mines, advanced math, especially calculus, is a mainstay in the curriculum, regardless of major.
4. They scored 17 or less on their ACT writing.

COMPASS results are designed to assist the institution in placing students into appropriate math and English courses or, if necessary, into developmental or preparatory courses. We caution students that successful completion of a high school course (e.g., trigonometry) does not guarantee that this course has been mastered at the college level. Placement is confirmed by passing the appropriate COMPASS test area.

### **Computer and Network Usage Guidelines and Policy**

Students, faculty, staff and others affiliated with School of Mines are provided access to computing and networking services for use in academic pursuits and other activities that advance the goals of the institution.

All computer users must be properly registered and authorized through Information Technology Services (ITS). In accepting authorization to use computing or networking services, a user agrees to comply with all applicable federal, state and local laws and all regulations and policies of both the university and the Regents of the state of South Dakota.

Individuals should guard their electronic identity. Choose secure passwords, and never reveal them to anyone. Individuals can be held liable for activity carried out by others using their accounts. Keep all passwords and access mechanisms secure and private. Facilities and network services are provided for use only by account holders, not their family members or friends.

Theft, misuse, or other abuse of computing or networking services will not be tolerated and may result in loss of computer and/or network privileges, disciplinary action, criminal or civil prosecution.

To connect to the wireless network, we require a wireless equipped laptop and Windows XP/Vista operating system. Instructions on how to connect are located on the ITS website: <http://its.sdsmt.edu>.

All guidelines and terms of use apply to ALL computer usage, wireless as well as wired desktop and laptop.

Unacceptable activities include, but are not limited to:

- Unauthorized file access or file transfer;
- Use of another individual's identification, password, or account;
- Use of computing or networking facilities that interferes with the work of another student, faculty member, or university official, or with the normal operation of computers, terminals, peripherals, or networks at the university or elsewhere;
- Making, acquiring, or using unauthorized copies of computer software or violating terms of applicable software licensing agreements;
- Use of computer or network systems that result in violation of copyright law;
- Running, installing, or distributing any program intended to damage or to place excessive load on a computer system or network;
- Attempting to circumvent data protection schemes through any mechanism, including unauthorized access or tampering with security;
- Electronically posting or distributing materials resulting in any violation of existing laws, regulations, or university or Regental policies;
- Attempting to monitor or tamper with another person's electronic communications, or reading, copying, changing, or deleting another person's files or software without the explicit agreement of that person; and
- Providing access to computer accounts, Internet connectivity, electronic mail, or other significant services to persons not authorized for use of School of Mines facilities, resources, or network services. For example, students with computers hosted on the residence hall network may not permit family or friends to use these services. Although these guidelines cover most aspects of the policy, a full copy of the current university policy on acceptable use of computing and network resources may be found at: <http://its.sdsmt.edu/student/8408/>.

## Conduct Policy

South Dakota School of Mines and Technology subscribes to the widely recognized traditions and lawful missions of tax-supported higher education in the United States. These traditions and missions work to: (1) develop students to well-rounded maturity, physically, socially, emotionally, intellectually, and vocationally; (2) develop, refine, and teach ethical and cultural values; (3) teach the practice of excellence in thought, behavior, and performance; (4) teach principles of patriotism, civil obligation, and respect for the law; and (5) transfer the wealth of knowledge and tradition from one generation to the other. The regulations established by the Regents, faculty, or administration, have been developed to enhance the opportunities for fulfilling the above purposes. Students are expected to adhere to and support such policies.

In general, students are expected to conduct themselves as responsible citizens at all times and to uphold all federal, state and local laws. Conduct that is held detrimental to the college community (composed of students, faculty, staff and administration) may result in disciplinary action.

The Regents for the state supported institutions of higher learning in South Dakota have formulated the following policy statement relating to student conduct and behavior:

*The attendance of a student at one of the higher education institutions under the jurisdiction of the Board of Regents is a voluntary entrance into the academic community. By such act the student assumes obligations of conduct and performance imposed by the institution. The constitutional rights of students will not be abridged by action of the academic community. The institutions may discipline or expel the student from the academic community for any intentional act, which disrupts or prevents the accomplishment of any lawful mission, process, or function of the institution or in order to secure compliance with the obligations of conduct and performance imposed. (Regents Policy Manual, Sec. 10.1.2. June 1990)*

Complete details of current policy regarding student conduct, responsibilities, and disciplinary sanctions will be found in the student code of conduct brochure. A Code of Student Rights and Responsibilities and the Board of Regents Policy on Student Conduct was adopted in January of 1995. Adopted policy serves as a basic set of guidelines for students, faculty members, and administration. School of Mines judicial process provides all members of the student body with the facilities for appeal and adjudication.

Admission and enrollment in the university obligates the student to be familiar with and to abide by the standards and the rules and regulations of the university as well as the laws of the various levels of government. Students should be aware of and familiar with such laws, rules, and regulations with respect to their status on the campus, as defined in the student code of conduct. The student code of conduct is printed annually and is available to students at registration or upon request and online. Changes in some of these rules may be desirable from time to time, and student cooperation and

participation in bringing about changes through appropriate channels is encouraged. However, violations of existing regulations will not be condoned and disciplinary sanctions may be imposed for such violations.

The policies and procedures listed in this section were established by the South Dakota Board of Regents and/or South Dakota School of Mines and Technology. For further information regarding policies in this section, please contact one of the Vice President's Offices at the university or visit: <http://sdmines.sdsmt.edu/sdsmt/policies>.

### **Cooperative Education Program**

A partnership with business, industry, and government agencies, the Cooperative Education Program provides students with opportunities to apply their classroom learning to "real world" work experiences in industry. Co-op students are hired by employers to work in positions related to their major. Minimum GPA and other co-op eligibility requirements vary among employers. Interested students should contact the Career Center or their department's Cooperative Education Coordinator. Students are responsible for securing their own co-op positions and are encouraged to register with the Career Center for assistance with identifying and applying for co-op opportunities. After accepting a co-op offer, students are to inform the Career Center of their co-op employer, salary, and dates of employment.

During their co-op work experience, students are expected to apply knowledge learned in the classroom and to grow professionally through development of their interpersonal, communication, teamwork, and workplace etiquette skills.

1. **Academic Credit:** 1 to 3 credits. Prerequisite: Permission of instructor. Credit is available for each semester or summer work experience upon approval by the departmental Cooperative Education Coordinator. Students must satisfy departmental requirements in order to earn credit for their co-op. Requirements include a written report of the work experience and an employer's evaluation of work performance. Because the work performed by a student working full-time while on co-op is equivalent to the workload of a full-time student, a student on co-op who is registered for CP credit shall be considered to have full-time status.
2. **Administration:** The Cooperative Education Steering Committee is comprised of the departmental Cooperative Education Coordinators, the Provost and Vice President for Academic Affairs, and the director of Career Center. The committee is responsible for developing cooperative education industrial or business experiences; assisting students with identifying co-op opportunities; maintaining contact with cooperative education employers; and conducting an on-going evaluation of the program. For additional information, contact the director of Career Center (605) 394-2667 or visit: <http://careers.sdsmt.edu/>.

### **Course Numbering System**

Tuition for courses numbered 000 through 499 will be assessed at the undergraduate rate for all students.

### **Pre-College Courses**

001-099 Pre-college, remedial skills, special improvement (non-degree credit)

### **Undergraduate Courses**

100-199 Freshman level

200-299 Sophomore level

300-399 Junior level

400-499 Senior level (may be dual listed with 500 level graduate course)

Tuition for courses numbered 500 through 899 will be assessed at the graduate rate for all students.

### **Graduate Courses**

500-599: Entry level graduate (may be dual listed with a 400 level undergraduate course and may include limited enrollments by undergraduates)

600-699: Graduate level (undergraduate enrollment only by exception)

700-799: Graduate level (Graduate students only)

800-899: Doctoral and post-doctoral level (Doctoral and post-doctoral students only)

### **Experimental Courses**

Experimental courses can be offered for a maximum of two (2) times before formal approval is received, but they must be reported through the system curriculum approval process.

### **Course Overloads**

A normal student load is 18 credit hours or fewer. An overload is a course load in excess of 18 credit hours.

To register for an overload, students must consult with their academic advisors. Student requests for overload enrollments should be submitted in writing to their college dean (or equivalent) at their "HOME" institution to grant the approval for registration in credits beyond the overload status. This approval will normally be granted based on a student's exceptional past academic experience.

The form to request a course overload can be found at the following URL: [registrar.sdsmt.edu/docs/66199.pdf](http://registrar.sdsmt.edu/docs/66199.pdf)

## Course Retake Policy

The registration retake policy defines how many times a student may register for (take) a course.

The retake policies approved by the BOR are as follows:

1. A student will be allowed a total of three takes for undergraduate courses (course numbers of 001 to 499) for which credit is only counted toward graduation once. The student must petition in writing to the Vice President for Academic Affairs to be permitted to take an undergraduate course more than three times.

Students wishing to appeal must complete the Application for Academic Appeal form that is available at the Office of the Vice President for Academic Affairs or can be downloaded from: <http://sdmines.sdsmt.edu/studentlife/forms>. At the undergraduate level only the LAST attempt (take) of the course will count toward graduation and into the grade point average calculations.

2. A student will be allowed a total of two takes for graduate courses (course numbers of 500 or above) for which credit is only counted toward graduation once. The student must petition the graduate dean for permission to take a graduate course more than two times.
3. A student will be allowed unlimited takes for an undergraduate or graduate course for which credit toward graduation may be received more than once (e.g., Independent Study, Thesis). All takes will count into grade point average calculations. Individual departments/majors may limit the number of credits allowed toward graduation in certain courses. Students should check with their advisor.
4. The Audit (AU) grade is the only grade that will not be counted as a take of a course. All other grades, including Withdraw "W" grade, will count as a take of a course.
5. Transfer courses and non-courses (CLEP, credit by exam) will also count as a take of a course.
6. The count for retakes will begin with courses in which students are enrolled fall 2003. Takes of a course prior to fall 2003 will not be counted.

## Credit Hours Definition

The amount of academic work scheduled or "carried" by a student is measured in terms of credit hours. A credit hour is three hours of in-class time and preparation combined per week for one (1) semester. A recitation or lecture is scheduled as one fifty-minute period plus two (2) hours of preparation for an average student per week per credit hour. Each credit hour of laboratory work is scheduled as one-hundred-ten to one-hundred-seventy (110 to 170) minutes per week. Laboratories scheduled for two (2) hours per credit hour are expected to require one (1) hour of work outside of the scheduled time per week per credit hour.

## Credit Received through Validation Methods

### Advanced Placement Program (AP)

Entering freshman students who have completed an honors course in high school and who have taken and successfully passed appropriate College Entrance Examination Board Advanced Placement test with a score of 3, 4, or 5 may receive course credit. The South Dakota Board of Regents policy on specific courses for which credit is given and other requirements are found at the following

URL: [www.sdbor.edu/services/academics/documents/AP\\_guidelines\\_000.pdf](http://www.sdbor.edu/services/academics/documents/AP_guidelines_000.pdf)

### College Level Examination Program (CLEP)

The South Dakota Board of Regents and its universities encourage high school student to pursue rigorous academic programs and to take advantage of opportunities available to them to earn college credit. The College Board's College Level Examination Program (CLEP) provides an opportunity to earn college credit. Colleges and universities award college credit for satisfactory performance on the CLEP examinations. Satisfactory performance on CLEP examinations can reduce the cost of college education by reducing the number of credits a student must take to complete the degree. CLEP tests may be retaken only following a lapse of six months. South Dakota Board of Regents policy on specific courses for which credit is given and other requirements are found at: [http://www.sdbor.edu/policy/2-Accademic\\_Affairs/documents/2-5.pdf](http://www.sdbor.edu/policy/2-Accademic_Affairs/documents/2-5.pdf).

### International Baccalaureate (IB)

School of Mines recognizes the rigor of IB courses and the IB Diploma Program and encourages students to complete higher level courses and exams when ready. Students who complete higher level courses and exams and obtain a score of five (5) or above will be considered for advanced placement credit in the corresponding courses. South Dakota Board of Regents policy on specific courses for which credit is given and other requirements are found at: [http://www.sdbor.edu/policy/2-Accademic\\_Affairs/documents/2-5.pdf](http://www.sdbor.edu/policy/2-Accademic_Affairs/documents/2-5.pdf).

### Credit by University Examination

The School of Mines faculty has adopted a policy to permit college credit by university examination. Any student enrolled in the college who has studied a subject independently or who has completed equivalent college level course elsewhere for which he or she is unable to get a transcript acceptable to this institution may request a special examination to establish credit under the conditions specified below:

1. The student must consult his or her advisor and the head of the department in which the course is offered, who will conduct a preliminary survey of the work in which the student claims to be prepared and will determine whether an examination is warranted, what topics it should cover, and what credit may be expected.

2. After determining eligibility to take an examination the candidate pays a per-subject fee at the Office of Student Accounts/Cashier's Office and then secures the appropriate form from the Office of the Registrar and Academic Services.
3. If the student successfully completes the examination, the permanent record will show "Credit by Examination" with a grade of "EX". No entry will be made on a permanent record if the examination is failed.
4. Credit by examination is not permitted if the student has previously completed the course for collegiate credit.

### **Credit by Other Validation Methods**

Credits earned through validation methods other than nationally recognized examinations (that is, university administered tests and verification like military credit or prior learning) are not allowed:

1. To exceed 32 credits for baccalaureate degrees
2. To exceed 16 credits for associate degrees
3. If the student previously visited or is currently registered for the class
4. For any graduate level courses (exception for some programs).

### **Dean's List Designation**

Undergraduate, full-time and part-time students may be designated for the Dean's List at the end of the fall and spring terms. The Dean's List designation is determined by the home university and is based on a student's total course registrations for academic credit for the term from any Regental university. The Dean's List designation does not appear on the transcript.

According to the South Dakota Board of Regents policy, undergraduate full-time students must meet the following guidelines to be awarded Dean's List designation:

- Students must have earned a minimum of 12 credit hours in courses numbered 100-699 during the term.
- Students must achieve a System Term GPA of at least 3.50.
- Students with F, I, U, RI, or RU grades are not eligible regardless of System Term GPA attained.

### **Dropping a Course Deadline**

Please see "Date for a Grade of W" for information about dropping a course.

### **Dual Use of Credit**

Many high school students complete college-level courses while enrolled in high school. School of Mines encourages talented high school students to extend their educational background in this manner. South Dakota law provides that students in grades 10, 11 and 12 may enroll in higher education as a special student in a course or courses offered with the school district's approval, and these courses may be applied to high school graduation requirements. See Admission - Undergraduate procedures for further information.

### **Enrollment in Courses**

#### **A. Undergraduate Courses (001-499)**

1. All undergraduate and graduate students enrolling at Regental universities in courses numbered 001-499 shall be admitted as undergraduate students (either-degree seeking or non-degree seeking) and registered at the undergraduate level. For all undergraduate and graduate students enrolling at Regental universities in courses numbered 001-499, the courses shall be recorded on the transcript at the undergraduate academic level and included in the calculation of all undergraduate grade point averages.
2. When an undergraduate course is used on a converted credit basis (transferred for one level to another) to meet graduate plan of study requirements at Regental universities, the course shall be recorded on the transcript at the undergraduate academic level with the credit hours approved for the course and then duplicated at the graduate level through an internal transfer policy (Refer to BOR policy 2:5.16). At the undergraduate level, the credit is included in the calculation of the undergraduate institutional grade point average and the undergraduate cumulative grade point average at the full credit rate. At the graduate level, the credit is included in the calculation of the graduate institutional grade point average and the graduate cumulative grade point average at the converted credit rate (transferred for one level to another).
3. Undergraduate courses required as prerequisites in preparation for registration in graduate courses shall be recorded on the transcript at the undergraduate level and will not be duplicated at the graduate level because the courses are not a part of the Regental graduate plan of study.

#### **B. Graduate Courses (500-899)**

1. All undergraduate and graduate students enrolling at Regental universities in courses numbered 500-899 shall be admitted as graduate students (either degree seeking or non-degree seeking) and registered at the graduate level. For all undergraduate and graduate students enrolling at Regental universities in courses numbered 500-899, the courses shall be recorded on the transcript at the graduate academic level and included in the calculation of all graduate grade point averages.
2. When a graduate course is used on a converted (transferred for one level to another) or actual credit basis to meet undergraduate degree requirements for a Regental accelerated program, the course shall be recorded on the transcript at the graduate academic level with the credit

hours approved for the course and then duplicated at the undergraduate level through an internal transfer policy (Refer to BOR policy 2:5.16). At the graduate level, the credit is included in the calculation of the graduate institutional grade point average and the graduate cumulative grade point average at the full credit rate. At the undergraduate level, the credit is included in the calculation of the undergraduate institutional grade point average and the undergraduate cumulative grade point average at the converted (transferred for one level to another) or actual credit rate.

### **C. Undergraduate Students Taking Graduate Courses**

Undergraduate students who have completed a minimum of 90 credit hours may enroll in a limited number of 500 level courses. The Vice President for Academic Affairs may grant an exception for enrollment in a 600 level course. The student shall pay graduate tuition and the courses shall be recorded on a graduate transcript. These graduate courses may apply to an undergraduate degree.

### **Excused Absences for School Sponsored Events**

The faculty recognizes extracurricular activities to be a valued component of student development and education. When an activity results in a classroom absence, the faculty members have agreed to accommodate students involved in these activities in accordance with this policy.

#### **Procedures:**

1. Students who participate in recognized activities will notify their instructors prior to the absence.
2. Students will be given the opportunity to make-up any exams missed in the course of the absence.
3. Students will consult with their instructors regarding the make-up/submission of other graded activities that will be missed as a consequence of the absence.
4. Recognized activities are those determined by the advisor of the sponsoring School of Mines organization or the coach of the involved athletic team. If there are any questions, the advisor or coach should consult with the Vice President for Student Affairs or Athletic Director.
5. All other arrangements (if allowable) for absences not covered under this policy must be decided through consultation between the faculty member and the student, and/or under the guidelines of the class syllabus of the instructor.
6. Unresolved issues may be taken up following the established School of Mines Grievance Procedure for Students Policy III-A-31. Recognized activities under this policy are determined by the School of Mines advisor/coach. Upon request or as a standard process the advisor/coach may send an e-mail notice verifying the event.

### **Family Educational Rights and Privacy Act (FERPA) of 1974 or Buckley Amendment**

The purpose of FERPA is to protect the privacy rights of students from the indiscriminate collection, maintenance, disclosure, and release of personally identifiable student information, including information regarding student status or performance.

Under FERPA each current and former student at School of Mines has the following fundamental rights:

- The right to review and inspect the student's education records.
- The right to request the amendment of the student's education records that the student believes are inaccurate or misleading, and the right to a hearing if the request for amendment is not granted.
- The right to consent to disclosures of personally identifiable information contained in the student's education records, except to the extent that FERPA authorizes disclosure without consent.
- The right to file a complaint with the U.S. Department of Education concerning alleged failures by School of Mines to comply with the requirements of FERPA.

Students should be aware that these rights and privileges are available to them. Formal notification regarding FERPA is provided annually. An announcement covering information designated as Public or Directory Information is included on posters, in the Family Matters, First Year Information and Commuter Connection newsletters and on the Academic and Enrollment Family Educational Rights and Privacy Act web page at: [registrar.sdsmt.edu/103463/](http://registrar.sdsmt.edu/103463/) Directory information includes the student's name, local and permanent address, telephone listing, electronic mail address, photograph (e.g., year book photos), date and place of birth, major field of study, dates of attendance (including graduation date), grade level, enrollment status (e.g., undergraduate or graduate, full or part time), participation in officially recognized activities and sports, weight and height of members of athletic teams, degree, honors and awards received, and the most recent education agency or institution attended (previous to School of Mines). This information is critical to some obligations and services performed by the university. Students have the right to request that such information concerning them be withheld. For a full description of FERPA, information regarding the location of students' educational records, and procedures at School of Mines for compliance with the law, please contact the Office of the Registrar and Academic Services. US government reporting requirements have been added for international students (F and J status). As a result of the regulations that became effective on January 1, 2003, the Family Educational Rights and Privacy Act (FERPA) is waived for F and J students in respect to these specific reporting requirements. The regulations will be strictly enforced by the appropriate bureau(s) within the US Department of Homeland Security (DHS) and information will be reported electronically to DHS via Student and Exchange Visitor Information System (SEVIS). The consequences to students for non-compliance with the new regulations are severe. Contact the director of the Ivanhoe International Center at [Ivanhoe@sdsmt.edu](mailto:Ivanhoe@sdsmt.edu) for more information.

## Final Examination Policy

The South Dakota School of Mines and Technology provides a policy for the administration of final examinations.

The faculty, recognizing that courses and programs of instruction differ substantially and that methodologies of instruction and evaluation remain the province of each instructor, does not seek to impose any mandatory final examination policy upon the constituent faculty of this institution. However, each faculty member is hereby encouraged to give the last examination (comprehensive or non-comprehensive) during the final examination week. A five-day final examination period shall be scheduled by the registration officer. No special individual or departmental requests will be honored in constructing the final examination schedule.

The instructor or instructors for each course shall indicate to their department head whether or not they intend to give a final examination, the number of hours for the exam, and whether additional rooms are needed for alternate seating; requests for additional rooms can be honored only if rooms are available. No additions will be permitted once the schedule has been published. All final exam requests will be due from departments at the time course registry requests are due. The final version of the exam schedule will be published in the Course Listings bulletin.

Final exams in all laboratory courses and courses of one credit or less will be given during the last regularly scheduled class period of the semester. Final examinations for evening classes meeting after 4:30 p.m. will be held at the last meeting of the class during final exam week. Final examinations for all other courses are scheduled by the registration officer according to the regular class meeting time during the semester and must be given at the scheduled time; they may not be rescheduled or given prior to the start of the final examination period. Examinations will be held in the regularly scheduled classrooms unless instructors make special advance arrangements through the registration officer.

Instructors in multi-section courses may request a "common final examination" period if requests are made in advance. Rooms must be reserved with the registration officer for such exams in order to avoid conflicts.

Final exam periods will be one hour and 50 minutes each, although instructors may request a longer final exam period (two hours and 50 minutes) if needed.

If a student is scheduled for three or more examinations on any one day, the middle examination(s) of the day shall be rescheduled for this student by the instructor(s) upon the request of the student. The student will be required to make this request between the 10<sup>th</sup> and 15<sup>th</sup> day of classes.

Other than those events approved by the faculty of the South Dakota School of Mines and Technology, final examinations will be the only events scheduled during the week of final examinations. Students having conflicts arising from participation in such scheduled events must see their professors at least one week prior to the examinations week to determine an equitable alternative to taking the examination at the scheduled time.

Instructors will submit all grades not later than three working days after the last day of final examinations for the term.

## Grade Point Average Definition

The following grade point averages are calculated each academic term (fall, spring, summer):

Institutional GPA-based on credits earned at a specific Regental university. Utilized to determine if degree requirements have been met and to determine honors designation at graduation.

System Term GPA-based on credits earned at any of the six Regental universities within a given academic term (fall, spring, summer). Utilized to determine minimum progression status.

Transfer GPA-based on credits earned and officially transferred from an accredited college or university outside the Regental system. When a letter grade that normally calculates into the grade point average exists for a non-academic course (e.g., credit earned via examination), it will be included in the transfer GPA.

Cumulative GPA-based on all credits earned by the student (transfer credit plus system credit). Utilized to determine minimum progression status, to determine if degree requirements have been met and to determine honors designation at graduation.

## Calculation of grade point averages when undergraduate courses are repeated

When a course has been repeated for credit, all attempts will be entered on the transcript but the last grade earned will be used in the calculation of the cumulative grade point average (See also 2:5.11).

Class	Credit Hour Range	GPA Standard
Freshman	0-29.99	2.0
Sophomore	30-59.99	2.0
Junior	60-89.99	2.0
Senior	90+	2.0

## **Graduate Credit for Undergraduate Courses**

Graduate credit for School of Mines seniors, per faculty adopted regulations: "An undergraduate student who has senior standing at School of Mines and is ranked in the upper one-half of the class, may petition the Dean of Graduate Education on a form provided by the Office of the Registrar and Academic Services for the purpose that a course be recorded on his/her graduate record."

The following conditions or limitations apply:

1. The student must attest that he/she is planning to continue work toward an advanced degree at the South Dakota School of Mines and Technology, but must understand that the university is under no obligation to credit courses so attempted toward any advanced degree until a graduate program of study has been approved.
2. The course(s) must be numbered 500-699.
3. The course(s) must not be required for his or her undergraduate degree; the hours may not count toward the 128 or 136 semester credit hours required for the Bachelor of Science degree.
4. The extra courses should not create an overload upon the student.
5. Not more than twelve (12) hours of graduate credit taken as a School of Mines undergraduate may be applied toward an advanced degree at the South Dakota School of Mines and Technology. Upon written justification by the head of the student's major department, the Dean of Graduate Education may approve a minor variance from this limit.
6. Petitions from undergraduate students other than those defined above will not be accepted. (See graduate student general information section of this catalog for graduate policy.)

## **Intellectual Property Statement**

The South Dakota Board of Regents has developed a policy on intellectual property that sets forth the principles and procedures through which the Board will balance those interests.

South Dakota Board of Regents employees who carry out or administer such instructional, research and service activities routinely produce works or make discoveries that may be subject to legal protection as intellectual properties.

The Board recognizes and affirms the public policy principle, woven into the very fabric of the United States Constitution by its framers, that creators of intellectual properties should obtain a fair return from the fruits of their inventiveness. It also recognizes and affirms the principle that the public should have a fair return on its investment in support of such creative efforts.

For further information on intellectual property, see Board of Regents Policy 4:34. [www.sdbor.edu/policy/4-Personnel/documents/4-34.pdf](http://www.sdbor.edu/policy/4-Personnel/documents/4-34.pdf).

## **Minimum Graduation Standards**

To be awarded a baccalaureate degree, an associate degree or certificate a student must at a minimum have a cumulative GPA of 2.0 or higher.

## **Minimum Progression Standards**

Minimum progression standards and related actions are based on the student's cumulative grade point average and system term grade point average.

1. A student with a cumulative grade point average of 2.0 or better is considered to be in good academic standing.
2. If a student's cumulative grade point average falls below 2.0 in any academic term (i.e. fall, spring, summer), the student is placed on academic probation the following term.
3. While on academic probation, the student must earn a system term grade point average of 2.0 or better.
4. When a student on academic probation achieves a cumulative grade point average of 2.0 or better, the student is returned to good academic standing.
5. A student on academic probation who fails to maintain a system term grade point average of 2.0 or better is placed on academic suspension for a minimum period of two academic terms.
6. Students on academic suspension will not be allowed to register for any coursework at any Regental university except when an appeal has been approved by the Regental university from which the student is pursuing a degree. An approved appeal granted by one Regental university will be honored by all Regental universities. Also refer to policy 2:3.G Probation/Suspension of Students.
7. Only Academic Suspension will be entered on the student's transcript. Academic probation will be noted in the internal academic record only. Progression and graduation are contingent on satisfactory performance on the Proficiency Examination. Refer to policy 2:28.

## **Re-admission following Withdrawal**

A student who has withdrawn from the university may be readmitted in that same semester by permission of the Vice President for Academic Affairs if the student has paid the appropriate tuition and fees.

## **Registration Changes**

All students will be assigned an academic advisor upon admission; thereafter, all course registrations and changes, other than withdrawal from the university, should be approved by the assigned advisor. Students may request advisor or major changes from the Office of the Registrar and Academic Services.

## **Software and Intellectual Rights**

Respect for intellectual labor and creativity is vital to academic discourse and enterprise. This principle applies to works of all authors and publishers in all media. It encompasses respect for the right to acknowledgment, right to privacy, and right to determine the form, manner, and terms of publication and distribution.

## **Software Copyright Statement**

The South Dakota School of Mines and Technology has obtained licenses from a variety of vendors to use their software on computers that are owned and controlled by the school. South Dakota School of Mines and Technology does not own this software or its related documentation and, in general, School of Mines does not have the right to reproduce such software or to permit its reproduction by others. Microsoft MSDN is the only exception. Please contact the ITS Help Desk for information regarding MSDN, [helpdesk@sdsmt.edu](mailto:helpdesk@sdsmt.edu).

School of Mines students, faculty, and staff shall use all software only in accordance with applicable license agreements. Centrally managed licensing agreements are on file in the Information Technology Service Office or the Business Office. Making, acquiring, or using unauthorized copies of computer software or other copyrighted materials may result in disciplinary or legal action as the circumstances warrant.

The following statement regarding intellectual property and the legal and ethical use of software was developed by EDUCOM, a nonprofit consortium of higher education institutions, which promotes the use of computing, networking and information resources in teaching, learning, scholarship, and research. School of Mines subscribes to the spirit of this statement, and strives to promote understanding and observation of it.

## **Student Appeals Policy**

A procedure is provided for situations where a student feels that an institutional or Board of Regents policy affecting terms or conditions of enrollment or academic standing has been improperly applied. Students who believe that an academic evaluation has been unfairly applied should follow this procedure. The South Dakota Board of Regents Student Appeals for Academic Affairs policy 2:9 can be reviewed in its entirety at: [www.sdbor.edu/policy/2-Academic\\_Affairs/documents/2-9.pdf](http://www.sdbor.edu/policy/2-Academic_Affairs/documents/2-9.pdf)

Students who wish to discuss their situation and how this process applies should consult with the Vice President for Student Affairs and Dean of Students.

## **Transcript of Credits**

A transcript of credits is an authentic copy of the student's academic record from each Regental university attended. The fee is \$5.00 for one copy, and \$2.50 for each additional copy per request. A transcript must include all courses attempted. Transcripts are released only on written request with the signature of the individual concerned. This order must be placed in person, by mail, or by FAX to the Office of the Registrar and Academic Services. Upon graduation each student is entitled to one complete transcript of the credits earned without charge.

## **Undergraduate Grading System**

Undergraduate grades will be assigned to the undergraduate academic level and to all courses and sections with course numbers ranging from 001 to 499. Plus and minus grades are not used.

### **A Exceptional**

4.00 grade points per semester hour

### **B Above Average**

3.00 grade points per semester hour

### **C Average**

2.00 grade points per semester hour

### **D Lowest Passing Grade**

1.00 grade points per semester hour

### **F Failure**

0.00 grade points per semester hour

**S Satisfactory**

Does not calculate into any GPA

**U Unsatisfactory**

Does not calculate into any GPA

**RI Incomplete (Remedial)**

Does not calculate into any GPA

**RS Satisfactory (Remedial)**

Does not calculate into any GPA

**RU Unsatisfactory (Remedial)**

Does not calculate into any GPA

**W Withdrawal**

Does not calculate into any GPA, no credit granted

**AU Audit**

Does not calculate into any GPA

**I Incomplete**

Does not calculate into any GPA

**IP In Progress**

Does not calculate into any GPA

**EX Credit by Exam**

Does not calculate into any GPA

**CR Credit**

Does not calculate into any GPA

**LR Lab grade linked to recitation Grade**

O credit course

**NR Grade not Reported by Instructor**

Does not calculate into any GPA

**NG No grade**

O credit tracking course

**TR Note for NSE/MEDT**

Does not calculate into the GPA

**Academic Amnesty\***

Does not calculate in any GPA, no credit given \*Letter grade followed by an asterisk indicates Academic Amnesty granted.

**Incomplete Grade Request**

An incomplete (I) grade may be granted only when all of the following conditions apply:

- a. A student has encountered extenuating circumstances that do not permit him/her to complete the course.
- b. The student must be earning a passing grade at the time the incomplete is necessitated. Anticipated course failure is not a justification for an incomplete.
- c. The student does not have to repeat the course to meet the requirements.
- d. The instructor must agree to grant an incomplete grade.
- e. The instructor and student must agree on a plan to complete the coursework.
- f. The coursework must be completed within one semester; extensions may be granted by the Vice President for Academic Affairs/Provost.
- g. If the student completes the course within the specified time, the grades that may be assigned are A, B, C, D, F, S, RS, RU, or U.
- h. If the student does not complete the course within the specified time, the grade assigned will be F (Failure) or U (Unsatisfactory) or RU (Remedial Unsatisfactory).

An in progress (IP) grade may be granted only when all of the following conditions apply:

- a. The requirements for the course (for every student enrolled in the course) extend beyond the current term.
- b. The extension beyond the current term must be defined before the class begins.
- c. The instructor must request permission to award IP grades for a course from their department head, and then approval must be obtained from the Vice President for Academic Affairs.
- d. A definite date for completion of the course must be established in the course syllabus.

An audit (AU) grade may be granted only when the student has elected the AU option on or prior to the census date of the term.

A credit (CR) grade may be granted only for non course credit that is not related to an examination or to equating transfer grades to the BOR grading system. This grade is not used for any Regental university courses.

An examination for credit (EX) grade may be granted only for non course credit validation obtained through a validation process. This grade is not used for any Regental university course.

A grade of NG will be used only with those course sections that are designated as Tracking/Program Sustaining (Q).

Remedial grades (RI, RS, RU) may be granted only for courses numbered 001 to 099.

S Satisfactory/Unsatisfactory (S/U) grade may be granted only when the entire course requires the S/U grade or the student has elected the S/U option on or prior to census date of the term.

### **Waiver Request**

In extenuating circumstances students may request that a requirement stated in the academic policies of the institution or of the South Dakota Board of Regents be waived. Examples of such requirements include, but are not limited to, the limit on the number of times a course may be attempted, the time limits on completion of pre-general education and general education courses, the academic suspension policy, the proficiency exam policy, and the change of grade from an F to a W. Students wishing to appeal must complete the Application for Academic Appeal form that is available at the Office of the Vice President for Academic Affairs or can be downloaded from: <http://sdmines.sdsmt.edu/studentlife/forms>.

### **Withdrawal Grades Policy and Deadline**

Undergraduate and graduate students who drop a course, or withdraw from the System, shall receive a grade of "W" if that action occurs anytime between the day after the census day for that course and the day that corresponds with the completion of 70 percent of the class days for that course. Likewise, a student who withdraws from the system during that time period also shall receive grades of "W" for all the courses in which he/she is registered.

For standard classes, the last day to receive a grade of "W" is determined by calculating 70 percent of the class meeting days in the term, counting from the first day of classes in the term and rounding up if the calculation produces a fractional value greater than or equal to 0.5.

For any non-standard course, the last day to receive a grade of "W" is based on the number of class meeting days for the course, using the method described above.

A notation of the date of withdrawal will be included on the student's transcript if he/she withdraws from the system.

If a student withdraws from a course after the time period specified above, a grade of "F" will automatically be assigned by the Office of the Registrar and Academic Services. (South Dakota Board of Regents Policy 5:7.2)

### **Withdrawal from the University**

The effective date used for students withdrawing from the university is the date that the withdrawal process is initiated in the Office of the Registrar and Academic Services. This notice must be given by the student using the appropriate forms. Dates for withdrawing from the university will be proportionally adjusted for summer terms of instruction.

Complete withdrawal from the university from the day after registration day through 70 percent of the class meeting days in the term results in the assignment of "W" grades unless the professor-in-charge has previously assigned a final grade. A withdrawal from the university must be initiated in the Office of the Registrar and Academic Services and processed through the Director of Retention and Testing. A withdrawal from the university will be processed only when all courses at all Regental universities are being dropped by a student.

If a student withdraws from the university after completion of 70 percent of class days, grades of "F" automatically are assigned by the Office of the Registrar and Academic Services in all courses for which the student was enrolled unless a final grade has previously been issued by the course instructor. In the event that a final grade has not been assigned, consideration may be given to extenuating circumstances that may warrant the assignment of a grade of "W." Should such extenuating circumstances exist, students wishing to appeal must complete the Application for Academic

Appeal form that is available at the Office of the Vice President for Academic Affairs or can be downloaded from <http://sdmines.sdsmt.edu/studentlife/forms>. Such appeal must be filed within one term after the term in which the withdrawal occurred.

## **Graduation Requirements - Undergraduate**

### **Application for Graduation and Commencement**

An Application for Graduation and Commencement must be completed by the date indicated on the academic calendar which is located in the academic calendar section of the catalog. If you are completing degree requirements during the summer term you must complete the form for the preceding May graduation. A student is allowed to walk only once in a commencement ceremony. Students must be actively enrolled in the semester that they graduate and meet the requirements of the degree. This form is online at the following URL: [interact.sdsmt.edu/aes/graduation.htm](http://interact.sdsmt.edu/aes/graduation.htm)

### **Minimum Graduation Standards**

To be awarded a baccalaureate degree, an associate degree or a certificate a student must at a minimum have a cumulative GPA of 2.0 or higher.

### **Associate Degree**

The institution granting the degree determines the honors designation for its associate-level graduates. To earn an honor designation at graduation, an associate-level graduate must meet both the following cumulative and institutional grade point averages:

#### **With highest honor:**

equal to or greater than 3.90

#### **With high honor:**

equal to or greater than 3.70 and less than 3.90

#### **With honor:**

equal to or greater than 3.50 and less than 3.7

An associate-level graduate must have completed a minimum of 30 credit hours at the institution granting the degree. Courses that are part of a formal collaborative agreement among Regental universities are considered to be earned from the institution granting the degree.

### **Baccalaureate Degree**

The institution granting the degree determines the honors designation for its graduates. To earn an honors designation at graduation, the student must meet both the following cumulative and institutional grade point averages:

#### **Summa Cum Laude:**

equal to or greater than 3.90

#### **Magna Cum Laude:**

equal to or greater than 3.70 and less than 3.90

#### **Cum Laude:**

equal to or greater than 3.50 and less than 3.70

The student must have completed a minimum of 60 credit hours at the institution granting the degree. Courses that are part of a formal collaborative agreement among Regental universities are considered to be earned from the institution granting the degree.

### **Two Bachelor of Science Degrees From South Dakota School of Mines and Technology**

An undergraduate student who wishes to qualify for a second bachelor of science degree conferred by School of Mines must complete a minimum of thirty (32) semester hours of credit in residence beyond the credit hours used for the first B.S. degree.

Students should report their intent to pursue two (2) bachelor of science degrees to the Office of the Registrar and Academic Services. This action will initiate the assignment of an advisor in each discipline.

### **General Requirements**

The following rules on graduation requirements apply for the bachelor of science degree in any curriculum offered by the university. Requirements that apply to many or all programs are described below. Please refer to the curriculum for an individual degree program for specific course requirements.

Each candidate for a degree is personally responsible for meeting all requirements for graduation. No university official can relieve a candidate of this responsibility. The South Dakota School of Mines and Technology reserves the right to change any course of study or any part of a curriculum in keeping with accreditation, educational, and scientific developments.

## **Bachelor of Science Graduation Requirements**

**General Education Core Requirements – SEE PAGES 168 - 175**

**Pre General Education Courses in English and Mathematics – SEE PAGE 172**

**For information regarding the Associate of Arts degree requirements, see General Studies, A.A. – pages 9 - 11**

### **Semester Credit and Grade-Point Average**

Additional requirements are listed with each departmental curriculum found in a later section of this catalog. All curricula require passing grades in the prescribed courses and a minimum cumulative grade point average of 2.00. Each engineering curriculum requires 130 hours of credit for graduation and each science curriculum requires one 120 hours of credit.

### **Military Science Credits**

Military Science credits may apply to all degrees as free electives. This option varies with the number of free electives available in an individual curriculum. A veteran may petition the Registrar and Director of Academic Services to receive credit for basic military science and physical education.

### **Transfer Credit**

Articulation of credit may be allowed for previous college education if the courses are equivalent to required or elective courses at this university and if each course presented is of passing quality.

The acceptability of transfer credit is determined by the student's major department.

Transfer credit for work at a junior, community college (two year) and/or two-year technical college may not exceed one-half of the hours required for completion of the baccalaureate degree at the accepting institution.

### **Credit Definitions**

#### **Credits in Residence**

Credit in residence within the Board of Regents system is a course offered by any of the degree-granting Regental institutions at any approved sites using any approved method of delivery.

#### **Institutional Credits**

An institutional credit is a credit offered by the degree granting institution and includes credits that are part of a formal collaborative agreement between that institution and another Regental institution.

#### **Validated Credits**

Credit earned for college level courses by validation methods such as Credit by Exam, CLEP, AP, portfolio, and others within the Regental system will not be considered "credits in residence."

### **Institutional Credit Requirements for Degree-Seeking Students**

1. Minimum number of credit hours that must be earned from the institution granting the degree:

Baccalaureate	30 hours
Associate	15 hours
2. Number of the last credit hours earned preceding completion of the degree that must be earned from the institution granting the degree:

Baccalaureate	15 of the last 30 hours
Associate	8 of the last 15 hours
3. Minimum number of credit hours specified in the major or minor requirements that must be completed at the degree granting institution: 50 percent. However, this requirement may be waived for students enrolled in the set of majors offered by the system's Centers which include in the established programs of study common courses offered by one of the other Regental universities. In addition, the Vice President for Academic Affairs/Provost may make exceptions to this requirement for individuals based on the student's prior learning experiences.

### **Required Check-out Procedure**

All graduating seniors and students terminating enrollment at School of Mines are responsible for ensuring that they have returned all keys, library books, laboratory equipment, and other university property to the appropriate departments prior to graduation or their last day of enrollment. All financial obligations to the university or any of its departments must also be paid prior to graduation or termination of enrollment at School of Mines.

Perkins Student Loan recipients must complete an exit interview with a Business Office representative prior to graduation or termination of enrollment at School of Mines. The university reserves the right to withhold a student's diploma and/or transcript of grades for failure to meet any of the above specified requirements.

### **Collegiate Assessment of Academic Proficiency**

#### **CAAP Exams Required for Graduation**

The South Dakota Board of Regents has mandated that all students attending a state university in South Dakota and seeking their first undergraduate degree take and pass the Board of Regents Proficiency Examination. Baccalaureate degree-seeking students will sit for the exam on completion of 48 passed credit hours at or above the 100 level and associate degree-seeking students will sit for the exam on completion of 32 passed credit hours at or above the 100 level. Enrolled students who have already earned a baccalaureate degree are exempt from the requirement.

Testing will be offered during a two-week period during the fall and spring semesters. Students who fail to sit for the exam, when required to do so, will not be allowed to register for courses at any of the state universities for two academic terms unless the student seeks and is granted a deferment for a valid cause (i.e. co-op, internship, etc).

Students failing to achieve the minimum proficiency level on one or more components of the exam will be allowed to retest. Retesting must occur within one year of after initial testing. During that year, students may continue to enroll in courses. As preparation for retesting, students are required to complete a development plan for remediation, within one month of notice of failure and in collaboration with the director of Retention and Testing. Students will be able to retest twice during that year and a fee of \$15.00 will be charged to cover the cost of testing.

Students will be informed by the testing office when they are eligible to test. Approximately four to six weeks after a student has tested, he or she will receive the results and an explanation of how to interpret his or her achievement. Students who failed to achieve an acceptable score within one year from initial testing will not be permitted to continue their enrollment. An appeal process for certification of proficiency using alternate methods is available to those students.

## **Graduate Education**

South Dakota School of Mines and Technology offers graduate degree programs at the master's and doctoral levels. The graduate program provides opportunities for advanced study and research in the fields of engineering and science. Each individual degree program of study is designed to broaden and extend the student's knowledge within the chosen field, to develop the power of independent, critical thinking and to promote individual and cooperative research skills.

The first Master's Degree program was authorized at the South Dakota School of Mines and Technology in October 1935, and the first degree was granted in 1937. Permission to offer the first Ph.D. program was granted in January 1967 to the Department of Geology and Geological Engineering. Six additional Ph.D. programs have been authorized since that time with the most recent addition being a Ph.D. in Mechanical Engineering in 2009. The Graduate Office was created in the 1950-51 academic year.

The policies of the Graduate Office are formulated with the assistance of the Council on Graduate Education, which is advisory to the Dean of Graduate Education. The policies are approved by the Faculty Senate and the Board of Regents and are administered by the Graduate Dean. Forms mentioned in the catalog are available at the Graduate Office or on the graduate education website.

### **The Council on Graduate Education**

The Council on Graduate Education consists of representatives from each graduate program and the Dean of Graduate Education or his/her designee. (The Vice President for Academic Affairs serves in an ex-officio capacity.)

## **Graduate Programs**

**Master of Science degrees** are offered in:

- Atmospheric and Environmental Sciences
- Biomedical Engineering
- Chemical Engineering
- Civil Engineering
- Computational Sciences and Robotics
- Construction Management
- Electrical Engineering
- Engineering Management
- Geology and Geological Engineering
- Materials Engineering and Science
- Mechanical Engineering
- Mining Engineering
- Paleontology
- Physics

**Doctor of Philosophy degrees** are offered in:

- Atmospheric and Environmental Sciences
- Biomedical Engineering
- Chemical and Biological Engineering
- Geology and Geological Engineering
- Materials Engineering and Science
- Mechanical Engineering
- Nanoscience and Nanoengineering

## **Admission to the Graduate School**

The graduate office encourages applications from qualified students holding bachelor's degrees in engineering or science from accredited four-year colleges and universities. A student desiring admission should obtain an application form from the graduate office or via the website at: <http://graded.sdsmt.edu>. The completed form and a non-refundable application fee of \$35 (for all applicants) are required to be submitted to the graduate office. Required supporting documents are specified on the application and on the web site. Application materials from domestic applicants should be received by June 1 for fall semester admission or by October 1 for spring semester admission. International applicants must submit all of their materials by March 15 for fall semester admission or by August 1 for spring semester admission. Applicant files will not be considered for acceptance until all of the application items are received.

If the applicant has not completed an undergraduate program, evidence of graduation must be submitted prior to enrollment.

When an application for admission to a graduate program is received, the faculty of the program in which the applicant expects to major will evaluate the applicant's academic qualifications. The head/coordinator, on behalf of the faculty, will recommend whether or not the applicant should be accepted into the graduate program and whether the admission should be as an unconditional, conditional, probationary, or special student. The Dean of Graduate Education will review this recommendation and provide a letter of decision to the applicant.

Additional information about requirements for specific graduate programs can be found in the program description section of the catalog.

Admission to the Graduate school for study toward a master's degree does not imply that the student will be allowed to work toward a doctorate. A separate application and evaluation of the student's qualifications are necessary before acceptance into a doctoral program. Admission to the graduate school for study toward a Ph.D. degree does not constitute admission to candidacy for the Ph.D. degree. Refer to a later section for information on admission to candidacy.

A student who is admitted to the Graduate School but is unable to attend in the semester in which he/she was accepted may request a deferment for up to two years. The request must be made in writing to the Office of Graduate Education and must specify the revised start date. Deferments must be approved by the Dean of Graduate Education. Students must reapply if the anticipated start date is more than two years after the acceptance date.

Students who are denied admission are not eligible to reapply to the same program for one year.

## **International Student Admissions**

### **English Proficiency**

All international applicants must provide evidence of English proficiency, with the exception of applicants from countries where English is the native language.

Applicants who have a prior degree from a college or university in the U.S. may also be exempted, based on English courses taken and grades received in those courses.

The School of Mines has established minimum scores for admission for TOEFL, IELTS and the Pearson Test of English- Academic, listed below. We recognize a variety of valid English proficiency tests which will be evaluated on an individual basis. English proficiency test results must be sent to the graduate office. Please use school code 6652 for TOEFL results to be sent to the School of Mines.

Detailed information about the English requirement is available on the web site at [international.sdsmt.edu/new-students/admissions/English/](http://international.sdsmt.edu/new-students/admissions/English/)

### **English Proficiency Conditional Admission**

Applicants who are planning to attend an intensive English as a Second Language (ESL) program in the US prior to attending the School of Mines may be eligible for conditional admission. Conditional admission may be granted if the applicant meets admission requirements with the exception of the minimum English score as indicated above. The School of Mines also recognizes the difficulty for ESL students in taking standardized exams that are offered only in English, such as the SAT, ACT and GRE. Students in ESL programs may be required to take such tests after they have advanced to a certain level in ESL. Requirements will be specified in a conditional admission letter sent to the graduate applicant. Once the student has completed the ESL program with satisfactory grades and meets any additional requirements, the student may be eligible for unconditional admission.

### **Transcript Evaluation**

Effective August 15, 2012, SDSM&T will require a third party foreign transcript evaluation for all incoming international graduate students. Exceptions can be granted by the Dean of Graduate Education for exemplary students who are recommended for a waiver by the department. The two primary evaluation companies in the U.S. are World Education Services (WES) and Educational Credential Evaluators (ECE). SDSM&T will require a course-by course evaluation report sent directly to us from the evaluating institution.

## **Visa Requirements**

An international applicant will not be issued the U.S. Department of Justice Form I-20, Certificate of Eligibility for Non-immigrant (F-1) student status, until admission to graduate school for study toward a specific advanced degree has been granted. Form I-20 is usually necessary for admission to the United States for college attendance. Conditions of issuance of this form include documented evidence of financial ability to cover the projected annual costs of education at this university including living allowance. This institution will issue a DS-2019 Form only when appropriate.

International students are advised that full-time status at this university is necessary in order to satisfy F-1 status requirements.

As a result of the regulations that became effective on January 1, 2003, the Family Educational Rights and Privacy Act (FERPA) is waived for F and J students with respect to reporting requirements specific to student status. The regulations will be strictly enforced by the appropriate bureau(s) within the US Department of Homeland Security (DHS), and information will be reported electronically to DHS via Student and Exchange Visitor

Information System (SEVIS). The consequences to students for non-compliance with the new regulations are severe. For more information, e-mail the Ivanhoe International Center at [Ivanhoe@sdsmt.edu](mailto:Ivanhoe@sdsmt.edu) or go to <http://international.sdsmt.edu>.

## **Application Fees and Medical Insurance**

All applicants are required to submit the \$35 application fee with the application. In addition, a \$75 international student enrollment fee will be assessed each semester. Both charges are non-refundable.

Each international student (and any dependents accompanying him/her to the United States) is REQUIRED to enroll in the Major Medical Hospitalization/Surgical Insurance Plan provided through South Dakota School of Mines and Technology. No outside policies will be accepted as substitutes. The only exception to this rule is if the student is sponsored by his/her home country government (documentation of this Application Fees and Medical Insurance

## **Graduate Funding**

- Graduate Assistantships
- Assistantships with Tuition Reduction
- Minimum Registration for Assistantships without Tuition Reduction
- Graduate Fellowships
- Other Resources

## **Graduate Assistantships**

South Dakota School of Mines and Technology has funds available from various sources for graduate assistantships and fellowships. Such awards are usually made on the basis of scholastic merit and the availability of funds. Assistantships are not available to students on probation unless an exception is granted by the Dean of Graduate Education.

Financial assistance is available for graduate teaching assistants (GTA) and for graduate research assistants (GRA). A GTA assists with instruction within laboratory sections, grades papers, or performs other assigned instructional duties. A GRA is compensated to conduct supervised research, generally relating to the student's thesis or dissertation research.

The Dean of Graduate Education grants the award, acting upon the recommendation of the department head, program coordinator, or major professor after evaluation of the student's academic record, overall qualifications, and programmatic progress. Graduate assistants are required to attend GTA/GRA training each semester prior to any release of funds.

Graduate assistants under state contract are subject to institutional policies set forth in the Faculty/Staff Handbook. Research assistants are required to sign an "Employee Agreement to Disclose Inventions" form. Teaching assistants are required to sign a "Family Educational Rights and Privacy Act Compliance Sheet".

A student with a research assistantship (GRA) should recognize that the prescribed hours of research work are minimum expectations mandated by employment practices and may not represent the effort that will be actually necessary to produce a satisfactory thesis or dissertation within a reasonable period of time.

Students must register before assistantships and fellowships are processed for the semester for which they are authorized in order to prevent payment delays.

Graduate assistants who are eligible for reduced tuition at one South Dakota Regental institution are also eligible at other South Dakota institutions.

Graduate Special Students (non-degree-seeking students) are not eligible to receive assistantships.

Graduate students are assessed the same campus fees as undergraduates (see "Tuition and Fees"). State law does not permit reduction or remission of fees under any circumstances.

### **Assistantships with Tuition Reduction**

The minimum compensation, established annually by the Board of Regents and currently set at \$3,157, must be awarded in each semester to qualify for reduced tuition.

Additionally, a student with an assistantship must meet the following minimum registration requirements to qualify for reduced tuition:

1. Spring and Fall Assistantships: The minimum registration required to receive reduced tuition with a qualifying assistantship in a fall or spring semester is 9 credits.
2. Summer assistantships. The minimum registration required to receive reduced tuition with a qualifying assistantship in the summer is 2 credits. Self-support classes, including English remediation classes, are not eligible for reduced tuition.

A student receiving an assistantship and tuition remission is required to maintain 9 credits throughout the semester in which the support is received. If a student drops to fewer than 9 credits, the student will immediately lose the assistantship and will be required to repay the institution for the tuition remission on the dropped class. Students who withdraw from the institution will have their assistantships pro-rated to reflect time actually worked.

### **Minimum Registration for Assistantships without Tuition Reduction**

Students may elect to register for fewer than the 9 credits required for tuition reduction while receiving an assistantship. However, the following minimum registration still applies to any student receiving an assistantship, even if tuition reduction is not awarded:

1. An assistant receiving a three-quarter time stipend (62.5 percent academic study, 37.5 percent research or teaching) must be registered for a minimum of 7 credit hours during the academic semester in which the assistantship is in effect. Registering for 7 credits does not qualify for reduced tuition. Only students registered for 9 credits in the fall or spring and receiving a qualifying assistantship may receive reduced tuition.
2. An assistant receiving a half-time stipend, (75 percent academic study, 25 percent research or teaching) must be registered for a minimum of 5 credit hours during the academic semester in which the assistantship is in effect.

Registering for 5 credits does not qualify for reduced tuition. Only students registered for 9 credits in the fall or spring and receiving a qualifying assistantship may receive reduced tuition.

**Note** that an assistant receiving a full-time stipend (50 percent academic study, 50 percent research or teaching) must be registered for a minimum of 9 credit hours during the fall or spring academic semester in which the assistantship is in effect. Reduced tuition is available for students meeting these criteria.

### **Graduate Fellowships**

A number of fellowships from industrial and governmental agency sources are currently available. Eligibility requirements and restrictions are parallel to those for research assistantships. A fellowship award usually does not include reduced tuition as a benefit. Pre-registration by continuing students is required to prevent payment delays.

### **Other Resources**

Graduate students who are U.S. citizens or eligible non-citizens may be eligible for other forms of financial aid such as Federal Stafford Student Loans, Federal Perkins Student Loans, or Federal Work-Study. Application and requests for additional information on these programs should be made to the Financial Aid Office.

### **Master of Science Programs**

Master of Science programs at SDSM&T may offer three options by which a student may complete the requirements for a degree. They are the thesis option, the non-thesis option, and the coursework-only option. Professional degrees are contained within the coursework-only option.

In the following descriptions the term "program" refers to a division in a department such as the Environmental Engineering program within the Department of Civil and Environmental Engineering, or a non-departmental unit such as Engineering Management, Materials Engineering and Science, or Atmospheric and Environmental Sciences.

Students are encouraged to read the sections "Advanced-degree Requirements", "Undergraduates Taking Graduate Courses/Graduates Taking

Undergraduate Courses" and "Work Taken at Another Institution" for additional information about limitations on coursework that may be applied toward the degree.

### **Thesis Option Requirements**

The M.S. degree minimum requirements for the thesis option are:

1. A program of at least 30 credit hours of coursework and research.
2. At least 15 credit hours of graduate coursework approved by the program (500-level courses and above).

3. At least 6 credit hours of thesis research are required for the thesis option. No more than nine 9 credit hours of thesis research will count toward degree requirements. However, the student may register for additional research credits for continuing registration purposes.
4. A satisfactory thesis based upon individual research. (see below)
5. Meeting or exceeding academic standards prescribed elsewhere in this bulletin, including maintaining at least a 3.0 GPA.
6. Passing an examination on general knowledge and successfully defending the thesis.

### **Thesis Requirements**

The thesis should represent an effort of such quality and construction that it can be displayed in the school library with similar scholarly works, as well as providing material for publication(s) in an appropriate professional journal(s).

The thesis is written under the direction of the major professor, but the student should feel free to seek guidance from all members of his/her advisory committee. Before starting to write the thesis, the student is urged to consult "Instructions for the Preparation of Theses and Dissertations" on the graduate education website (<http://resources.sdsmt.edu/forms/grad-ed/thesis-and-dissertation-instructions.pdf>) and to consult style manuals online or in the SDSM&T Devereaux Library. In general, the thesis may follow the style of captions, footnotes, and bibliographical references used by the leading technical journal in the student's field. Students are urged to review carefully copyright ownership provisions in the "Instructions" document.

A final draft of the thesis should be submitted by the student to each member of his/her advisory committee a minimum of 2 full weeks before the time and date of the student's scheduled defense. Earlier submission deadlines may be required by the advisory committee.

The Dean requires that the final draft of the thesis be submitted to the graduate office by the published deadline, approximately 21 calendar days before graduation, to allow adequate time for review, corrections and revisions. The final draft of the thesis, after all revisions recommended by the committee have been made, must be signed by the author and approved and signed by the major professor, the head/coordinator of the student's major department/program, and the Dean of Graduate Education before final reproduction. Signatures of other committee members are allowed but not required.

The institution requires 4 copies of the thesis in final form: the original (unbound) manuscript and 1 bound copy for the Devereaux Library, and 2 bound copies for the student's department/program, one 1 of which will be forwarded to the major professor. 2 electronic versions of the thesis will also be required in digital format, 1 for the department and 1 for the graduate office. Contact the graduate office for instructions and requirements for this digital version. In case of a proprietary thesis, the original hard copy and digital version will be retained without reproduction in secured graduate office files throughout the specified proprietary period.

### **Thesis Defense**

A student pursuing the thesis option must defend the thesis in an oral examination. The thesis defense will normally be held during the last six weeks of the student's last term, but it may be given at any time after the thesis has received committee approval. No thesis defense may be scheduled during the period of university final examinations. The Final Examination and thesis research defense may be combined. The procedures listed in the section titled "Final Examination" apply to both the thesis defense and the Final Examination.

### **Non-thesis Option Requirements**

Students enrolled in a non-thesis program may have the option of completing a non-thesis research project or taking additional course credits in place of the research project credits. The latter option is often referred to as a "coursework only" option and is common in professional degree programs. Students electing a non-thesis program should check with their program or department to determine which non-thesis options are available to them.

### **The M.S. degree minimum requirements for the non-thesis option are:**

1. A program of at least 32 credit hours of coursework (refer to specific program requirements for exact number of minimum coursework credit hours).
2. At least 20 credit hours of graduate coursework approved by the program (500 level and above).
3. The number of non-thesis research project credits that may be used for the degree is limited to 6 credits.
4. Meeting or exceeding academic standards prescribed elsewhere in this bulletin, including maintaining at least a 3.0 GPA.
5. Passing an examination on general knowledge in the field.

### **Final Examination**

All Master of Science degree candidates **will** be given a final examination covering course material. The examination may be written, oral, or both at the discretion of the major department or program. A portfolio may be used to satisfy the final examination requirement if the program and the Dean of Graduate Education have approved this approach.

A student pursuing the thesis option must also defend the thesis in an oral examination. The final examination and thesis defense may be combined. Oral examinations, including a thesis defense, are open to all interested faculty members. Departmental or program policy shall determine whether non-faculty persons may attend the examination.

The student shall obtain and complete the relevant Graduate Office form to schedule the final examination and/or thesis defense and, in conjunction with the major professor, shall seek the approval of all committee members and shall file the form with the Graduate Office no less than five working days before the exam. The Graduate Office will announce this information to the campus community.

The thesis defense oral examination will normally be held during the last 6 weeks of the student's last term, but it may be given at any time after the thesis has received committee approval. No final examination or thesis defense may be scheduled during the period of university final examinations.

The student's committee constitutes the examining board for a final oral examination. The major professor will head the session. The major professor is responsible for ensuring that a majority of the committee, as well as the Graduate Representative, is present. The examination will not be held if these conditions cannot be met. A negative vote by any two or more members of the student's committee or a negative vote by the Graduate Office representative will signify failure of the examination. All committee members must be given the opportunity for input to and evaluation of a written non-thesis final examination. Refer to the Graduate Office policies for information on committees and exam procedures for proprietary thesis programs.

Results of all written or oral examinations will be attested to by all committee members on a form furnished to the Graduate Representative by the Graduate Office. The original form with signatures and dates will be filed with the Graduate Office and a copy with the department/program. If the student passes with reservation or pending correction, a **copy** of the form will be filed with both offices. The originals will be filed with both offices, with the appropriate affirming signatures, when final corrections have been made and accepted.

If the candidate fails to satisfy the examiners on either coursework or thesis, written or oral examinations, the committee may schedule a re-examination over general background, thesis, or both. The re-examination will be scheduled at the discretion of the candidate's advisory committee, normally 8 to 12 weeks after the date of the first examination. The student may petition his/her committee for re-examination prior to the eight week limit.

### **Participation in Commencement**

A student must apply to graduate by completing the Application for Graduation form on the Graduate Education website and must meet the program requirements before the degree is awarded. The Application for Graduation form also serves as a request to participate in the commencement ceremonies. In general, for each degree earned, a student is allowed to participate in commencement once and have his or her name in the commencement program once. Note that participation in the commencement ceremony does not equate to the conferring of a degree. The degree is conferred when all requirements are met and the release of diploma process is completed.

By default, the names of all students who have completed the requirements for graduation by the designated spring date will be included in the May program and students who have completed the requirements by the designated fall date will be included in the December program. The student's name will appear in the program in the semester of completion, whether the student is participating in the ceremony or not, except as noted below.

### **M.S. Candidates Participating in Commencement prior to Completion of all Requirements**

M.S. Students who will finish in August may request permission, in writing, to participate in May commencement and his or her name will appear in the May program. If the student is scheduled to graduate in August and does not participate in the May graduation, the student's name will, by default, appear in the December program and the student is welcome to participate in the December commencement ceremony.

Students who will complete the requirements for a degree after December but substantially before the end of the spring term may request permission, in writing, to participate in December commencement and will be listed in the December program.

A student who wishes to participate in a commencement ceremony later than the semester in which the degree is completed must notify the Graduate

Office of his or her intent prior to the end of the semester in which the degree requirements are met. In general, a student is allowed to participate in a commencement ceremony within one year of completing the requirements for the degree.

### **Time Limitation**

A Master of Science degree program must be completed within 5 calendar years dating from the student's formal entrance into a degree-seeking program. Courses taken by the student at any institution that are requested to be part of the degree program and that were taken more than five years prior to the date of anticipated graduation must be reviewed by the student's major department/program and the Dean of Graduate Education for possible acceptance. Following this review, the student's major department/program and the Dean of Graduate Education will determine whether a reduction in credits applicable toward the degree, a re-examination, or both is required for the student to complete his or her degree program. In exceptional circumstances, students may petition the Dean of Graduate Education for an extension to the 5 year time limit.

A student who is granted a Leave of Absence (see section on "Leave of Absence") will not be subject to continuing registration, and the leave of absence will not count toward the time limits to complete his/her program of study.

## **Graduate Student Registration**

### **Full-Time/Half-Time Defined**

A graduate student will report to the advisor specified in the admission letter and thereafter will follow the registration procedure for all South Dakota School of Mines and Technology students. The advisor is responsible for counseling the graduate student with respect to programmatic requirements until the student has selected a major professor. In some programs, the advisor may continue to work with the student and the major professor to ensure that all degree requirements have been satisfied.

A full-time graduate student is defined as a student registered for 9 or more credit hours per semester at any of the universities in the South Dakota Regental system during the academic year. All international students must be registered full-time to maintain student status with the U.S. Government. A three-quarter-time graduate student is defined as a student registered for at least 7 credits but less than 9 credit hours per semester during the academic year.

A half-time graduate student is defined as a student registered for at least 4.5 credits and less than 7 credit hours per semester during the academic year.

Two (2) credits are considered full-time during the summer for purposes of receiving an assistantship. To qualify for federal student aid or to qualify for in-school deferment status (for federal or private alternative student loans), a student must be registered for at least 4.5 credits during any semester, including summer.

Audited credits do not apply toward the above definitions. Remedial English classes count toward the determination of full-time status.

### **Continuing Registration**

Degree-seeking graduate students must be registered on a continuing basis during each fall and spring semester of the regular academic year. The number of credits required is specified in the next section, "Minimum Registration". This applies regardless of whether the graduate student is in residence, is off-campus, or is pursuing a degree on a part-time basis. Failure to maintain continuing registration will result in deactivation of the graduate student's program. Therefore, graduate students who fail to comply and subsequently wish to return to their same program of study will be required to obtain written permission from the Dean of Graduate Education and may be required to reapply.

Students may petition for a leave of absence if they are unable to fulfill the continuing registration requirement. (See "Leave of Absence" section.)

Graduate Special Students (non-degree-seeking students) are exempt from the continuing registration rule.

### **Minimum Registration**

Degree seeking graduate students must enroll for a minimum of 2 credits during the spring and fall semesters. A student must also register for a minimum of 2 credits during the summer if the student is using departmental or institutional resources. Minimum registration is required any semester in which a student schedules or takes exams, conducts research, or completes a degree. The number of credit hours taken in excess of the minimum should accurately reflect the extent of the graduate student's coursework and research activities.

Graduate students must meet this minimum registration requirement during the specific semester or summer in which they complete all requirements for their degree and become eligible for graduation. There will be no grace period; hence, students who fail to complete all degree requirements prior to the official closure date for a given semester or summer will be required to register for a minimum of 2 credits during a subsequent semester or summer in order to graduate.

### **Academic Loads**

Thirteen credit hours per semester are considered to be the maximum graduate load. Higher loads must be approved by the Dean of Graduate Education and the major professor. Students wishing to take a higher course load must complete a Course Overload Request form. Appropriate course loads should be determined in conjunction with the advisor or major professor and should reflect the effort required for students working as GTAs or GRAs. Please refer to the section "Graduate Student Support" for additional information on the number of credit hours required during a semester to be eligible for assistantships and financial aid.

### **Leave of Absence**

A student who is unable to continue his/her program of graduate study due to unanticipated circumstances may request a leave of absence from his/her program of study by completing and submitting a "Request for Leave of Absence" form, available in the graduate office and at the graduate education website. The form must be completed and signed by the student, the student's advisor, department head or program coordinator and then submitted to the graduate office for each semester of absence. The Dean of Graduate Education will evaluate the request and either approve or deny it. If the request is approved, the student will not be subject to continuing registration, and the leave of absence will not count toward the time limits to complete his/her program of study. A leave of absence is determined on a semester-by-semester basis and is usually limited to a maximum of one calendar year. International students are not eligible for a leave of absence if they intend to remain in the U.S.

### **Undergraduates Taking Graduate Courses**

Graduate-level credits (500 level or above) taken as an undergraduate student are automatically placed on a graduate transcript and may not be used toward an undergraduate degree except under the following circumstances:

1. Appropriate approvals and credit transfers have been obtained through Academic and Enrollment Services
2. Graduate-level credits taken as an undergraduate and used to fulfill requirements for the undergraduate degree may not be used toward a graduate degree unless the credits were taken as part of an approved accelerated master's program at SDSM&T.
3. Up to 12 semester hours of graduate-level credits taken as an undergraduate and not used to fulfill requirements for the undergraduate degree may be used toward a graduate degree only after the courses in question are approved by the student's graduate committee.

### **Graduate Students Taking Undergraduate Courses**

Undergraduate-level credits (300 or 400 level) taken as a graduate student are automatically placed on an undergraduate transcript and may not be used toward a graduate degree except under the following circumstances:

1. The courses must be approved by the student's graduate committee and by the Department Head.
2. The student must have earned a "B" grade or better in any 300- or 400-level course which is to be credited toward advanced degree requirements. (See also individual department restrictions on 300-400 level courses.)
3. The student cannot apply any credit hours or grades for 100- and 200-level courses (which are usually taken to overcome academic deficiencies) toward advanced degree requirements. If, in the opinion of the student's advisor, major professor and advisory committee, progress in these courses is unsatisfactory, additional work may be required to demonstrate proficiency.
4. The number of undergraduate credits not used to fulfill requirements for the undergraduate degree that may be applied toward a master's degree is limited to 9 hours.

### **Work Taken at Another Institution**

A minimum of 60% of the credit hours in the graduate degree program must be completed from the institution granting the degree. Credit for up to 12 semester hours of graduate-caliber coursework taken at another institution may be transferred toward the requirements for the Master's degree at the South Dakota School of Mines and Technology.

Domestic graduate transfer courses and transfer grades are recorded and evaluated by the School of Mines, calculated into grade point averages according to the South Dakota Regental grade scheme, and recorded on the student's academic transcript only if these transfer courses are equivalent to a specific graduate course at South Dakota School of Mines and Technology. International transfer courses will appear on the transcript along with the number of credits earned, but no grade will appear or be calculated into grade point average.

Such credit from institutions external to the South Dakota Regental system must be reviewed and approved by the student's committee and by the Dean of Graduate Education. The Dean of Graduate Education shall notify the Registrar and Director of Academic Services in writing of the credits to be accepted and placed on the student's transcript. An official transcript received directly from the issuing institution to support the request is required. The transferred course number, title, and semester hours will be entered on the student's transcript.

### **Dual Enrollment in Ph.D./M.S. Programs**

Concurrent enrollment in a Ph.D. program and an M.S. program in a different department is normally not allowed.

### **Exception Policy**

A student who seeks an exception to the above policy must follow the procedure set forth below. Students must be aware that exceptions to this policy will be granted only under extraordinary circumstances.

1. The Ph.D. student must obtain prior written approval for this dual-degree plan from his/her major professor and the head/coordinator of the relevant Ph.D. program.
2. If approval is granted in Step 1, then the Ph.D. student must obtain written approval for the M.S. degree plan from the head of the corresponding M.S. program.
3. If approval is granted for Step 2, then the student will need to establish a second graduate committee and file a separate program of study for the M.S. degree with the graduate office.
4. The Dean of Graduate Education will have authority to either approve or disapprove this second program of study. If the M.S. program of study is approved by the Dean of Graduate Education, then the major professor of the student's Ph.D. program will be appointed as the representative of the graduate school of the student's M.S. graduate committee.
5. The first 2 semesters of the dual program will be considered probationary. The second program of study can be terminated based on recommendations of the Ph.D. major professor and/or M.S. major professor to the Dean of Graduate Education.

## Dual Majors

South Dakota School of Mines and Technology does not permit, in general, credit hours that have been used to satisfy requirements for one Master of Science degree to be applied toward another master's degree from this institution. Under exceptional circumstances however, a student may petition the Council on Graduate Education through his/her advisory committee for a variance from this policy.

## Accelerated Master's Programs

The faculty at SDSM&T have approved the creation of Accelerated Master's Degree programs which will enable a student to complete both the B.S. and M.S. degrees in 5 years. These accelerated programs are honors programs to which an interested student must apply. The details for a particular program can be found in the program information section of the catalog. Not all programs offer the accelerated option.

Students desiring to participate in an accelerated program are encouraged to apply at the end of their junior year. A minimum undergraduate cumulative GPA of 3.0 at the time the student applies to the program is required. Programs may grant exceptions to the GPA requirement under situations approved by the Dean of Graduate Education.

Up to 12 credits applied toward the B.S. program may be used to satisfy graduate credit requirements (See individual programs for the number of credits allowed by the program.) The following restrictions apply:

1. The courses must be taken at the graduate level as an undergraduate.
2. The student must apply to, and be admitted to, the graduate school in the accelerated program prior to taking courses to be credited toward the accelerated program.
3. No courses taken prior to admission to the Accelerated Program may be counted toward a graduate degree. No exceptions to this policy will be approved.
4. Courses that are "double counted" must be approved by the program coordinator/major professor for inclusion in the program of study prior to registration for the course or the credits will not be applied toward the graduate degree. No exceptions to this policy will be approved.
5. Only courses taken at SDSM&T are eligible for dual credit. No transferred courses, even from other regential institutions, will be allowed to count toward the accelerated graduate degree.

## Special Students

An individual who holds a Baccalaureate degree and wishes to pursue further study without a commitment to advanced degree candidacy may apply to the graduate office for admission as a special student at the graduate level. The applicant must provide evidence of the baccalaureate degree. Upon admission as a special student, he/she will be subject to graduate office policies. A maximum of 12 credit hours may be accumulated, after which a Special Student must either apply for admission as a degree-seeking student or must petition for a variance from this policy. A course with a grade of "Incomplete" counts toward the 12 credit maximum. Graduate students classified as special students are not eligible for assistantships. If a student is granted admission to a program as a degree-seeking student, a maximum of 12 credits taken as a Special Student may be applied toward the degree.

## Change of Program

A student admitted to the graduate school in a specified program must complete at least one semester in the original program before being allowed to transfer. A student who wishes to change programs should request the change using an "Intent to Transfer" form. The current program must be notified prior to seeking the transfer. Approval from the proposed program is required. If admittance to the new program is not granted, the possibility of a discontinuation from study in any area at SDMS&T is possible. Upon favorable recommendation from the new program, the Dean of Graduate Education will issue a letter of transfer and notify the appropriate offices and the student of the change.

## Advanced-Degree Grade Requirements

To qualify for any advanced degree, the faculty has stipulated that the following requirements must be satisfied:

1. The student must earn a minimum 3.00 cumulative GPA for all 300- through 800-numbered courses taken in all departments which appear on the graduate transcript. In addition, the student must also have a minimum cumulative GPA of 3.00 for courses taken in his/her major department after admission to the graduate program, or taken for graduate credit at the School of Mines as an undergraduate or special student. Note that thesis and dissertation research credit hours and grades will not be counted in the determination of these grade-point averages. Only courses listed on the graduate transcript are used for computing the graduate GPA.
2. The student must earn a "C" grade or better in any graduate course (500 through 800 level), which is to be credited toward advanced degree requirements.
3. The student must earn a "B" grade or better in any 300 or 400 level course which is to be credited toward advanced degree requirements.
4. The student's thesis or dissertation research must be of a quality to earn a final grade of "S."
5. A student who fails any course must repeat the course with a passing grade as defined above. The student may petition through his or her advisor or major professor to the Dean of Graduate Education for an exception to this rule.
6. The student cannot apply any credit hours or grades for 100- and 200-level courses (which are usually taken to overcome academic deficiencies) toward advanced degree requirements. If, in the opinion of the student's advisor, major professor and advisory committee, progress in these courses is unsatisfactory, additional work may be required to demonstrate proficiency.

7. Of credits counted for an advanced degree, not more than 50 percent of the credit hours in any graduate program can be at the 500 level or below. Exceptions must be approved by the Dean of Graduate Education.

If a course is repeated for a passing or improved grade, only the grade for the last attempt will be included in the computation of the cumulative grade-point average shown on the graduate student's transcript.

Advanced degree credit given for "Special Topics in," "Advanced Topics in," or "Seminar in" is limited to 9 credits. Refer to the specific course description for any other restrictions.

All graduate research credit hours are graded according to regular grading standards. However, for graduate research credits (courses numbered 788, 798, and 898) the final grades for a completed program will be issued as either "U" for Unsatisfactory or "S" for Satisfactory. These S and U grades will not be used in the computation of grade-point averages.

Research credit may be applied toward the fulfillment of credit-hour requirements. The number of credit hours so applied is identified in the relevant sections under Master of Science and Doctor of Philosophy degree programs.

## **Graduate Grading System**

The grades listed in this section can be assigned to all courses with course numbers of 500 or greater. Plus and minus grades are not used.

### **1. Coursework Final Grades**

#### **A Exceptional**

4.00 grade points per semester hour.

#### **B Good**

3.00 grade points per semester hour.

#### **C Average**

2.00 grade points per semester hour.

#### **D Unsatisfactory**

1.00 grade point per semester hour.

#### **F Failure**

0.00 grade points per semester hour.

#### **S Satisfactory**

Does not calculate into any GPA. This is the grade that will appear on a transcript for a successfully completed course taken with the pass/fail option or for research credits (see below).

#### **U Unsatisfactory**

Does not calculate into any GPA. This is the grade that will appear on a transcript for failing to complete a pass/fail course or research credits (see below).

#### **W Withdrawal**

Does not calculate into any GPA, no credit granted.

#### **AU Audit**

Does not calculate into any GPA. An audit (AU) grade may be granted only when the student has elected the AU option on, or prior to, the census date of the term.

### **2. Incomplete Grades**

#### **I Incomplete**

Does not calculate into any GPA. An incomplete (I) grade may be granted only when all of the following conditions apply:

- a. A student has encountered extenuating circumstances that do not permit him/her to complete the course.
- b. The student must be earning a passing grade at the time the Incomplete is requested. Anticipated course failure is not a justification for an incomplete.

- c. The student does not have to repeat the course to meet the requirements.
- d. The instructor must agree to grant an incomplete grade.
- e. The instructor and student must agree on a plan to complete the coursework.
- f. The coursework must be completed within one calendar year. Extensions may be granted by the Dean of Graduate Education.
- g. If the student completes the course within the specified time, the grades that may be assigned are A, B, C, D, F, S, or U.
- h. If the student does not complete the course within the specified time the incomplete grade remains on the transcript.

### **IP In Progress**

Does not calculate into any GPA. An in progress (IP) grade may be granted only when all of the following conditions apply:

- a. The requirements for the course (for every student enrolled in the course) extend beyond the current term.
- b. The extension beyond the current term must be defined before the class begins.
- c. The instructor must request permission to award IP grades for a course from his or her department head/coordinator and from the Dean of Graduate Education. Then approval must be obtained from the Vice President for Academic Affairs.
- d. A definite date for completion of the course must be established in the course syllabus.

### **3. Research Grades**

#### **S Satisfactory**

Does not calculate into any GPA. This is a final grade for a research course (including thesis or dissertation research).

#### **U Unsatisfactory**

Does not calculate into any GPA. This is a final grade for a research course (thesis or dissertation research).

#### **NP Normal Progress**

Does not calculate into any GPA. A normal progress (NP) grade calculates into attempted credits but does not calculate into completed credits. Research grades do count toward attempted credits once a final grade of S or U is assigned. A normal progress (NP) grade may be granted by an instructor when the instructor determines that a graduate student is making normal progress in a graduate Thesis/Dissertation course. This is intended to be an intermediate grade which should be changed to 'S' or 'U' upon completion of the course requirements.

### **4. Additional Grading Options**

#### **NR Grade not reported by the Instructor**

Does not calculate into any GPA.

#### **EX Credit by Exam**

Does not calculate into any GPA. An examination for credit (EX) grade may be granted only for non-course credit validation obtained through a validation process. This grade is not used for any Regental university course.

#### **CR Credit**

Does not calculate into any GPA. A credit (CR) grade may be granted only for non-course credit that is not related to an examination or to equating transfer grades to the BOR grading system. This grade is not used for any Regental university course.

#### **TR Transcribed**

Does not calculate into any GPA and no credit is granted.

#### **LR Lab grade linked to Recitation Grade**

0 credit course.

### **Course Retake Policy**

A student will be allowed a total of two registrations for any particular graduate course (course numbers of 500 and above) for which credit is to be counted toward graduation. The student must petition the Dean of Graduate Education and obtain the Dean's approval to be permitted to take a graduate course more than two times. Only the LAST attempt of the course will count in the grade point average calculations. A student will be allowed multiple registrations for certain graduate courses for which credit toward graduation may be received more than once (e.g., Independent Study, Thesis, Research, etc.). Grades for all such courses will be used for grade point average calculations. Please note that individual credits allowed toward graduation in these types of courses.

## **Pass-Fail Option for Graduate Students**

The following policy pertains to the pass/fail option at the graduate level:

1. 100- and 200-level courses, either within or outside of the department, which cannot be applied for credit toward a graduate degree may (with the consent of the student's major professor and advisory committee) be taken on a pass-fail basis under the same rules that apply to undergraduate students.
2. 300- through 800-level courses outside of the student's department/program may (with the consent of the student's major professor and advisory committee) be taken on a pass-fail basis except that a "C" grade shall be considered the lowest passing grade. The maximum number of hours of pass-fail work for which a master's degree candidate may receive credit will be 6 for the thesis option and 9 for the non-thesis option.
3. No 300- through 800-level courses offered by the student's major department/program may be taken for credit under the pass-fail option. Beyond the master's level, the pass-fail option may be exercised at the discretion of the candidate's graduate advisory committee but must still be approved by the Dean of Graduate Education.
4. Graduate Education.

## **Probation and Reinstatement Policy**

An applicant who has a large number of deficiencies, or whose undergraduate record is relatively weak, may be admitted to the graduate program on probationary status. For a student admitted on probation, a deficiency in grade requirements during the first semester of enrollment may be considered sufficient grounds for terminating the student's enrollment in the graduate program. Such a termination decision will be made by the Dean of Graduate Education after consulting with the student's major professor and the department head or relevant program coordinator.

A current graduate student who does not meet the following requirements (items 1-7 below) during any semester will be placed on probation and will be so informed by the Dean of Graduate Education. A failure to remove the deficiencies during the following semester may be considered sufficient grounds for terminating the student's enrollment in the graduate program. Assistantships are not available to students on probation unless an exception is granted by the Dean of Graduate Education.

Probation imposed because of grade deficiencies in specific courses (items 2-3 below) will continue each semester until the course(s) has been retaken and an acceptable grade(s) has been received. Probation imposed because of overall GPA deficiencies (item 1 below) will continue each semester until the GPA reaches the acceptable level.

A student will be placed on probation for a "U" grade received for research credit(s). Since a "U" is a final grade, probation will be maintained until at least one subsequent "S" credit is awarded. A student may graduate with "U" grades, but must also accumulate "S" grades for the required minimum number of research credits in a given advanced degree program. A student who has transferred from a thesis to a non-thesis program and who has received "U" grades as the last research grades in the thesis program will be admitted to the new program on a probationary status. Such probation may be removed by satisfactory progress (according to the usual performance criteria) during the first semester in the new program.

In addition to probation triggered by academic performance, a student may be placed on probation for failing to meet programmatic or institutional requirements. Probation for such deficiencies will be removed after the requirement(s) has been satisfied. A student's probationary status will be reviewed at the close of each semester for appropriate action: removal from probation, continuation of probation, or termination. A student may petition the Dean of Graduate Education for reconsideration of a termination decision. (Refer to section on "Appeal Procedure.")

1. A student must maintain a "B" (3.00) or better grade point average in all 300- through 800- level courses taken for graduate credit at the School of Mines. Thesis and dissertation research credit hours and grades will not be counted in the determination of this GPA.
2. A student must earn no less than a "C" (2.00) grade in any graduate course (500 through 800 level) taken for graduate credit, and which is to be credited toward advanced degree requirements.
3. A student must earn no less than a "B" (3.00) in any 300- or 400-level course taken for graduate credit, and which is to be credited toward advanced degree requirements.
4. A student's thesis or dissertation research must be of a quality to warrant the issuance of a semester grade of "S" or an interim grade of "NP." A research grade of "U" will result in the student being placed on probation.
5. A student must earn no less than a "B" (3.00) in any 100- or 200-level course required by the student's advisory committee even though the course cannot be applied toward a graduate degree.
6. A student must pass all courses taken on the pass-fail basis. (Refer to section on "Pass-Fail Option for Graduate Students.")
7. A student must remove all other program deficiencies, such as meeting stated deadlines for applicable qualifying, comprehensive, and final examinations; selection of a graduate advisory committee; and filing of a satisfactory program of study in the graduate office.

## **Appeal Procedure**

Procedures for appealing or petitioning for a variance from certain policies are set forth in the relevant sections of this document when such variances are permitted in unusual or exceptional circumstances. Appeals or petitions involving such matters as grade changes from "F" or "I" to "W" must be lodged with the Academic Appeals Committee through the Vice President for Academic Affairs, after review by the Dean of Graduate Education.

Appeals concerning probation, suspension, or potential variances in academic graduate policy should first be lodged with the student's major department/program. Before rendering a decision on the appeal, the department head or program coordinator will seek a recommendation from the student's graduate advisory committee. If the student is not satisfied with the decision on the appeal, the student may petition the Dean of Graduate Education for reconsideration of the appeal. The Council on Graduate Education may be called upon to render a decision in such cases.

For situations not covered above, or if the student is dissatisfied with a prior appeal decision, he/she should seek the advice of the Dean of Graduate Education or the Dean of Students to determine what recourse is available to assist in seeking a solution.

### **Supervision of Advanced Degree Programs**

The supervision of the general study program of each student, including compliance with all the various Board of Regents, institutional, and Graduate Division policies, is primarily the responsibility of the advisor. The graduate advisory committee assists in this role. The Advisory Committee consists of:

- a major professor,
- a graduate division representative, (must not be from the student's department/program),
- 1 additional member for master's students,
- 3 additional members for doctoral students.

The major professor is primarily responsible for supervision of the graduate student's research and thesis/dissertation preparation, as well as ensuring that academic standards and requirements are met and satisfied. The advisor and the major professor may or may not be the same person, depending on restrictions or requirements within the student's program and/or department.

The major professor serves as chairperson of the Graduate Advisory Committee and assists the student in selection of other members of the committee. The graduate division representative must be chosen from outside the major department/program and approved by the Dean of Graduate Education.

To be eligible to serve as a major professor on a student's advisory committee, the person must be a faculty member at SDSM&T with a terminal degree. Individuals without a terminal degree may be granted an exception to this policy if the department notifies the Graduate School of its approval in writing.

Off-campus advisors must be appointed as adjunct faculty to be eligible to serve as a major professor. The department/program must notify the graduate office in writing of this appointment and approve the individual to direct research work. In such cases, a co-major professor located on campus should be selected to assist with administrative guidance.

To be eligible to serve as the Graduate Representative on a student's advisory committee, the person must be a full-time faculty member at SDSM&T with a terminal degree.

A change in advisor may be accomplished at the student's request by submitting a "Request to Change Advisor" form, with all appropriate approval signatures, to the Dean of Graduate Education.

If staff changes or other valid reasons dictate a change in major professor, such a transition can be made at the request of the student and with the consent of the student's committee as evidenced by filing a revised "Program of Study" with the graduate office. A written appeal by a student for a change in major professor may be filed with the Council on Graduate Education through the Dean of Graduate Education in contested cases. The decision by the Council on Graduate Education is final.

Changes to committee members other than the major professor only require the signature of the major professor and the new committee member.

If a student completes the M.S. degree and wishes to continue for a Ph.D. the student must apply to the doctoral program. If a student is enrolled in an M.S. program and wishes to enter the doctoral program without completing the M.S. degree, the student must apply for a transfer of programs.

If a master's candidate elects to transfer, the student's department/program shall determine by qualifying examination or by review of his/her record to date whether the student shall be permitted to transfer to the doctoral degree. Upon approval of the transfer, the department head or program coordinator, after consultation with the student and the existing advisory committee, shall expand the student's committee to a total of five members who will assist with the student's doctoral program.

### **Program of Study**

The student's advisory committee will assist the student in formulating a schedule of coursework leading to the advanced degree. A copy of the appropriate form and advisory committee signatures must be filed with the student, the student's department/program, and the graduate office no later than the mid-term of the semester after which 9 credit hours have been completed or for which a grade of "Incomplete" has been issued. This is usually the second semester of study for full-time degree-seeking students. These forms can be found at the graduate education website and may vary by

program or type of degree sought. A copy of any amended forms must be filed in a timely manner by the student and with the same offices as the original schedule.

Students who have been granted a leave of absence before submission of a POS/PRA will be required to submit a POS/PRA by mid-term of the semester after completion of 9 credit hours.

### **Language Requirements**

There is no standard language requirement within the Graduate Division. However, departments/programs may establish their own language requirement.

### **Certification for the Degree**

Before a diploma can be released, \_\_\_\_\_ the Dean of Graduate Education must certify that the candidate has fulfilled all degree requirements. For certification of the degree for a given semester, ALL requirements must be complete on or before the scheduled due dates published by the Graduate Education Office. Note that all keys must be returned to the Physical Plant before the degree is granted.

Candidates are cautioned not to make travel plans or other arrangements that will be difficult or costly to change until they are certain that all degree requirements can and will be satisfied. It is the responsibility of the candidate to know and comply with these degree requirements.

### **Participation in Commencement**

A student must apply to graduate by completing the Application for Graduation form on the Graduate Education website and must meet the program requirements before the degree is awarded. The Application for Graduation form also serves as a request to participate in the commencement ceremonies. In general, for each degree earned, a student is allowed to participate in commencement once and have his or her name in the commencement program once. Note that participation in the commencement ceremony does not equate to the conferring of a degree. The degree is conferred when all requirements are met and the release of diploma process is completed.

By default, the names of all students who have completed the requirements for graduation by the designated spring date will be included in the May program and students who have completed the requirements by the designated fall date will be included in the December program. The student's name will appear in the program in the semester of completion, whether the student is participating in the ceremony or not, except as noted below.

### **M.S. Candidates Participating in Commencement Prior to Completion of all Requirements**

M.S. students who will finish in August may request permission, in writing, to participate in May commencement and his or her name will appear in the May program. If the student is scheduled to graduate in August and does not participate in the May graduation, the student's name will, by default, appear in the December program and the student is welcome to participate in the December commencement ceremony.

Students who will complete the requirements for a degree after December but substantially before the end of the spring term may request permission, in writing, to participate in December commencement and will be listed in the December program.

A student who wishes to participate in a commencement ceremony later than the semester in which the degree is completed must notify the graduate office of his or her intent prior to the end of the semester in which the degree requirements are met. In general, a student is allowed to participate in a commencement ceremony within one year of completing the requirements for the degree.

### **Time Limitation**

A Master of Science degree program must be completed within 5 calendar years dating from the student's formal entrance into a degree-seeking program. Courses taken by the student at any institution that may be credited to the degree program and that were taken more than 5 years prior to the date of anticipated graduation must be reviewed by the student's major department/program and the Dean of Graduate Education for possible acceptance. Following this review, the student's major department/program and the Dean of Graduate Education will determine whether a reduction in credits applicable toward the degree, a re-examination, or both, is required for the student to complete his or her degree program. In exceptional circumstances, students may petition the Dean of Graduate Education for an extension to the 5 year time limit. The applicable forms are available at the Graduate Education website.

A student who is granted a Leave of Absence (see section on "Leave of Absence") will not be subject to continuing registration, and the leave of absence will not count toward the time limits to complete his/her program of study.

### **Master's Degree Requirements**

- Thesis Option Requirements
- Thesis Requirements
- Thesis Defense

- Non-Thesis Option Requirements
- Final Examination
- Graduate Programs Listing

Master of Science programs at SDSM&T may offer three options by which a student may complete the requirements for a degree. They are the thesis option, the non-thesis option, and the coursework-only option. Professional degrees are contained within the coursework-only option.

In the following descriptions the term “program” refers to a department, a division in a department such as the Construction Management program within the Department of Civil and Environmental Engineering, or a non-departmental unit such as Biomedical Engineering, Materials Engineering and Science, or Nanoscience and Nanoengineering.

Note that additional information regarding limitations on coursework that may be applied toward the degree can be found in other sections of the catalog.

### **Thesis Option Requirements**

The M.S. degree minimum requirements for the thesis option are:

1. a program of at least 30 credit hours of coursework and research,
2. at least 15 credit hours of graduate coursework approved by the program (500- level courses and above),
3. at least 6 credit hours of thesis research and no more than 9 credit hours of thesis research, (However, the student may register for additional research credits for continuing registration purposes.)
4. a satisfactory thesis based upon individual research, (See below.)
5. meeting or exceeding academic standards prescribed elsewhere in this catalog, including maintaining at least a 3.0 cumulative GPA,
6. successfully defending the thesis.

### **Thesis Requirements**

The thesis should represent an effort of such quality and construction that it can be displayed in the school library with similar scholarly works, as well as providing material for publication(s) in an appropriate professional journal(s).

The thesis is written under the direction of the major professor, but the student should feel free to seek guidance from all members of his/her advisory committee. Before starting to write the thesis, the student is urged to consult “Instructions for the Preparation of Theses and Dissertations” on the graduate education website (<http://resources.sdsmt.edu/forms/grad-ed/thesis-and-dissertation-instructions.pdf>) and to consult style manuals online or in the SDSM&T Devereaux Library. In general, the thesis may follow the style of captions, footnotes, and bibliographical references used by the leading technical journal in the student’s field. Students are urged to review carefully copyright ownership provisions in the “Instructions” document.

A final draft of the thesis should be submitted by the student to each member of his/her advisory committee a minimum of 2 full weeks before the time and date of the student’s scheduled defense. Earlier submission deadlines may be required by the advisory committee.

The Dean requires that the final draft of the thesis be submitted to the graduate office by the published deadline, approximately two weeks before graduation, to allow adequate time for review, corrections and revisions. The final draft of the thesis, after all revisions recommended by the committee have been made, must be signed by the author and approved and signed by the major professor, the head/coordinator of the student’s major department/program, and the Dean of Graduate Education before final reproduction. Signatures of other committee members are allowed but not required.

The institution requires one electronic copy and two paper copies (the original unbound manuscript and one bound copy) of the thesis to be delivered to the Devereaux Library in final form. Additional copies may be required by the student’s program or department. In the case of a proprietary thesis, the original hard copy and digital version will be retained without reproduction in secured graduate office files throughout the specified proprietary period.

### **Thesis Defense**

A student pursuing the thesis option must defend the thesis in an oral examination. The thesis defense will normally be held during the last six weeks of the student’s last term, but it may be given at any time after the thesis has received committee approval. No thesis defense may be scheduled during the period of university final examinations. The Final Examination and thesis research defense may be combined. (See “Final Examination”.)

The student shall obtain and complete the relevant graduate office form to schedule the final examination and/or thesis defense and, in conjunction with the major professor, shall seek the approval of all committee members and shall file the form with the graduate office no less than 5 working days before the exam. The graduate office will announce this information to the campus community.

The thesis defense oral examination will normally be held during the last 6 weeks of the student's last term, but it may be given at any time after the thesis has received committee approval. However, as noted above no final examination or thesis defense may be scheduled during the period of university final examinations.

The student's committee constitutes the examining board for the thesis defense. The major professor will head the session. The major professor is responsible for ensuring that a majority of the committee, as well as the Graduate Representative, is present. The defense will not be held if these conditions cannot be met. A negative vote by any two or more members of the student's committee or a negative vote by the graduate office representative will signify failure of the defense. Refer to the graduate office policies for information on committees and exam procedures for proprietary thesis programs.

Results of all written or oral examinations will be attested to by all committee members on a form furnished to the graduate representative by the graduate office. The original form with signatures and dates will be filed with the graduate office and a copy with the department/program. If the student passes with reservation or pending correction, a copy of the form will be filed with both offices. The originals will be filed with both offices, with the appropriate affirming signatures, when final corrections have been made and accepted. If the candidate fails to satisfy the examiners on either coursework or thesis, written or oral examinations, the committee may schedule a re-examination over general background, thesis, or both. The re-examination will be scheduled at the discretion of the candidate's advisory committee, normally 8 to 12 weeks after the date of the first examination. The student may petition his or her committee for re-examination prior to the 8-week limit.

### **Non-thesis Option Requirements**

Students enrolled in a non-thesis program may have the option of completing a non-thesis research project or taking additional course credits in place of the research project credits. The latter option is often referred to as a "coursework only" option and is common in professional degree programs. Students electing a non-thesis program should check with their program or department to determine which non-thesis options are available to them.

The M.S. degree minimum requirements for the non-thesis option are:

1. a program of at least 32 credit hours of coursework (refer to specific program requirements for exact number of minimum coursework credit hours),
2. at least 20 credit hours of graduate coursework approved by the program (500 level and above),
3. at most 6 credits of non-thesis research project,
4. meeting or exceeding academic standards prescribed elsewhere in this catalog, including maintaining at least a 3.0 cumulative GPA.

### **Final Examination**

A Master of Science degree candidate may be required by his or her program to take a final examination covering course material as a requirement for the degree. The examination may be written, oral, or both. All committee members must be given the opportunity for input to, and evaluation of, a written non-thesis final examination.

A student pursuing the thesis option must also defend the thesis in an oral examination. The final examination and thesis defense may be combined. Oral examinations, including a thesis defense, are open to all interested faculty members. Departmental or program policy shall determine whether non-faculty persons may attend the examination.

The process for scheduling a Final Examination and the policies governing the examination process are described in the "Thesis Defense" section.

## **Nature and Purpose of the Doctoral Programs**

The doctoral program is designed to prepare a student for a lifetime of intellectual inquiry that manifests itself in creative scholarship and research, often leading to professional careers in social, governmental, business, industrial organizations, and academia. The program emphasizes freedom of inquiry and expression and development of the student's capacity to make significant contributions to knowledge. An essential element is the development of the ability to understand and evaluate critically the literature of the field and to apply appropriate principles and procedures to the recognition, evaluation, interpretation, and understanding of issues and problems at the frontiers of knowledge. These goals are most effectively accomplished in close association with those experienced in research and teaching.

A central purpose of doctoral programs is the extension of knowledge, but this cannot be accomplished on all fronts simultaneously. Students must choose an area in which to specialize, a faculty member with whom to work, and a research topic of mutual interest to the student and the faculty advisor. Individualized programs of study are then developed, and committee members are selected cooperatively as coursework and research are undertaken. When all coursework has been completed, the research finished, the dissertation written, and all examinations passed, the student will have acquired the knowledge and skills expected of a scholar and will have extended knowledge and research capability in the field.

### **Ph.D. Degree Requirements**

The requirements for the Doctor of Philosophy degree are:

1. satisfactory completion of a Comprehensive Examination,
2. a minimum total of 80 semester credits beyond the bachelor's degree, 50 of which should be coursework credit hours.,
3. a minimum of 20 semester credit hours of appropriate research credits,
4. satisfaction of academic standards as prescribed elsewhere in this catalog, including maintaining at least a 3.0 cumulative GPA,
5. at least two consecutive semesters of residence as a full-time student.
6. satisfaction of any departmental language or other specific requirements,
7. a dissertation written in grammatical English that represents results from at least the equivalent of one academic year of full-time research.

Between three and four academic years of full-time graduate study beyond the baccalaureate degree normally are required to earn a doctorate.

Ph.D. candidates already holding an M.S. degree may request up to a maximum of 24 semester credits of appropriate M.S. coursework credits and up to a maximum of 6 credits of acceptable M.S. research credits to apply to the Ph.D. credit requirement. Students wishing to make such a request must use the "Reduction of Credits" form found at the graduate education website.

A candidate who has entered a Ph.D. program directly from a Baccalaureate program may be allowed to use up to 12 credits of upper-division undergraduate 400-level courses (which have not been applied toward the Baccalaureate) toward the 50 credit-hour course requirement for the degree with the same restrictions and procedures as those specified for master's degrees.

Ph.D. candidates already holding an M.S. degree may use up to 6 credits of 400-level coursework in addition to any courses credited from the M.S. degree. The head of the student's major department must petition the Council on Graduate Education through the Dean of Graduate Education for use of 300-level credits for Ph.D. programs.

The Graduate Advisory Committee approves the total number of research credits that the candidate may carry, consistent with departmental, continuing registration, and other requirements.

The student's advisory committee can recommend to the Dean of Graduate Education a program requiring more credits than the minimum indicated above if it believes that this is in the best interests of the student.

The committee may approve a plan for the student to undertake work at some other institution of recognized standing, but may not reduce the two-semester residence requirement.

### **Residence Requirements**

At least 2 consecutive semesters of residence as a full-time student are required at South Dakota School of Mines and Technology unless an exception is granted by the Dean of Graduate Education and the Faculty Senate.

### **Supporting Fields**

In order to foster the principles upon which a Doctor of Philosophy degree is based, as set forth in the introductory paragraphs to this section on doctoral programs, a Ph.D. student and her or his advisory committee are strongly encouraged to formulate a program of study that comprises, minimally, one-quarter of the required coursework in a supporting fields. These courses may be completed in one or more departments in areas of study consistent with the student's major program. Because individual program requirements may exceed these minimum institutional guidelines, the student is urged to review carefully the curriculum for his or her field of study.

## **The Qualifying Examination**

Doctoral students admitted into all Ph.D. disciplines must pass a **qualifying examination**, normally to be taken no later than the second semester of residence. A master's student who proposes to continue into a doctoral program should so advise his or her major professor. Thereupon, the student will be given an examination by the advisory committee to determine whether to permit the student to proceed to the doctoral level of graduate study.

This qualifying examination may be scheduled in the semester during which it is expected that 36 hours of credit beyond the B.S. degree, (which are deemed acceptable toward the student's doctoral program) will be accumulated. The examination for the master's degree may be used as the forum for the qualifying examination, at the discretion of the department/program.

## **The Comprehensive Examination**

When the student's program of coursework has been substantially completed, she or he will undertake the **comprehensive examination** for admission to candidacy. This examination will consist of written and oral examinations covering his or her field of study and related subjects. It will be prepared by the student's advisory committee, with potential suggestions from any faculty member from whom the student has taken a graduate course.

The student's advisory committee schedules and arranges the written and oral examinations. Review of the examinations will be accomplished as soon as possible by all members of the committee, and the results will be reported to the Dean of Graduate Education on the appropriate form supplied by the graduate office.

Satisfactory completion of the comprehensive examination requires that no more than one member of the advisory committee votes against passing. If the student passes with conditions, such as failure to pass a part of the examination, the committee shall inform her or him promptly as to how and when the conditions may be removed. If, in the opinion of two or more members of the advisory committee, the student has failed the comprehensive examination, another such examination may not be attempted during the same semester. After failure to pass a second time, work toward the doctorate can be continued only with the consent of the advisory committee, the Council on Graduate Education, and the Dean of Graduate Education.

The comprehensive examination should normally be passed at least 5 months before the dissertation is defended.

## **Admission to Candidacy**

At least 5 months before the dissertation defense, the doctoral student should apply to his or her major professor for admission to candidacy on a form available from the graduate office. If the advisory committee and department head/program coordinator approve the application by certifying that the candidate has passed the comprehensive examination, the signed form must be returned to the Dean of Graduate Education who, in turn, will admit the student to candidacy.

## **The Dissertation**

It is expected that the dissertation will represent the culmination of at least the equivalent of one academic year of full-time research.

The dissertation need be of no specific length, but it must be written in grammatically proper English. It must also advance or modify knowledge and demonstrate the candidate's technical mastery of the field. In lieu of the conventional dissertation format, the dissertation can consist of a compilation of three published and/or submitted journal manuscripts that are derived from the candidate's doctoral research and are either authored or co-authored by the candidate. Dissertations submitted in this form must have an introduction and conclusion to tie the journal papers into a cohesive research paper. The final dissertation must be accompanied by an abstract of 250 to 600 words and vitae of the candidate.

The final draft of the dissertation, after all revisions recommended by the committee have been made, must be signed by the student and approved and signed by the major professor, the head/coordinator of the student's major department/program, and the Dean of Graduate Education before final reproduction. Signatures of other committee members are allowed but not required. The Dean of Graduate Education requires the final draft of the dissertation to be submitted to the graduate office by the published deadline, approximately two weeks before graduation, to allow adequate time for review, corrections and revisions.

The institution requires one electronic copy and two paper copies (the original unbound manuscript and one bound copy) of the thesis to be delivered to the Devereaux Library in final form. Additional copies may be required by the student's program or department. In the case of a proprietary thesis, the original hard copy and digital version will be retained without reproduction in secured graduate office files throughout the specified proprietary period.

## **Defense of the Dissertation**

The defense of the dissertation is an oral examination open to the public except in proprietary programs. It will be scheduled at the convenience of the candidate's advisory committee at any time after the student has completed the required coursework and after the major professor is satisfied that the dissertation is an acceptable manuscript, in terms of both technical quality and proper expression.

A final draft of the dissertation must be submitted by the candidate to each member of his/her advisory committee a minimum of 2 weeks before the scheduled dissertation defense. Earlier submission deadlines may be required by the advisory committee.

The student shall obtain and complete the graduate office form to schedule the defense, and in conjunction with the major professor, shall seek the approval of all committee members. The student shall return the form to the graduate office no less than 5 working days before the defense date. The graduate office will announce the defense to the campus community.

While the student's committee determines the character and length of the examination, sufficient time should be devoted to a consideration of matters relating to the dissertation to test thoroughly the ability of the candidate to defend her or his work. Questions will, in general, be confined to the dissertation and to background material related to it.

Satisfactory completion of the final examination requires a "pass" vote from the graduate office representative and no more than one "fail" vote from the other members of the advisory committee. If the student fails, another examination can be scheduled only with the approval of the student's advisory committee and the Dean of Graduate Education.

### **Participation in Commencement**

A student must apply to graduate by completing the Application for Graduation form on the Graduate Education website and must meet the program requirements before the degree is awarded. The Application for Graduation form also serves as a request to participate in the commencement ceremonies. In general, for each degree earned, a student is allowed to participate in commencement once and have his or her name in the commencement program once. Note that participation in the commencement ceremony does not equate to the conferring of a degree. The degree is conferred when all requirements are met and the release of diploma process is completed.

By default, the names of all students who have completed the requirements for graduation by the designated spring date will be included in the May program, and students who have completed the requirements by the designated fall date will be included in the December program. The student's name will appear in the program in the semester of completion, whether the student is participating in the ceremony or not, except as noted below.

A Ph.D. candidate must have successfully defended his or her dissertation and be substantially finished with all degree requirements by the designated date to participate in commencement and the hooding ceremony. A request to participate in commencement prior to completion of all requirements may be made to the Dean of Graduate Education.

A student who wishes to participate in a commencement ceremony later than the semester in which the degree is completed must notify the graduate office of his or her intent prior to the end of the semester in which the degree requirements are completed. In general, a student is expected to participate in a commencement ceremony within one year of completing the requirements for the degree.

### **Time Limitation**

If the requirements for the Doctor of Philosophy degree are not completed within a maximum period of 8 calendar years from the date of original enrollment in the doctoral program, the student's program is subject to review by the staff of the student's major department/program and the Dean of Graduate Education to determine whether a reduction in credits applicable toward the degree is justified before the student is permitted to proceed with the degree program. The procedures described under "Time Limitation" for M.S. degree candidates also apply here.

A student who is granted a Leave of Absence (see section on "Leave of Absence") will not be subject to continuing registration, and the leave of absence will not count toward the time limits to complete his or her program of study.

### **Reservation of Rights**

The information contained in this catalog is the most accurate available at the time of publication, but changes may become effective before the next catalog is published. It is ultimately the student's responsibility to stay abreast of current regulations, curricula, and the status of specific programs being offered. Further, please note that the university reserves the right to change graduation or other academic requirements where changes are necessary to comply with Board of Regents policy directives, to meet external demands relating to accountability or accreditation standards, to reflect curriculum changes or substitutions, or to implement evolving discipline requirements in major fields.