

Department of Physical Science

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Degrees Offered

Department of Physical Science

Bachelor of Arts/Bachelor of Science,

- Physical Science, Teacher Education Emphasis

Bachelor of Science

- Chemistry, Professional Emphasis
- Chemistry, Health Care Emphasis
- Chemistry, Forensic Emphasis
- Chemistry, Teacher Education Emphasis
- Geology, Earth Science Emphasis
- Geology, Professional Emphasis

Minor

- Chemistry
- Chemistry Teacher Education
- Geography
- Geography Teacher Education
- Geology Teacher Education
- Physics
- Physics Teacher Education

Certificate

- Geographic Information System

Emphasis

- Geographic Information Systems
(The GIS emphasis is available with a number of different degrees. See College of Computing, Integrated Engineering, and Technology.)

Bachelor of Interdisciplinary Studies,

A customized degree based on either two or three areas of student interest. (See page 96 and the advisor or dean of the College of Science for more information.) Recent examples include combinations of coursework in GIS, Computer Science, Geology, Geography, Sociology, Political Science, Biology, Business, CAD/CAM, Information Technology, and Marketing.

CHEMISTRY

Website: <http://www.suu.edu/sci/physci/chemistry/>

Chemistry, a central science, is an active discipline vital to human existence and essential to the understanding of biological, medical, industrial, economic, and environmental issues.

The Southern Utah University chemistry faculty are committed to instilling an understanding of chemistry and its relevance through quality teaching, scholarly activities, and service. In a world that is becoming increasingly more technical and complex, providing chemical instruction with the depth, breadth, and rigor required to meet this need is of primary importance.

As chemistry faculty, we strive to provide students with quality, current, comprehensive, courses of study which serve the following needs including:

- 1) Preparation of students who choose to pursue graduate degrees in chemistry.
- 2) Preparation of students who choose to pursue degrees in the health sciences (medicine, dentistry, pharmacy, etc.)
- 3) Preparation of students who choose to gain employment in a science related field with an undergraduate degree.
- 4) Preparation of students who choose to become chemical educators.
- 5) Education of students to think critically and independently.
- 6) Helping students improve communicative, creative, analytic, and information gathering skills.

To accomplish these goals, the chemistry faculty will provide the following:

- 1) Honest evaluations of student abilities and potential.
- 2) A climate of mutual trust and respect among faculty, staff and students.
- 3) The application and involvement of basic scientific principles and methodologies.
- 4) Competitive opportunities for mentorship through undergraduate research, employment, and other hands-on educational means.

Admission to Chemistry Program

The objective of requiring admission to the chemistry program is to ensure preparedness for upper-division chemistry courses. A secondary purpose is to facilitate tracking and advising of students. The requirements for attaining admission to the chemistry programs are as follows:

1. To be considered for admission to SUU's chemistry program students must have:

a) A cumulative GPA of at least 2.5.

b) Completed the following, or its equivalent; with a grade of "C" (2.0) or better:

Chemical Principles series with laboratory

(CHEM 1210, 1215, 1220, 1225)

Calculus Series (MATH 1210, 1220).

2. No pre-chemistry students may enroll in courses with numbers greater than 2999 without formally declaring themselves chemistry majors.

a) The chemistry faculty will ensure that this requirement has been met.

b) Non-chemistry majors or minors may take upper division chemistry courses only with permission of the instructors.

Southern Utah University Water Laboratory

The SUU Water Laboratory is a student staffed laboratory accredited by the state of Utah under the National Environmental Laboratory Accreditation Program (NELAB). Serving southern Utah since 1972, this laboratory provides SUU students with an interest in chemistry a hands-on, chemical laboratory experience. The laboratory also provides students with employment opportunities.

The SUU Water Laboratory serves the tri-state area (Arizona, Nevada and Utah) by providing a local source of chemical and bacteriological analysis of water and waste water.

GEOSCIENCES

Website: <http://www.suu.edu/sci/phyci/geosciences/>

GEOGRAPHY

Geography is traditionally divided into three areas, and all three are offered in the SUU geography curriculum. These include physical geography, an examination of earth's physical systems; human or cultural geography, which explores spatial relationships in human activities; and technical geography, or the technologies of geographic research. This last area encompasses cartography, GIS, GPS, and related fields. The mission of the SUU geography program is:

1. To continue and expand the relationship with the departments of physical and social sciences and to support the programs and degrees offered by these departments.
2. To discover, describe, explain, and interpret the character of the earth as home to humans. We focus on interrelationships within and among natural and cultural subsystems and regional components. This is done by training students in concepts, skills, and real world problem solving, not by requiring rote memorization of isolated facts.
3. To contribute to the liberal education offered by the university, to provide excellence in teaching, and to offer students the best in geography education that can be obtained at any institution of higher learning. We will continue to evaluate and update courses to reflect the concepts that geography is fun, exciting, useful, relevant, rewarding, and remunerative. Quality teaching is our highest priority.
4. To offer specialized training in cartography and GIS for persons from a variety of disciplines. These include, but are not limited to, biology, geology, history, sociology, business, engineering, technology, and geography. GIS can become a powerful tool for undergraduate research projects in these and other areas.

GEOLOGY

The geology area strives to provide students at Southern Utah University with excellence in earth science education. Our integrated efforts are directed toward those methods we feel produce the best possible educational experience. The primary goal of the geology faculty is to ensure academic excellence while demanding integrity and building self-esteem in our students. Specifically, our mission is to foster a positive learning environment which serves a variety of needs including:

1. Preparation of students who choose to pursue graduate studies in geology;
2. Preparation of students to directly enter the work force;
3. Preparation of students who choose to pursue careers in areas other than science (i.e. business or law), but need a broadly based background in geology as a foundation for those pursuits;
4. Preparation of students who choose a career in earth science education; and
5. Preparation of students choosing physical science general education courses to be more knowledgeable citizens by providing a quality educational experience. The geology area carries out its role through application of, and involvement with, the basic principles of science and by instilling understanding and appreciation of scientific methodologies.

Advanced Standing in Geology

The objective of advanced standing is to ensure preparedness for upper-division geology courses. A secondary purpose is to facilitate tracking and advising of majors. The requirements for attaining advanced standing in geology are as follows:

1. Achieve a cumulative GPA of at least 2.0 (a grade less than "C" will not be accepted in the major or minor).
2. Complete each of the following or its equivalent: Physical Geology (GEO 1110) and Physical Geology Lab (GEO 1115); Principles of Chemistry I (CHEM 1210) and Principles of Chemistry I Lab (CHEM 1215); College Algebra (MATH 1050); and Trigonometry (MATH 1060).

3. GEO 3210/3215, Mineralogy, serves as the "gatekeeper course." Instructor permission is required for registration in GEO 3210. No pre-geology student may receive a grade in the gatekeeper course without formally declaring either a major or a minor. (The instructor of GEO 3210 will ensure that this requirement has been met.) Non-pre-geology students may take upper level geology courses with permission of the instructor.

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

Our GIS courses and laboratory serve a variety of departments, degrees and affiliated entities throughout the SUU campus and surrounding communities. The GIS courses and laboratory provide access to spatial technologies accompanied with knowledge, theory, and hands on experience in order to foster a diversity of geographic research. To provide these spatial technologies the GIS courses and laboratory strive to use the most current technology, hardware and software, in the fields of remote sensing, global positioning systems, GIS and cartography. The GIS lab offers service learning opportunities to students through local and regional projects. In addition we provide access to internships.

The mission of the GIS laboratory is to prepare individuals to integrate spatial technologies by providing a learning environment that fosters undergraduate research and motivates individuals to develop required abilities. Students will be encouraged to gain further knowledge, increase awareness, and gain new perspectives in order to apply the science of geographic information. The strength of our mission relies on the diversity and interdisciplinary nature of spatial technologies, which demands that we aim at continually discovering new methods for articulation on and off campus.

A Bachelor of Interdisciplinary Studies degree (see page 96) can be designed to accommodate students interested in GIS. Examples of programs that often use GIS include, but are not limited to, biology, geology, history, sociology and political science, business and marketing, engineering technology, agriculture, information systems, computer science, criminology, university studies, education and geography. In addition, the GIS laboratory provides service to the library, facilities management, university and departmental administration, and the local and regional communities.

Geographic Information System (GIS) as a component for other degrees:

Coursework in GIS is also available to complement the following degrees: Information Systems, Computer Science, and Engineering Technology (See College of Computing, Integrated Engineering, and Technology)

Geographic Information Systems Certificate Requirements

The GIS certificate program was designed to be completed as an integrated component of a 4-year degree (for example Geography, Geology, Biology, Information Systems, Computer Science, Engineering Technology or other). The GIS certificate can be completed as an individual program, but the ideal program is best completed over a 2 - 3 year period of time. The foundation courses should be completed in the freshmen year, the technical GIS courses in the sophomore year and the GIS application courses in the junior and senior years.

PHYSICS

Website: <http://www.suu.edu/sci/phyci/physics/>

The mission of the physics faculty is to ensure academic excellence while demanding integrity and building self-esteem in our students. Our mission is met through the following:

Department of Physical Science

The Learning Environment - to provide students with quality, current, comprehensive, rigorous courses of study; to prepare successful pupils by stimulating curiosity and instilling a lifelong love of learning; and to develop within the students communication skills and creative, analytic information gathering and processing skills.

The Faculty - to develop excellence in teaching by fostering the pedagogical development of our faculty, to maintain strong professional commitment and development, and to promote excellence within the faculty through involvement in scholarly activities, developments in our respective fields, and service to the university and the communities of southern Utah.

Degree Requirements

Physical Science Composite Teacher Education Emphasis Bachelor of Arts/Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements (must take MATH 1210**)	18
Knowledge Areas Requirements (must take CHEM 1210 and CHEM 1215)	19
University Requirements	
BA Degree – Foreign Language/ASL requirement (16 hours or proficiency test)	
BS Degree – Math or Science minimum requirement (12 hours)	
Required courses (65 hours):	
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 2010 Chemical Laboratory Safety	1
CHEM 2310 Organic Chemistry I	4
CHEM 2320 Organic Chemistry II	4
CHEM 2325 Organic Chemistry II Lab	2
CHEM 3000 Quantitative Analysis*	3
CHEM 3700 Environmental Chemistry	3
GEOG 3220 Weather and Climate *	3
GEOG 3225 Weather and Climate Lab*	1
GEO 1110 Physical Geology	3
GEO 1115 Physical Geology Lab	1
GEO 1220 Historical Geology	3
GEO 1225 Historical Geology Lab	1
GEO 3210 Mineralogy	3
GEO 3215 Mineralogy Lab	1
Plus four (4) credit hours from the following list:	
GEO 3010 Environmental Geology*	3
GEO 3015 Environmental Geology Laboratory*	1
GEO 3110 Paleontology*	3
GEO 3115 Paleontology Laboratory*	1
GEO 3170 Oceanography*	3
GEO 3175 Oceanography Laboratory*	1
GEO 3410 Sedimentology/Stratigraphy*	3
GEO 3415 Sedimentology/Stratigraphy Lab*	1

GEO 3510 Structural Geology*	3
GEO 3515 Structural Geology Laboratory*	1
GEO 4000 Selected Field Trips (two hour max)	.5-3
GEO 4070 Applied Geochemistry*	3
MATH 1220 Calculus II	4
PHYS 1040 Elementary Astronomy	3
PHYS 1045 Elementary Astronomy Lab	1
PHYS 2210 Physics for Scientists and Engineers I	4
PHYS 2215 Physics for Scientists and Engineers I Lab	1
PHYS 2220 Physics for Scientists and Engineers II	4
PHYS 2225 Physics for Scientists and Engineers II Lab	1
PHYS 3310 Quantum Physics I	3
PSCI 4900 Teaching Science in Secondary Schools	2
<i>Comments:</i>	
1) This is a composite degree, a minor is not required.	
2) Courses in computer science are strongly recommended additional electives	
3) Secondary Teaching Certification requires specific professional education courses, (see below) consult the department of teacher education for additional advisement.	
4) This degree does not include the requisite number of upper division hours. Students completing this degree will fill the upper division requirements while completing course work for the Secondary Teaching Certificate.	
5) Bachelor of Arts degree must meet language requirements as outlined in "Degree Requirements" on page 99 of this catalog.	
Free Electives (see comments above)	18
Total Credits, B.A. or B.S. degree	120

* Courses are taught every other year. Please consult advisor.

** If you are not prepared for this math course, please see advisor for alternate recommendations.

Professional Education Requirements for Secondary Licensure	
Course Title	Credits
Required Credits: 30-31 minimum in Education	
EDUC 2000 Exploring Education in Society*	3
SPED 3030 Foundations of Special Education	2
EDUC 3170 Instructional Technology for Educators	3
SCED 3200 Secondary Educational Psychology	3
(Academic Department)4900 (methods of teaching course in the area(s) seeking licensure	2-3
Secondary Block as noted below:	
SCED 3570 Motivation and the Management of Diverse Instructional Environments for Secondary Teachers	3
SCED 3590 Instructional Planning, Delivery, and Assessment for Secondary Teachers	3
SCED 3720 Content Literacy	2
SCED 4520 Secondary Practicum/Seminar Clinical Practice (student teaching) is taken the semester prior to secondary block as noted below	3
SCED 4980 Clinical Practice	7
(Academic Department) 4980 Clinical Practice (student teaching in the content area(s) of licensure is taken the semester following the secondary block)	2

Total Credits	33-34
*Meets general education requirements in the interdisciplinary knowledge area	

Chemistry Composite Professional Emphasis Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements (must take MATH 1210**)	18
Knowledge Areas Requirements	19
University Requirements	
BS Degree – Math or Science minimum requirement (12 hours)	
Chemistry Requirements - Professional Emphasis (70 hours)	
Recommended for students who wish to receive professional career preparation. This degree emphasis follows the guidelines set forth by the American Chemical Society.	
CHEM 1210 Principles of Chemistry I	4
CHEM 1215 Principles of Chemistry I Lab	1
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 2310 Organic Chemistry I	4
CHEM 2320 Organic Chemistry II	4
CHEM 2325 Organic Chemistry II Lab	2
CHEM 3000 Quantitative Analysis *	3
CHEM 3160 Inorganic Chemistry *	3
CHEM 3610 Physical Chemistry I	3
CHEM 3615 Physical Chemistry I Lab	1
CHEM 3620 Physical Chemistry II	3
CHEM 3625 Physical Chemistry II Lab	1
CHEM 4160 Advanced Inorganic Chemistry *	3
CHEM 4165 Advanced Inorganic Chemistry Lab *	1
CHEM 4230 Instrumental Analysis *	3
CHEM 4240 Analysis Lab	2
CHEM 4250 Synthesis Lab *	2
CHEM 4990 Chemical Literature/Seminar	1
MATH 1220 Calculus II	4
MATH 2210 Calculus III	4
MATH 2270 Linear Algebra	3
MATH 2280 Differential Equations	3
PHYS 2210 Physics for Scientists & Engineers I	4
PHYS 2215 Physics for Scientists & Engineers I Lab	1
PHYS 2220 Physics for Scientists & Engineers II	4
PHYS 2225 Physics for Scientists & Engineers II Lab	1
Free Electives (14 hours must be upper division)	14
Total Credits, B.S. degree	121
Physics for Scientists & Engineers Recitation; PHYS 2230 & PHYS 2260 are optional but recommended.	

Comments: (1) A grade of "C" (2.0 or above) must be earned in each course required for the major and minor. (2) Knowledge of computer science is strongly recommended. (3) All Chemistry Majors must successfully complete an exit exam before graduation. (4) This is a composite degree, a minor is not required. (5) This degree does not include the requisite number of upper division hours. Students completing this degree will fill the upper division requirement with elective credit.

* Courses are taught every other year. Please see advisor.

** If you are not prepared for this math course, please see advisor for alternate recommendations.

Chemistry Composite Health Care Emphasis Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements (must take MATH 1210**)	18
Knowledge Areas Requirements (must take BIOL 1620/1625 and CHEM 1210/1215)	20
University Requirements	
BS Degree – Math or Science minimum requirement (12 hours)	
Chemistry Requirements - Health Care	
Recommended for students who seek diversified preparation for admission to medical, dental, or veterinary school.	
Support Courses Option 2 (8 hours)	
BIOL 1610 General Biology I	3
BIOL 1615 General Biology I Lab	1
BIOL 3060 Genetics	3
BIOL 3065 Genetics Lab	1
Required Courses (50 hours):	
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 2310 Organic Chemistry I	4
CHEM 2320 Organic Chemistry II	4
CHEM 2325 Organic Chemistry II Lab	2
CHEM 3000 Quantitative Analysis *	3
CHEM 3160 Intermediate Inorganic *	3
CHEM 3610 Physical Chemistry I	3
CHEM 3615 Physical Chemistry I Lab	1
CHEM 4110 Biochemistry I	4
CHEM 4120 Biochemistry II	4
CHEM 4240 Analysis Laboratory	2
CHEM 4990 Chemical Literature/Seminar	1
MATH 1220 Calculus II	4
PHYS 2010 College Physics I **	4
PHYS 2015 College Physics I Lab **	1
PHYS 2020 College Physics II **	4
PHYS 2025 College Physics II Lab **	1
Students must choose either option 1 or option 2 below.	
Option 1 (8 hours)	
CHEM 3620 Physical Chemistry II	3

CHEM 3625 Physical Chemistry II Lab	1
CHEM 4160 Advanced Inorganic Chemistry *	3
CHEM 4165 Advanced Inorganic Chemistry Lab *	1
Option 2 (7 hours)	
BIOL 3310 Cell and Molecular Biology	3
BIOL 3315 Cell and Molecular Biology Lab	1
CHEM 4540 Selected Topics (Health Care)	3
Option I: Free Electives (11 upper division)	24
Option 2: Free Electives (8 upper division)	17
Total Credits, B.S. degree (option 1 or 2)	120
PHYS 2030 and PHYS 2060 are optional but recommended. The Physics for Scientists and Engineers sequence is recommended for continued graduate level studies. PHYS 2210, 2215, 2220 and 2225 may be completed in place of the College Physics sequence.	
Comments: (1) A grade of "C" (2.0 or above) must be earned in each course required for the major and minor. (2) Knowledge of computer science is strongly recommended. (3) All Chemistry Majors must successfully complete an exit exam before graduation. (4) This is a composite degree, a minor is not required. (5) This degree does not include the requisite numbers of upper division hours. Students completing this degree will fill the upper division requirement with elective credit.	

* Courses are taught every other year. Please consult advisor.

** If you are not prepared for this math course, please see advisor for alternate recommendations.

Chemistry Composite Forensic Emphasis Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements (must take MATH 1210**)	18
Knowledge Areas Requirements (must take BIOL 1620/1625, CHEM 1210/1215 and CJ 1010)	20
University Requirements	
BS Degree – Math or Science minimum requirement (12 hours)	
Required Courses (77 hours):	
Recommended for students who wish to pursue a career in Forensic Science.	
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 2310 Organic Chemistry I	4
CHEM 2320 Organic Chemistry II	4
CHEM 2325 Organic Chemistry II Lab	2
CHEM 3000 Quantitative Analysis *	3
CHEM 4110 Biochemistry	4
CHEM 4120 Biochemistry II	4
CHEM 4230 Instrumental Analysis *	3
CHEM 4240 Analysis Lab	2
CHEM 4540 Selected Topics (Qualitative Analysis)	3
CHEM 4990 Chemical Literature/Seminar	1
MATH 1040 Statistics	4
MATH 1220 Calculus II	4

PHYS 2210 Physics for Scientists and Engineers I	4
PHYS 2215 Physics for Scientists and Engineers I Lab	1
PHYS 2220 Physics for Scientists and Engineers II	4
PHYS 2225 Physics for Scientists & Engineers II Lab	1
CJ 1340 Criminal Investigation	3
CJ 1350 Introduction to Forensic Science	3
CJ 2350 Laws of Evidence	3
CJ 3100 Advanced Criminalistics	3
BIOL 1610 General Biology I	3
BIOL 1615 General Biology I Lab	1
BIOL 3060 Genetics	3
BIOL 3065 Genetics Lab	1
BIOL 3310 Cell and Molecular Biology	3
BIOL 3315 Cell and Molecular Biology Lab	1
Free Electives (upper division hours)	9
Total Credits, B.S. degree	124
Comments: (1) A grade of "C" (2.0 or above) must be earned in each course required for the major and minor. (2) Knowledge of computer science is strongly recommended. (3) All Chemistry Majors must successfully complete an exit exam before graduation. (4) This is a composite degree, a minor is not required. (5) This degree does not include the requisite number of upper division hours. Students completing this degree will fill the upper division requirement with elective credit.	

* Courses are taught every other year. Please consult advisor.

** If you are not prepared for this math course, please see advisor for alternate recommendations.

Chemistry Teacher Education Emphasis Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements (must take MATH 1210**)	18
Knowledge Areas Requirements	19
University Requirements	
BS Degree – Math or Science minimum requirement (12 hours)	
Chemistry Requirements - Education Emphasis (40 hours)	
CHEM 1210 Principles of Chemistry I	4
CHEM 1215 Principles of Chemistry I Lab	1
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 2010 Chemical Laboratory Safety	1
CHEM 2310 Organic Chemistry I	4
CHEM 2320 Organic Chemistry II	4
CHEM 2325 Organic Chemistry II Lab	2
CHEM 3000 Quantitative Analysis *	3
CHEM 3160 Intermediate Inorganic Chemistry *	3
CHEM 3610 Physical Chemistry I	3
CHEM 3615 Physical Chemistry I Lab	1
CHEM 3620 Physical Chemistry II	3

CHEM 3625 Physical Chemistry II Lab	1
CHEM 4240 Analysis Lab	2
CHEM 4990 Chemical Literature/Seminar	1
PSCI 4900 Teaching Science in the Secondary School	2
Recommended Minor (21 hours)	
MATH 1220 Calculus II	4
MATH 2270 Linear Algebra	3
MATH 3120 Foundations of Algebra and Analysis	3
MATH 3130 Foundations of Geometry	3
MATH 3700 Probability and Statistics	5
MATH 4900 Methods of Teaching Secondary School Mathematics	3
Electives (7 upper division hours, if math minor completed)	22
Total Credits, B.S. degree	120

Comments: (1) It is recommended that students completing the secondary education chemistry major minor in math. The math minor should reflect the requirements for the mathematics minor for secondary teachers. (See Math; Minor in this catalog). (2) A grade of "C" (2.0 or above) must be earned in each course required for the major and minor. (3) This major requires the student to complete the course work for the Secondary Teaching Certificate. (see below) Consult the department of teacher education. (4) This degree does not include the requisite number of upper division credit hours. Students completing this degree will fill the upper division requirement with their minor requirements or their Secondary Teaching Certificate coursework. (5) All Chemistry Majors must successfully complete an exit exam before graduation. Majors must consult with their advisor concerning their program schedule for the chemistry-education emphasis.

* Courses are taught every other year. Please consult advisor.

** If you are not prepared for this math course, please see advisor for alternate recommendations.

Professional Education Requirements for Secondary Licensure	
Course Title	Credits
Required Credits: 30-31 minimum in Education	
EDUC 2000 Exploring Education in Society*	3
SPED 3030 Foundations of Special Education	2
EDUC 3170 Instructional Technology for Educators	3
SCED 3200 Secondary Educational Psychology	3
4900 (methods of teaching course in the area(s) seeking licensure)	2-3
Secondary Block as noted below:	
SCED 3570 Motivation and the Management of Diverse Instructional Environments for Secondary Teachers	3
SCED 3590 Instructional Planning, Delivery, and Assessment for Secondary Teachers	3
SCED 3720 Content Literacy	2
SCED 4520 Secondary Practicum/Seminar Clinical Practice (student teaching) is taken the semester prior to secondary block as noted below	3
SCED 4980 Clinical Practice	7
(Academic Department) 4980 Clinical Practice (student teaching in the content area(s) of licensure is taken the semester following the secondary block)	2

Total Credits	33-34
*Meets general education requirements in the interdisciplinary knowledge area	

Chemistry Minor	
Course Number and Title	Credits
Required	
CHEM 1210 Principles of Chemistry I	4
CHEM 1215 Principles of Chemistry II Lab	1
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
10 hours of chemistry including a year-long series 2000 or above.	10
Total Credits	20

Chemistry Teacher Education Minor	
Course Number and Title	Credits
Required	
CHEM 1210 Principles of Chemistry I	4
CHEM 1215 Principles of Chemistry II Lab	1
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 2010 Chemical Laboratory Safety	1
CHEM 2310 Organic Chemistry I	4
CHEM 2320 Organic Chemistry II	4
CHEM 2325 Organic Chemistry II Lab	2
CHEM 3700 Environmental Chemistry	3
PSCI 4900 Teaching Science in the Secondary School	2
Total Credits	26
Comments: A grade of "C" (2.0 or above) must be earned in each course required for the major and minor.	

State standards require Chemistry Principles, a laboratory safety course, Organic Chemistry, Environmental Chemistry and Teaching Methods.

Geology Composite Earth Science Emphasis Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements	18
Knowledge Areas Requirements (must take BIOL 1620/1625 and CHEM 1210/1215)	20
University Requirements	
BS Degree – Math or Science minimum requirement (12 hours)	
Geology Requirements - Earth Science Emphasis (77 hours)	
GEO 1110 Physical Geology	3

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GEO 1115 Physical Geology Lab	1
GEO 1220 Historical Geology	3
GEO 1225 Historical Geology Lab	1
GEO 1500 Hand Sample Rock Identification	2
GEO 3010 Environmental Geology*	3
GEO 3015 Environmental Geology Lab*	1
GEO 3170 Oceanography*	3
GEO 3175 Oceanography Lab*	1
GEO 3210 Mineralogy	3
GEO 3215 Mineralogy Lab	1
GEO 3410 Sedimentology/Stratigraphy*	3
GEO 3415 Sedimentology/Stratigraphy Lab*	1
GEO 4000 Selected Field Trips	1
GEO 4120 Geological Field Methods	3
GEO 4800 Senior Project	3
GEO 4990 Seminar in Geology	1
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
CHEM 3700 Environmental Chemistry	3
MATH 1060 Trigonometry	3
PHYS 1040 Elementary Astronomy	3
PHYS 1045 Elementary Astronomy Lab	1
PHYS 2010 College Physics I	4
PHYS 2015 College Physics I Lab	1
PHYS 2020 College Physics II	4
PHYS 2025 College Physics II Lab	1
BIOL 1610 General Biology I	3
BIOL 1615 General Biology Laboratory I	1
BIOL 3030 Ecology	3
BIOL 3035 Ecology Laboratory	1
GEOG 1000 Physical Geography*	3
GEOG 1005 Physical Geography Lab*	1
GEOG 3220 Weather and Climate*	3
GEOG 3225 Weather and Climate Lab*	1
PSCI 4900 Teaching Science in Secondary Schools	2
Free Electives (3 credits must be upper division)	5
Total Credits	120
<i>Comments: (1) This is a composite degree, a minor is not required. (2) This degree does not include the requisite numbers of upper division hours. Students completing this degree will fill the upper division requirement with elective credit.</i>	

* These courses are taught every other year. Consult advisor

Geology Composite Professional Emphasis Bachelor of Science	
Course Number and Title	Credits
General Education Core (see page 103)	
Core Course Requirements (must take MATH 1210**)	18
Knowledge Areas Requirements	19
University Requirements	
BS Degree – Math or Science minimum requirement (12 hours)	
Geology Requirements - Professional Emphasis (79 hours)	
GEO 1110 Physical Geology	3
GEO 1115 Physical Geology Lab	1
GEO 1220 Historical Geology	3
GEO 1225 Historical Geology Lab	1
GEO 3010 Environmental Geology	3
GEO 3015 Environmental Geology Lab	1
GEO 3110 Paleontology *	3
GEO 3115 Paleontology Lab *	1
GEO 3210 Mineralogy	3
GEO 3215 Mineralogy Lab	1
GEO 3330 Ign-Met Petrology *	3
GEO 3335 Ign-Met Petrology Lab *	1
GEO 3410 Sedimentology/Stratigraphy *	3
GEO 3415 Sedimentology/Stratigraphy Lab*	1
GEO 3510 Structural Geology *	3
GEO 3515 Structural Geology Lab *	1
GEO 4000 Selected Field Trips	2
GEO 4120 Geological Field Methods	3
GEO 4800 Senior Project	3
GEO 4960 Field Geology	6
GEO 4990 Seminar in Geology	1
CHEM 1210 Principles of Chemistry I	4
CHEM 1215 Principles of Chemistry I Lab	1
CHEM 1220 Principles of Chemistry II	4
CHEM 1225 Principles of Chemistry II Lab	1
GEOG 3550 Principles of GIS	3
GEOG 3555 Principles of GIS Lab	2
GEOG 4150 Advanced GIS Methods Lab OR	
GEO 4070 Applied Geochemistry *	3
MATH 1220 Calculus II **	4
PHYS 2210 Physics for Scientists and Engineers I	4
PHYS 2215 Physics for Scientists and Engineers I Lab	1
PHYS 2220 Physics for Scientists and Engineers II	4
PHYS 2225 Physics for Scientists & Engineers II Lab	1
Free Electives	4
Total Credits, B.S. degree	120

* Courses are taught every other year.

**If you are not prepared for this math course, please see your advisor for alternate recommendations.

Geography Minor	
Course Number and Title	Credits
Required Courses (15 hours):	
GEOG 1000 Physical Geography*	3
GEOG 1005 Physical Geography Lab*	1
GEOG 1300 World Regional Geography	3
GEOG 3220 Weather and Climate*	3
GEOG 3225 Weather and Climate Lab*	1
GEOG 3500 Introduction to Cartography*	3
GEOG 3505 Introduction to Cartography Lab*	1
Electives: (select 5 hours)	
GEOG 1400 Human Geography*	3
GEOG 2900 GPS Theory, Techniques and Methods	2
GEOG 3300 World Political Geography*	3
GEOG 3350 Geomorphology*	3
GEOG 3355 Geomorphology Lab*	1
GEOG 3400 Environmental Geography*	3
GEOG 3550 Principles of GIS	3
GEOG 3555 Principles of GIS Lab	2
GEOG 3600 Geography of Utah	3
GEOG 3620 Geography of North America*	3
GEOG 4150 Advanced GIS Analysis Methods Lab	3
GEOG 4500 GIS Research Project	3
AGSC 3560 Soils	3
AGSC 3570 Soils Lab	1
ECON 4900 Economic Geography	3
Total Credits	20

* Courses are taught every other year. Consult your advisor.

Geography Teacher Education Minor	
Course Number and Title	Credits
Required Courses (12 hours):	
GEOG 1000 Physical Geography*	3
GEOG 1005 Physical Geography Lab*	1
GEOG 1300 World Regional Geography	3
GEOG 3600 Geography of Utah	3
GEOG 4900 Teaching Methods in Geography*	2
Electives (select 8 hours):	
GEOG 1400 Human Geography*	3
GEOG 3220 Weather and Climate*	3
GEOG 3225 Weather and Climate Lab*	1
GEOG 3300 World Political Geography*	3
GEOG 3350 Geomorphology	2
GEOG 3355 Geomorphology Lab	1

GEOG 3400 Environmental Geography*	3
GEOG 3500 Introduction to Cartography*	3
GEOG 3505 Introduction to Cartography Lab*	1
GEOG 3550 Principles of GIS	3
GEOG 3555 Principles of GIS Lab	2
GEOG 3620 Geography of North America*	3
AGSC 3560 Soils	3
AGSC 3570 Soils Lab	1
ECON 4900 Economic Geography	3
Total Credits	20

* These courses are taught every other year. Consult advisor.

Geology Teacher Education Minor	
Course Number and Title	Credits
Required Courses (16 hours):	
GEO 1110 Physical Geology	3
GEO 1115 Physical Geology Lab	1
GEO 1220 Historical Geology	3
GEO 1225 Historical Geology Lab	1
GEO 1500 Hand Sample Rock Identification	2
GEO 3210 Mineralogy	3
GEO 3215 Mineralogy Lab	1
PSCI 4900 Teaching Science in Secondary Schools	2
Electives (select 4 hours)	
GEO 3010 Environmental Geology*	3
GEO 3015 Environmental Geology Lab*	1
GEO 3110 Paleontology*	3
GEO 3115 Paleontology Lab*	1
GEO 3170 Oceanography*	3
GEO 3175 Oceanography Lab*	1
GEO 3410 Sedimentology and Stratigraphy*	3
GEO 3415 Sedimentology and Stratigraphy Lab*	1
GEO 3510 Structural Geology*	3
GEO 3515 Structural Geology Lab*	1
GEO 4000 Selected Field Trips	1
GEO 4070 Applied Geochemistry*	3
Total Credits	20

* These courses are taught every other year. Consult your advisor

Physics Minor	
Course Number and Title	Credits
Required	
PHYS 2210 Physics for Scientists and Engineers I	4
PHYS 2215 Physics for Scientists and Engineers I Lab	1
PHYS 2230 Physics for Scientists and Engineers I Recitation	1

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PHYS 2220 Physics for Scientists and Engineers II	4
PHYS 2225 Physics for Scientists & Engineers II Lab	1
PHYS 2260 Physics for Scientists and Engineers II Recitation	1
PHYS 3310 Quantum Physics I	3
PHYS 3320 Quantum Physics II	3
ENGR 3070 Electric Circuits	3
ENGR 3080 Electric Circuits Lab	1
Total Credits	22

Physics Teacher Education Minor	
Course Number and Title	Credits
Required (12 hours)	
PHYS 2210 Physics for Scientists and Engineers I	
PHYS 2215 Physics for Scientists and Engineers I Lab	
PHYS 2230 Physics for Scientists and Engineers I Recitation	4
PHYS 2220 Physics for Scientists and Engineers II	1
PHYS 2225 Physics for Scientists & Engineers II Lab	1
PHYS 2260 Physics for Scientists and Engineers II Recitation	4
	1
OR	
PHYS 2010 College Physics I	4
PHYS 2015 College Physics I Lab	1
PHYS 2030 College Physics I Recitation	1
PHYS 2020 College Physics II	4
PHYS 2025 College Physics II Lab	1
PHYS 2060 College Physics II Recitation	1
Plus(10 hours):	
PHYS 3310 Quantum Physics I	3
PHYS 3320 Quantum Physics II	3
ENGR 3070 Electric Circuits	3
ENGR 3080 Electric Circuits Lab	1
If a teaching license is to be awarded, PSCI 4900 is also required.	
Total Credits	22

Geographic Information Systems Certificate	
Course Number and Title	Credits
Required Foundation Courses (13 hours)	
The following courses must be completed or signature approval	
(1) MATH 1040 or equivalent (can be taken as General Education)	4
(2) CSIS 1000 or equivalent computer literacy (can be taken as General Education)	3
(3) CSIS 1400 or equivalent programming experience	3
(4) CSIS 3200 or equivalent database experience or approved substitution course	3
GIS Certificate Requirements (20 hours)	
GEOG 2900 GPS Theory, Techniques and Methods	2
GEOG 3500 Intro to Cartography	3
GEOG 3505 Intro to Cartography Lab	1

GEOG 3550 Principles of GIS	3
GEOG 3555 Principles of GIS Lab	2
GEOG 4150 Advance GIS Analysis Methods Lab	3
GEOG 4500 GIS Research Project (Capstone)	3
Choose one of the following:	
GEOG 4893 GIS Internship	3
GEOG 3993 Undergraduate Research in Geography/GIS	
CSIS 1410 Object Oriented Programming	
Total Credits	33
<i>Comments: (1) No electives required for the GIS certificate. (2) A grade of "C" (2.0 or above) or better must be earned in each course required for the certificate.</i>	

Geographic Information Systems Emphasis Requirements	
Course Number and Title	Credits
Required Foundation Courses (13 hours)	
The following courses must be completed or have signature approval for equivalent course(s).	
(1) MATH 1040 or equivalent (can be taken as General Education)	4
(2) CSIS 1000 or equivalent computer literacy (can be taken as General Education)	3
(3) CSIS 1400 or equivalent programming experience	3
(4) CSIS 3200 or equivalent database experience or approved substitution course	3
Emphasis Core Requirements (20 hours)	
GEOG 2900 GPS Theory, Techniques and Methods	2
GEOG 3500 Intro to Cartography	3
GEOG 3505 Intro to Cartography Lab	1
GEOG 3550 Principles of GIS	3
GEOG 3555 Principles of GIS Lab	2
GEOG 4150 Advance GIS Analysis Methods Lab	3
GEOG 4500 GIS Research Project (Capstone)	3
Choose one of the following:	
GEOG 4893 GIS Internship	3
GEOG 3993 Undergraduate Research in Geography/GIS	
CSIS 1410 Object Oriented Programming	
Elective Requirements (6 hours)	
(1) Additional elective credit hours are required to complete the GIS emphasis. Elective course work should relate to an application area of GIS and must be approved before the course is taken. Ideally, these elective courses should be taken after the core GIS course work and should focus on an applied component of GIS. Instructor approval is required.	
(2) A grade of "C" (2.0 or above) or better must be earned in each course required for the emphasis.	
Total Credits	39