The College of Science offers a comprehensive array of courses, programs and undergraduate degrees encompassing the sciences and mathematics. Courses are offered through three life science departments: Botany, Microbiology, and Zoology; three physical science departments: Chemistry, Geosciences, and Physics; and the Department of Mathematics. Undergraduate programs and coursework are available in five categories: Science and Mathematics, Pre-professional, Science & Mathematics Education, Technical, and General Education. Some content specific masters level education courses are available through certain departments and/or in collaboration with the Jerry and Vickie Moyes College of Education.

<table>
<thead>
<tr>
<th>Location: Science Lab, Room 611</th>
<th>Telephone Contact: Maxine Westmoreland 801-626-6159</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web Site: <a href="http://colleges.weber.edu/science/">http://colleges.weber.edu/science/</a></td>
<td></td>
</tr>
</tbody>
</table>

### Department / Area Listing

- **Center for Science & Mathematics Education**: 270
- **Utah Center of Excellence for Chemical Technology**: 271
- **Museum of Natural Science**: 271
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### Department Chairs

- **Botany**: Dr. Eugene Bozniak (area code 801) 626-6174
- **Chemistry**: Dr. Barry Lloyd 626-6952
- **Geosciences**: Dr. Adolph Yonkee 626-7139
- **Mathematics**: Dr. Kent Kidman 626-6095
- **Microbiology**: Dr. Craig Oberg 626-6949
- **Physics**: Dr. Brad Carroll 626-6163
- **Zoology**: Dr. Samuel Zeveloff 626-6165

### Degrees Offered

**Bachelor of Arts and Bachelor of Science Degree Programs are offered in:**
- Geology
- Microbiology
- Mathematics*
- Zoology
- Physics* & Applied Physics

*Teaching majors are also available

### A Bachelor of Science Degree Program is offered in:

- Applied Environmental Geoscience
- Botany and Botany Teaching
- Chemistry and Chemistry Teaching

### Bachelor of Arts and Bachelor of Science

**Composite Degrees are offered in:**

- Biology Teaching
- Earth Science Teaching
- Physical Science Teaching

### Associate of Science Degree is offered in:

- Biotechnician Training

### An Associate of Applied Science degree program is offered in:

- Chemistry (Technician)

### Minors are offered in:

- Botany*
- Chemistry*
- Earth Science Teaching
- Geology
- Geospatial Analysis
- Mathematics*
- Microbiology
- Physics*
- Zoology*

*Teaching minors are also available

### Institutional Certificates are offered in:

- Chemical Technician
- Geomatics (Applied Mapping Sciences)

### Pre-Professional Programs

- Chemical Technician
- Geomatics (Applied Mapping Sciences)

- Pre-Occupational Therapy
- Pre-Physician's Assistant
- Pre-Range Management

- Pre-Chiropractic
- Pre-Forestry
- Pre-Medical
- Pre-Optometry
- Pre-Physical Therapy
- Pre-Podiatry

### Continuing Ed

- Davis Campus

---

**The College of Science**

**Dr. Dale Ostlie, Dean**

**The College of Science offers a comprehensive array of courses, programs and undergraduate degrees encompassing the sciences and mathematics. Courses are offered through three life science departments: Botany, Microbiology, and Zoology; three physical science departments: Chemistry, Geosciences, and Physics; and the Department of Mathematics. Undergraduate programs and coursework are available in five categories: Science and Mathematics, Pre-professional, Science & Mathematics Education, Technical, and General Education. Some content specific masters level education courses are available through certain departments and/or in collaboration with the Jerry and Vickie Moyes College of Education.**
**Science and Mathematics Programs**, offered as both majors and minors allow students to pursue in-depth study in the science discipline of one's choice. They also allow one to experience a more diverse education through broader study outside of the sciences. Graduates in the sciences and mathematics are able to find employment in a variety of entry-level positions directly related to their major discipline. They are also able to move into graduate school or professional programs. Our graduates possess the broad liberal arts educational background and depth of expertise for significant career ladder movement in their discipline fields. They also have the breadth of knowledge and skills to exercise unique job mobility to become entrepreneurs and pioneer new career directions.

**Pre-professional Programs** are designed for students interested in specific professional careers requiring additional education at professional schools elsewhere. Weber State University has an excellent record of graduates being admitted into a wide range of professional school programs.

**Professional Teacher Preparation Programs** are designed to meet the needs of students seeking certification to teach in elementary and secondary schools. The Center for Science & Mathematics Education coordinates with the Jerry and Vickie Moyes College of Education to provide opportunities for students to investigate science teaching careers. There are many excellent career opportunities for graduates with teaching majors or minors in science or mathematics.

**Technical Education Programs** are offered to meet the needs of individuals seeking vocational and technical preparation required for skilled job-entry or reentry employment, as well as for career updating and occupational enhancement. Currently Associate of Science and Associate of Applied Science degrees are offered for Biotechnician training and Chemical Technician training, respectively, and Institutional Certificates are offered for Biotechnician training, Chemical Technician training, and Geomatics.

Students planning to major or minor in the College of Science should contact the appropriate department for assistance in planning their program. The details of the requirements for all majors and minors are listed within the respective departments. Students completing the teaching majors, minors, or emphasis will also work closely with the Center for Science & Mathematics Education and the Jerry and Vickie Moyes College of Education.

---

**Center for Science & Mathematics Education**

Director: Dr. Sharon Ohlhorst  
Location: Lind Lecture Hall 231  
Telephone: 801-626-6160  
Web Site: weber.edu/sciencecenter

Effective science and mathematics education of the citizenry requires rich and active experiences with the concepts and methods of science and math throughout life. To this end the Center for Science & Mathematics Education seeks to share the resources and expertise of the faculties at Weber State University with the surrounding schools and community. In addition, the Center coordinates 6000 level professional development courses (offered in collaboration with the Jerry and Vickie Moyes College of Education) to teachers. MED 6100S through MED 6500S are especially appropriate for enhancing content understanding, and pedagogy for teachers of grades K-6. MED 6500S through MED 6900S are designed for teachers of grades 7-12. Teachers may also register for certain 5000 level courses through the content departments.

---

The mission of the Center for Science and Math Education is to:

- **To provide training and advisement for pre-service secondary education science and mathematics teaching majors.**
- **To provide coordination for science and mathematics education at Weber State University, liaison with the WSU Department of Teacher Education, the Utah State Office of Education and the local school districts.**
- **To provide in-service training and support for science and mathematics teachers.**
- **To provide opportunities and support for K-12 students related to science and mathematics.**

The Center for Science & Mathematics Education also administers and advises students in the Biology Composite Teaching Major.

**Mathematics Education courses are listed under the Department of Mathematics.**

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**SCIENCE EDUCATION COURSES**

(Master of Education Courses)

MED 6610. Life Science for Elementary Teachers (3)  
This course provides a background in concepts relating to living organisms and the interactions among them and their environment. The flexibility of these concepts is examined in light of research activities.

MED 6620. Physical Science for Elementary Teachers (3)  
Basic concepts of the physical sciences (chemistry and physics) are covered. The importance of the scientific method and the design of experiments is addressed as well as basic facts and discoveries. Hands-on laboratory activities are an important part of the course.

MED 6630. Earth Science for Elementary Teachers (3)  
A background in basic concepts relating to the formation, development, and history of the earth is provided. General concepts of the structure, composition, and modification of the planet (atmosphere, lithosphere, and hydrosphere) are investigated through laboratory activities applicable to elementary classrooms. Activities emphasize inquiry and appropriate activities for developing content, process skills, laboratory skills, and positive attitudes toward science.

MED 6650. Understanding Science (2)  
This course examines the definition of science, the process of science, and the role of science in society.

MED 6660. Life Science for Secondary Teachers (3)  
This course examines basic concepts relating to living organisms, interactions among them, and relationships with their environment. Concepts of structure, function, ecology, behavior, and evolution will be investigated through laboratory activities applicable to secondary classrooms. Content relates to current areas of public concern and advances in the life sciences.

MED 6670. Physics for Secondary Teachers (3)  
A background in the basic concepts of physics is provided. Topics include laws of motion, gravity, energy, light, heat, sound, electricity, magnetism, atomic and nuclear physics, radioactivity, and relativity. Laboratories investigate concepts applicable to secondary classrooms. Activities associate science content with appropriate activities designed to develop process skills, laboratory skills, and positive attitudes toward science.

MED 6680. Chemistry for Secondary Teachers (3)  
A background in the basic concepts related to matter, its properties, and its reactions is provided. Laboratories investigate concepts applicable to secondary classrooms. Activities associate science con-
tent with appropriate activities designed to develop process skills, laboratory skills, and positive attitudes toward science.

MED 6690. Earth Science for Secondary Teachers (3)
A background in basic concepts relating to the information, development, and history of the earth is provided. General concepts of the structure, composition, and modification of the planet (atmosphere, lithosphere, and hydrosphere) are investigated through laboratory activities applicable to secondary classrooms. Activities emphasize inquiry and appropriate activities for developing content, process skills, laboratory skills, and positive attitudes toward science.

Utah Center of Excellence for Chemical Technology
Director: Dr. Edward B. Walker
Location: Science Lab Building, 503M
Telephone: 801-626-7444, Fax: 801-626-7445,
E-mail: ewalker@weber.edu

The mission of the Center of Excellence for Chemical Technology is to enhance the learning environment at Weber State University. The Center involves students and faculty in applied research activities that concomitantly provide extra-curricular learning opportunities, service to the community, and productive relationships with local and regional industries.

Museum of Natural Science
Director: Dr. Keith Harrison
Location: Lind Lecture Hall 104
Telephone: 801-626-6653

The Museum of Natural Science is an educational facility available to students in elementary and secondary schools, college students, and members of the community. Exhibits of interest include Lewis and Clark, Sound Waves and the Human Ear, Plate Tectonics, Valley Glaciation, Continental Glaciation, the Grand Canyon District, the Grand Staircase, Edward S. Curtis Indian Photographs, Ichthyosaurus, Dimetrodon, Allosaurus, Sabertooth Tiger, Petroglyphs, poisonous plants, sedimentary, igneous and metamorphic rocks, minerals, and fossils. Teachers wishing instructional materials and/or activities concerning the Museum's exhibits should contact the Director of the Museum of Natural Science, 801-626-6653. The Museum is open to the public from 8 a.m. to 5 p.m. Monday through Friday, except on holidays. Student group visits are encouraged in the afternoon.

Ott Planetarium
Director: Dr. Stacy Palen, SL 209
Web Site: weber.edu/planetarium

The Planetarium, featuring a 30-foot hemispherical dome, is used for instruction in under-graduate astronomy classes. It is also a science education facility featuring programs of interest to elementary students, secondary students, and the general public. For the general public, a program featuring some topic of current interest in astronomy is given one evening a week. Any teacher wishing instructional materials or wanting to set up an appointment for a class visit should contact the Director of the Planetarium, 801-626-6871.

Pre-Medical

<table>
<thead>
<tr>
<th>Professional Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>For information call the Department of Zoology, SL402, 801-626-6165.</td>
</tr>
<tr>
<td>Students pursuing one of the following programs should satisfy the pre-professional requirements while completing a bachelor degree within the College of Science. Students should work closely with both their pre-professional advisor and their academic major advisor. Since course loads are typically heavy, and requirements and application procedures vary among postgraduate programs, students should plan their academic strategies early and with full information.</td>
</tr>
<tr>
<td>Advisement</td>
</tr>
<tr>
<td>Students should be familiar with requirements in the Weber State catalog and consult with the pre-professional advisor and an advisor in their major department.</td>
</tr>
</tbody>
</table>

Emphasis
Advisor
Room
Telephone
Pre-Chiropractic
Dr. Barbara Trask
SL 407
801-626-7755
Pre-Dentistry
Dr. Glenn Hartung
SL 302M
801-626-7299
Pre-Medical
Dr. Barbara Trask
SL 407
801-626-7755
Pre-Optometry
Dr. Barbara Trask
SL 407
801-626-7755
Pre-Pharmacy
Dr. Don Davies
SL 608
801-626-6242
Pre-Physical & Occupational Therapy
Valerie Herzog
WH 109
801-626-7656
Pre-Physician's Assistant
Dr. Karen Nakaka
SL 306M
801-626-7509
Pre-Podiatry
Dr. Barbara Trask
SL 407
801-626-7755
Pre-Veterinary Medicine
Dr. Ron A. Meyers
SL 409
801-626-6170

General Education
Refer to pages 36-41 for general education requirements. Any general education course taken as part of a pre-medical/professional program may also be counted toward general education requirements. ENGL EN1010 and ENGL EN2010 fulfill the English competency requirement. MATH QL1050 fulfills the Quantitative Literacy requirement.

Course Requirements for Pre-Medical

The goal of the pre-medical program is to prepare students for a national competitive examination (the MCAT) and for medical school admission and courses. The pre-medical program is compatible with a variety of majors. Pre-medical classes and/or emphases exist within several departments of the College of Science.

Courses Required (74-75 credit hours)
ZOOL SI1110/1120 Principles of Zoology I & II (8)
ZOOL 2100 Human Anatomy (4)
ZOOL 2200 Human Physiology (4)
ZOOL 3200 Cell Biology (4)
ZOOL 3300 Genetics (4)
MICR LS/SI2054 Principles of Microbiology (4)
CHEM PS/SI1210/1220 Principles of Chemistry I & II (10)
CHEM 2310/2320 Organic Chemistry I & II (10)
PHYS PS/SI2010/2020 College Physics (10)
ENGL EN1010 Intro to Writing (3)
ENGL EN2010 Intermediate Writing (3)
ENGL 2100 Technical Writing (3)
or ENGL 2250 Creative Writing (3)
or ENGL 3210 Advanced College Writing (3)
or COMM HU1020 Principles of Public Speaking (3)
MATH 1010 Intermediate Algebra (4)
MATH 1060 Trigonometry (3)
or MATH QL1050 College Algebra (4)

AP or CLEP credits in English or science courses are not acceptable to medical schools.
### Course Requirements for Pre-Pharmacy

Courses Required (62 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
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<td>ZOOL 2200</td>
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</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</td>
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<tr>
<td>MATH QL1050</td>
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<tr>
<td>MATH 1060</td>
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</table>

Electives

Select courses as needed to finish requirements for graduation.

### Course Requirements for Pre-Optometry

Courses Required (76-81 credit hours)

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<th>Course</th>
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<tbody>
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<tr>
<td>or ZOOL LS1010</td>
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<tr>
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<td>4</td>
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<tr>
<td>MATH SI1210/SI1220</td>
<td>8</td>
</tr>
<tr>
<td>MICR LS/SI2054</td>
<td>4</td>
</tr>
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<td>ZOOL 3300</td>
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Recommended Electeds (none required)

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<td>ENGL 1010</td>
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<td>CHEM 2310/2320</td>
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Electives

Select courses as needed to finish requirements for graduation.

### Course Requirements for Pre-Physical Therapy

Courses Required (54-64 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
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<tr>
<td>ZOOL SI1110/SI1120</td>
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<tr>
<td>or ZOOL LS1010</td>
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<tr>
<td>ZOOL 2100</td>
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<td>ZOOL 2200</td>
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<tr>
<td>ZOOL 3200</td>
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<td>MATH 1060</td>
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<tr>
<td>MATH QL1040</td>
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<td>MATH SI1210/SI1220</td>
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Recommended Electeds (none required)

<table>
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<tr>
<td>CHEM 3070</td>
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</table>

Electives

Select courses as needed to finish requirements for graduation.

### Course Requirements for Pre-Veterinary Medicine

Courses Required (68 credit hours)

<table>
<thead>
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<th>Course</th>
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<tr>
<td>COMM HU1020</td>
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Recommended Electives (none required)

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<th>Course</th>
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<td>ZOOL 4120</td>
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### Course Requirements for Pre-Chiropractic

Courses Required (54-64 credit hours)

<table>
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<tr>
<td>ZOOL 3200</td>
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<tr>
<td>MATH 1060</td>
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<tr>
<td>MATH QL1040</td>
<td>3</td>
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<tr>
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<tr>
<td>CHEM SI1110/SI1120</td>
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Recommended Electives (none required)

<table>
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<td>ZOOL 4500</td>
<td>4</td>
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<tr>
<td>MICR 3254</td>
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</tr>
</tbody>
</table>

Electives

Select courses as needed to finish requirements for graduation.
### BIOTECHNICIAN

**ASSOCIATE OF SCIENCE DEGREE**

**INSTITUTIONAL CERTIFICATE**

**Location:** Science Lab, SL402  
**Telephone:** 801-626-6165  

This technology education program is designed to meet the needs of the biotechnology industry for technicians trained in the appropriate biological sciences and chemistry. Heavy emphasis is placed on providing students with opportunities for hands-on laboratory experiences that will enable them to qualify for good jobs in various biotechnology companies. Students would complete the three-year training program by completing a course of study leading to an Associate of Science degree in the first two years, and a laboratory-intensive course of study in the third year that would qualify them for a Biotechnician Certificate.

- **Grade Requirements:** Cumulative GPA of 2.00 or higher.
- **Credit Hour Requirements:** Total of 62 credit hours is required – of which 38 are required within the program. An additional 30 credit hours is required for the Institutional Certificate.

**Advisement**

Students should meet with the program advisor; the Department of Zoology secretary (801-626-6165) for information.

**General Education**

Refer to pages 36-41 for Associate of Science requirements. These should include either ECON A21740, HIST A11700, or POLS A11100. The following courses required for the Biotechnician program will satisfy the quantitative core and the life and physical sciences portion of the general education requirements: MATH QL1050, CHEM PS/SI1210, PHYS PS/SI1010, and MICR LS/SI2054.

Students should complete the A.S. program in two years and take the laboratory intensive courses for the Institutional Certificate in their third year.

**Course Requirements for A.S. Degree**

**Courses Required (37 credit hours)**
- MICR LS/SI2054: Principles of Microbiology (4)
- MICR 3053: Microbiological Procedures (3)
- BTNY SI2104: Plant Form and Function (4)
- or BTNY SI2114: Evolutionary Survey of Plants (4)
- ZOOL SI1110: Principles of Zoology I (4)
- ZOOL SI1120: Principles of Zoology II (4)
- CHEM PS/SI1210/SI1220: Principles of Chemistry I & II (10)
- PHYS PS/SI1010: Elementary Physics (3)
- BTNY 2600: Laboratory Safety (1)
- or MICR 2600: Laboratory Safety (1)
- MATH QL1050: College Algebra (4)

**Course Requirements for Institutional Certificate**

Thirty (30) credit hours are to be taken in addition to those courses required for the A.S. Degree.

**Required Courses (22 credit hours)**
- BTNY 3204: Plant Physiology (4)
- ZOOL 3300: Genetics (4)
- CHEM 2310/2320: Organic Chemistry I & II (10)
- MICR 4154: Microbial Genetics (4)
- or ZOOL 4300: Molecular Genetics (4)

**Electives (select 8 credit hours)**
- CHEM 3000: Quantitative Analysis (4)
- CHEM 3050: Instrumental Analysis (3)
- CHEM 3070: Biochemistry 1 (4)
- MICR 3254: Immunology (4)
- MICR 4252: Cell Culture (2)
- MICR 4354: Industrial Microbiology & Biotechnology (4)
- MICR 4554: Virology (4)
- BTNY 3504: Anatomy & Morphology of Vascular Plants (5)
- BTNY 3514: Algology (4)
- ZOOL 3200: Cell Biology (4)
- ZOOL 4120: Histology (4)
- ZOOL 4220: Endocrinology (4)
- or ZOOL 4210: Advanced Human Physiology (4)
- ZOOL 4500: or MICR 3305: Medical Microbiology (5)

---

**Botany**

**Chair:** Dr. Eugene G. Bozniak  
**Location:** Science Lab, Room SL402M  
**Telephone Contact:** Carrie Minnoch 801-626-6174  
**Professors:** Eugene G. Bozniak, Stephen L. Clark, Dawn M. Gatherum, Suzanne M. Harley, Barbara A. Wachocki; **Assistant Professor:** Ron J. Deckert

While plants have intrigued and delighted people for thousands of years, they still remain undervalued and too little appreciated. We somehow manage to see a faint connection between plants and our basic needs of food, shelter, clothing, and energy, but only in a rather limited way. Remote connections are made, if any at all, between the history of exploration; present-day social, economic, and political conditions; and access to plants and plant products. Interest and understanding of plants is becoming much more intense. During the last few decades we have seen an unprecedented increase in the variety of plants and plant products available in our markets as the popularity of ethnic cuisines has grown. Also, worldwide, people are becoming increasingly aware of sound nutrition and the role plants play in our general health. We now appreciate plants as reservoirs of untold numbers of pharmaceuticals important in our war on diseases. These interests are stimulating our collective concerns about understanding the past, present, and future uses of plants.

Recently we have begun to address our most serious problems, viz the loss of ecosystem integrity and habitats for animals dependent upon vegetation. This we have done through increased understanding of plants. We now know how valuable plants are in maintaining the health and stability of the global environment and that in its survival is the survival of the human species.

Botany is the study of all aspects of plants, including systematic, morphology, diversity, metabolism, and ecology. Through a study of plants, students gain an understanding and an appreciation of the life at the cellular, organismal, population, and community levels of organization. The study of Botany can lead to a variety of professional careers, including soil science, forestry, range management, biotechnology, plant breeding, horticulture, marine biology, environmental science, and teaching.

The Botany Department at Weber State University offers undergraduate training in all areas of botany. The required upper division courses provide a core knowledge of the field of botany: anatomy, physiology, genetics, ecology, taxonomy, and plant diversity. The department also requires botany majors to develop a portfolio. The portfolio is a multidimensional collection of both student and faculty selected materials that are both developmental and representational in nature. Within the portfolio, students can document their acquisition of a variety of skills, including critical thinking, research, communication, and presentation skills.
thinking, scientific reasoning, writing, speaking, and effective arguing. The portfolio is used for assessment purposes in addition to serving as an incentive to the student for developing good habits in assembling and organizing materials of relevance to themselves and others, such as personnel managers or graduate school selection committees. The department has also developed an undergraduate thesis program which provides a desirable capstone experience for many of the Botany majors.

Individuals who choose to study botany fall into three broad groups: those who are more interested in the quantitative or analytical side of plant biology (laboratory research orientation); those who are interested in the qualitative or descriptive side of science (field research orientation); and those general students, such as transfer students entering with an Associate's Degree, where greater flexibility is required. In order to serve each group effectively, the Botany Department offers a Botany Major with three tracks. Track A, enriched with quantitative science and intense laboratory hands-on experiences, is designed to best prepare students for graduate school and careers in laboratory research in Plant Biology. Track B, enriched with field-oriented course opportunities, is designed to best prepare students for field-related careers such as ecology, environmental science, and natural resource management. Track C, with greater flexibility through more elective courses, is designed to meet the needs of students who wish to be more broadly trained because of general interests in Plant Biology or of those students who enter the program with an Associate of Science Degree.

In addition to the Botany Major, the Department offers a Botany Teaching Major. In conjunction with a Zoology Teaching Minor, this program prepares individuals who are interested in teaching Biology at the secondary school level. The Botany and Zoology Departments also cooperate in offering a Biology Composite Teaching Major.

The Botany Department also serves students who are interested in pre-professional programs: Pre-Agriculture, Pre-Horticulture, Pre-Forestry, and Pre-Range Management. After completing these programs at Weber State, students must continue their education in the appropriate institutional programs. Students who are interested in pre-professional programs are encouraged to transfer to the appropriate institution. Students who are interested in natural resource management should consult their transfer school and careers in laboratory research in Plant Biology. The Herbarium provides an important resource for students who are interested in the scientific study of plants. The Herbarium contains more than 24,000 preserved plant specimens collected from Utah and the Western United States. This collection serves as an important reference for students, faculty, biologists, and all others who need to know the identity of plants, or learn something about their geographic distributions and ecological associations. It also serves as the repository of the plants collected for the Institute of American Indian Botany.

**Herbarium**

The Herbarium of Weber State University is housed on the fourth floor of the Science Lab Building and contains more than 24,000 preserved plant specimens collected from Utah and the Western United States. This collection serves as an important reference for students, faculty, biologists, and all others who need to know the identity of plants, or learn something about their geographic distributions and ecological associations. It also serves as the repository of the plants collected for the Institute of American Indian Botany.

**Institute of American Indian Botany**

The Institute is dedicated to the study of American Indian Botany and provides a place where all of those who have interest can learn, conduct research, teach, and preserve for generations yet to come, this segment of our great American heritage.

---

**Pre-Agriculture and Pre-Horticulture**

**TWO YEARS (NO DEGREE)**

**Advisor:** Dr. Eugene G. Bozniak  
**Location:** Science Lab, SL402M  
**Telephone:** 801-626-6176

Follow the catalog of a university which offers a degree program in these fields for general requirements, etc.

**Course Requirements for Two Year Program**

**Botany Courses Required (24 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>BTNY 2114</td>
<td>Evolutionary Survey of Plants (4)</td>
</tr>
<tr>
<td>BTNY 2121</td>
<td>Career Planning for Botanists (1)</td>
</tr>
<tr>
<td>BTNY DV2303</td>
<td>Ethnobotany (3)</td>
</tr>
<tr>
<td>BTNY 2413</td>
<td>Introduction to Natural Resource Management (3)</td>
</tr>
<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
</tr>
</tbody>
</table>

Select two of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>BTNY 3204</td>
<td>Plant Physiology (4)</td>
</tr>
<tr>
<td>BTNY 3214</td>
<td>Soils (4)</td>
</tr>
<tr>
<td>BTNY 3454</td>
<td>Plant Ecology (4)</td>
</tr>
<tr>
<td>BTNY 3624</td>
<td>Taxonomy of Vascular Plants (4)</td>
</tr>
</tbody>
</table>

**Required Support Courses (24-26 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>CHEM PS/SI1210,1220</td>
<td>Principles of Chemistry (10)</td>
</tr>
<tr>
<td>GEO PS/SI1110</td>
<td>Physical Geology (3)</td>
</tr>
<tr>
<td>MATH QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>or MATH QL1080</td>
<td>Pre-Calculus (5)</td>
</tr>
<tr>
<td>or MATH SI1210</td>
<td>Calculus (4)</td>
</tr>
<tr>
<td>or MATH QL1040</td>
<td>Introduction to Statistics (3)</td>
</tr>
</tbody>
</table>

Select One Group:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICR LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>&amp; MICR 3484</td>
<td>Environmental Microbiology (4)</td>
</tr>
<tr>
<td>or GEO SI1115</td>
<td>Physical Geology Laboratory (1)</td>
</tr>
<tr>
<td>&amp; GEO PS/SI1130</td>
<td>Introduction to Meteorology (3)</td>
</tr>
<tr>
<td>&amp; GEO 2050</td>
<td>Earth Materials (4)</td>
</tr>
</tbody>
</table>

**Suggested Course Sequence**

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

---

**Pre-Forestry and Pre-Range Management**

**TWO YEARS (NO DEGREE)**

**Advisor:** Dr. Eugene Bozniak  
**Location:** Science Lab, SL402M  
**Telephone:** 801-626-6176

Follow the catalog of a university which offers a degree program in these fields for general requirements, etc.

**Course Requirements for Two Year Program**

**Botany Courses Required (24 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>BTNY 2114</td>
<td>Evolutionary Survey of Plants (4)</td>
</tr>
<tr>
<td>BTNY 2121</td>
<td>Career Planning for Botanists (1)</td>
</tr>
<tr>
<td>BTNY DV2303</td>
<td>Ethnobotany (3)</td>
</tr>
<tr>
<td>BTNY 2413</td>
<td>Introduction to Natural Resource Management (3)</td>
</tr>
<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
</tr>
</tbody>
</table>

Select two of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 3214</td>
<td>Soils (4)</td>
</tr>
<tr>
<td>BTNY 3454</td>
<td>Plant Ecology (4)</td>
</tr>
<tr>
<td>BTNY 3624</td>
<td>Taxonomy of Vascular Plants (4)</td>
</tr>
</tbody>
</table>
Required Support Courses (37-39 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM PS/SI1210</td>
<td>Principles of Chemistry (10)</td>
</tr>
<tr>
<td>ECON SS1100</td>
<td>Environmental Issues and Economic Policy (3)</td>
</tr>
<tr>
<td>GEO PS/SI1110</td>
<td>Physical Geology (3)</td>
</tr>
<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory (1)</td>
</tr>
<tr>
<td>GEO PS/SI1130</td>
<td>Introduction to Meteorology (3)</td>
</tr>
<tr>
<td>GEO 2050</td>
<td>Earth Materials (4)</td>
</tr>
<tr>
<td>MATH QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>MATH QL1080</td>
<td>Pre-Calculus (5)</td>
</tr>
<tr>
<td>MATH SI2120</td>
<td>Calculus (4)</td>
</tr>
<tr>
<td>MATH QL1040</td>
<td>Introduction to Statistics (3)</td>
</tr>
<tr>
<td>PHYS PS/SI2010</td>
<td>General Physics (10)</td>
</tr>
</tbody>
</table>

Suggested Course Sequence

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

Biotechnology Training Program

ASSOCIATE OF SCIENCES DEGREE & CERTIFICATE

The Department of Botany participates with the Departments of Microbiology and Zoology in the Associate of Science degree and 3rd year Certificate in Biotechnology training for the biotechnology industry. This program is described earlier in this College of Science section of the catalog.

Botany Major

BACHELOR DEGREE (B.S.)

- Program Prerequisite: Not required.
- Minor: A minor is required. Botany majors getting a B.S. (Track A) will meet the requirements for a minor in Chemistry.
- Grade Requirements: An overall GPA of 2.00 in all courses required for this major. Also refer to the general grade requirements for graduation on page 36.
- Credit Hour Requirements: A total of 120 credit hours is required for graduation – required within the major are 91-97 credit hours for Track B (minor included), 76-87 credit hours for Track C (minor not included) and 67-76 credit hours for Track C (minor included). A total of 40 upper division credit hours is required (courses numbered 3000 and above) – required within the major are 29-33 upper division credit hours for Track A, 22-32 upper division credit hours for Track B and 28-32 upper division credit hours for Track C.

Advisement

 Majors are encouraged to consult with their advisor each semester. Contact the Botany department (801-626-6174).

Admission Requirements

 Declare your program of study (see page 18). There are no special admission or application requirements for this program.

General Education

 Refer to pages 36-41 for Bachelor of Science requirements. The following courses required for the Botany major will also satisfy general education requirements: BTNY LS1403, CHEM PS/SI1110 or PS1210, and PHYS PS/SI1010 or PS2010.

All Botany majors are required to develop a portfolio. The portfolio requirements are explained in detail when a student takes BTNY 2121.

Course Requirements for B.S. Degree

Botany Core Courses Required for Track A and Track B (16 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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<tbody>
<tr>
<td>BTNY LS1403</td>
<td>Environment Appreciation (3)</td>
</tr>
<tr>
<td>or BTNY 3403</td>
<td>Environment Appreciation (3)</td>
</tr>
<tr>
<td>BTNY SI2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>BTNY SI2114</td>
<td>Evolutionary Survey of Plants (4)</td>
</tr>
<tr>
<td>BTNY 2121</td>
<td>Career Planning for Botanists (1)</td>
</tr>
<tr>
<td>BTNY DV2303</td>
<td>Ethnobotany (3)</td>
</tr>
<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
</tr>
</tbody>
</table>

Track A

Botany Courses Required (17-18 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>BTNY 3105</td>
<td>Anatomy and Morphology of Vascular Plants (5)</td>
</tr>
<tr>
<td>BTNY 3204</td>
<td>Plant Physiology (4)</td>
</tr>
<tr>
<td>BTNY 3303</td>
<td>Plant Genetics (3)</td>
</tr>
<tr>
<td>BTNY 4840</td>
<td>Thesis Reading (2)</td>
</tr>
<tr>
<td>or BTNY 4830</td>
<td>Readings in Botany (2)</td>
</tr>
<tr>
<td>BTNY 4850</td>
<td>Thesis Research (2)</td>
</tr>
<tr>
<td>or BTNY 4800</td>
<td>Individual Research (2)</td>
</tr>
<tr>
<td>BTNY 4970</td>
<td>Botany Thesis (2)</td>
</tr>
<tr>
<td>or BTNY 4990</td>
<td>Seminar in Botany (1)</td>
</tr>
</tbody>
</table>

Elective Botany Courses (14 credit hours minimum; 6 lower division credit hours maximum)

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 2203</td>
<td>Home and Garden Plants (3)</td>
</tr>
<tr>
<td>BTNY 2413</td>
<td>Introduction to Natural Resource Management (3)</td>
</tr>
<tr>
<td>BTNY 2503</td>
<td>Biology of the Plant Cell (3)</td>
</tr>
<tr>
<td>BTNY 3214</td>
<td>Soils (4)</td>
</tr>
<tr>
<td>BTNY 3454</td>
<td>Plant Ecology (4)</td>
</tr>
<tr>
<td>BTNY 3473</td>
<td>Plant Geography (3)</td>
</tr>
<tr>
<td>BTNY 3504</td>
<td>Mycology (4)</td>
</tr>
<tr>
<td>BTNY 3514</td>
<td>Algology (4)</td>
</tr>
<tr>
<td>BTNY 3523</td>
<td>Marine Biology (3)</td>
</tr>
<tr>
<td>BTNY 3641</td>
<td>Intermountain Flora (1-4)</td>
</tr>
<tr>
<td>BTNY 3642</td>
<td>Taxonomy of Vascular Plants (4)</td>
</tr>
<tr>
<td>BTNY 4113</td>
<td>Plant Evolution (3)</td>
</tr>
<tr>
<td>BTNY 4252</td>
<td>Cell Culture (2)</td>
</tr>
<tr>
<td>BTNY 4750</td>
<td>Topics in Botany (2)</td>
</tr>
<tr>
<td>BTNY 4890</td>
<td>Cooperative Work Experience (5)</td>
</tr>
<tr>
<td>BTNY 4950</td>
<td>Advanced Field Botany (2)</td>
</tr>
</tbody>
</table>

Required Support Courses (44-49 credit hours)

This program includes a minor in Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>CHEM PS/SI1210</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
<tr>
<td>CHEM 2310/2320</td>
<td>Organic Chemistry I &amp; II (10)</td>
</tr>
<tr>
<td>CHEM 3000</td>
<td>Quantitative Analysis (4)</td>
</tr>
<tr>
<td>or CHEM 3070</td>
<td>Biochemistry I (4)</td>
</tr>
<tr>
<td>MATH QL1050/1060</td>
<td>College Algebra &amp; Trigonometry (7)</td>
</tr>
<tr>
<td>or MATH QL1080</td>
<td>Pre-Calculus (5)</td>
</tr>
<tr>
<td>or MATH QL SI2120</td>
<td>Calculus I (4)</td>
</tr>
<tr>
<td>or MATH QL1040</td>
<td>Introduction to Statistics (3)</td>
</tr>
<tr>
<td>PHYS PS/SI2010</td>
<td>College Physics I &amp; II (10)</td>
</tr>
<tr>
<td>or PHYS PS/SI2210/SI2220</td>
<td>Physics for Scientists &amp; Engineers (10)</td>
</tr>
</tbody>
</table>

Select two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS/SI1110</td>
<td>Physical Geology (3)</td>
</tr>
<tr>
<td>or GEOG PS/SI1000</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>MLCR LS/SI2054</td>
<td>Natural Environments of the Earth (3)</td>
</tr>
<tr>
<td>ZOOL SI1110</td>
<td>Principles of Zoology I (4)</td>
</tr>
<tr>
<td>ZOOL SI120</td>
<td>Principles of Zoology II (4)</td>
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</tbody>
</table>

Calculus and Statistics are recommended.
### Botany Core Courses Required (13 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 3105</td>
<td>Anatomy and Morphology of Vascular Plants (5)</td>
</tr>
<tr>
<td>BTNY 2121</td>
<td>Career Planning for Botanists (1)</td>
</tr>
<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
</tr>
</tbody>
</table>

### Select One Group:

- **MICR LS/SI2054 & MICR 3484**
  - Principles of Microbiology (4)
  - Environmental Microbiology (4)
- **GEO SI1115 & GEO PS/SI1130 & GEO 1220**
  - Physical Geography Laboratory (1)
  - Introduction to Meteorology (3)
  - Historical Geology (4)
- **GEOG 3450 & GEOG 3460**
  - Cartography (3)
  - Advanced Cartography (3)

### Elective Botany Courses (11 credit hours minimum; 6 lower division credit hours maximum)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 2023</td>
<td>Home and Garden Plants (3)</td>
</tr>
<tr>
<td>BTNY 2503</td>
<td>Biology of the Plant Cell (3)</td>
</tr>
<tr>
<td>BTNY 3105</td>
<td>Anatomy and Morphology of Vascular Plants (5)</td>
</tr>
<tr>
<td>BTNY 2204</td>
<td>Plant Physiology (4)</td>
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<td>BTNY 3303</td>
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<td>Readings in Botany (2)</td>
</tr>
<tr>
<td>BTNY 4890</td>
<td>Cooperative Work Experience (5)</td>
</tr>
</tbody>
</table>

### Required Support Courses (24-39 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM PS/SI1050</td>
<td>Introduction to General, Organic &amp; Biochemistry (5)</td>
</tr>
<tr>
<td>or CHEM PS/SI1110</td>
<td>Elementary Chemistry (5)</td>
</tr>
<tr>
<td>and CHEM SI1210</td>
<td>Elementary Organic Bio-Chemistry (5)</td>
</tr>
<tr>
<td>or CHEM PS/SI1210</td>
<td>Principles of Chemistry I (5)</td>
</tr>
<tr>
<td>and CHEM SI1220</td>
<td>Principles of Chemistry II (5)</td>
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<tr>
<td>PS/SI1110</td>
<td>Physical Geology (3)</td>
</tr>
<tr>
<td>or GEOG PS/SI1000</td>
<td>Natural Environments of the Earth (3)</td>
</tr>
<tr>
<td>MATH QL1040</td>
<td>Introduction to Statistics (3)</td>
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<tr>
<td>or MATH QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>PHYS PS/SI1010</td>
<td>Elementary Physics (3)</td>
</tr>
<tr>
<td>or PHYS PS/SI2010/SI2020</td>
<td>College Physics I &amp; II (10)</td>
</tr>
<tr>
<td>or PHYS PS/SI2210/SI2220</td>
<td>Physics for Scientists &amp; Engineers (10)</td>
</tr>
<tr>
<td>ZOOL SI1110</td>
<td>Principles of Zoology I (4)</td>
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  - Principles of Microbiology (4)
  - Environmental Microbiology (4)
- **GEO SI1115 & GEO PS/SI1130 & GEO 1220**
  - Physical Geography Laboratory (1)
  - Introduction to Meteorology (3)
  - Historical Geology (4)
- **GEOG 3450 & GEOG 3460**
  - Cartography (3)
  - Advanced Cartography (3)

### TRACK C

### Botany Core Courses Required (13 credit hours)

<table>
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</thead>
<tbody>
<tr>
<td>BTNY 3105</td>
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<td>BTNY 2121</td>
<td>Career Planning for Botanists (1)</td>
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<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
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</table>

### Elective Botany Courses (22 credit hours minimum; 6 lower division credit hours maximum)

<table>
<thead>
<tr>
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<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 2203</td>
<td>Home and Garden Plants (3)</td>
</tr>
<tr>
<td>BTNY DV2303</td>
<td>Ethnobotany (3)</td>
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<tr>
<td>BTNY 2503</td>
<td>Biology of the Plant Cell (3)</td>
</tr>
<tr>
<td>BTNY 3105</td>
<td>Anatomy and Morphology of Vascular Plants (5)</td>
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<tr>
<td>BTNY 3204</td>
<td>Plant Physiology (4)</td>
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<tr>
<td>BTNY 3303</td>
<td>Plant Genetics (3)</td>
</tr>
<tr>
<td>BTNY 3473</td>
<td>Plant Geography (3)</td>
</tr>
<tr>
<td>BTNY 3504</td>
<td>Mycology (4)</td>
</tr>
<tr>
<td>BTNY 3514</td>
<td>Algodology (4)</td>
</tr>
<tr>
<td>BTNY 3523</td>
<td>Marine Biology (3)</td>
</tr>
<tr>
<td>BTNY 3641</td>
<td>Intermountain Flora (1-4)</td>
</tr>
<tr>
<td>BTNY 4113</td>
<td>Plant Evolution (3)</td>
</tr>
<tr>
<td>BTNY 4252</td>
<td>Cell Culture (2)</td>
</tr>
<tr>
<td>BTNY 4750</td>
<td>Topics in Botany (2)</td>
</tr>
<tr>
<td>BTNY 4800</td>
<td>Individual Research (2)</td>
</tr>
<tr>
<td>BTNY 4850</td>
<td>Thesis Research (2)</td>
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<tr>
<td>BTNY 4830</td>
<td>Readings in Botany (2)</td>
</tr>
<tr>
<td>BTNY 4890</td>
<td>Cooperative Work Experience (5)</td>
</tr>
<tr>
<td>BTNY 4950</td>
<td>Advanced Field Botany (1-5)</td>
</tr>
</tbody>
</table>

### Required Support Courses (20-28 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>CHEM PS/SI1110</td>
<td>Elementary Chemistry (5)</td>
</tr>
<tr>
<td>or CHEM PS/SI1210</td>
<td>Principles of Chemistry I (5)</td>
</tr>
<tr>
<td>or CHEM SI1220</td>
<td>Principles of Chemistry II (5)</td>
</tr>
<tr>
<td>PHYS PS/SI1010</td>
<td>Elementary Physics (3)</td>
</tr>
<tr>
<td>or PHYS PS/SI2010/SI2020</td>
<td>College Physics I &amp; II (10)</td>
</tr>
<tr>
<td>or PHYS PS/SI2210/SI2220</td>
<td>Physics for Scientists &amp; Engineers (10)</td>
</tr>
</tbody>
</table>

Select two of the following:

- **GEO PS/SI1110**
  - Physical Geology (3)
- **GEOG PS/SI1000**
  - Natural Environments of the Earth (3)
- **MICR LS/SI2054**
  - Principles of Microbiology (4)
- **ZOOL SI1110**
  - Principles of Zoology I (4)
- **ZOOL SI1120**
  - Principles of Zoology II (4)

### Botany Teaching Major

**BACHELOR DEGREE (B.S.)**

- **Program Prerequisite:** Must satisfy Teacher Education admission and certification requirements (see Teacher Education Department).
- **Minor:** Required. This minor should be in Zoology.
- **Grade Requirements:** An overall GPA of 3.00 is required for admission to the Teacher Education program.
- **Credit Hour Requirements:** A total of 120-126 credit hours is required for graduation – 67 of these are required within the major. A total of 40 upper division hours is required (courses numbered 3000 and above), all of which are required within the major.

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.
Advisement
Teaching majors are encouraged to consult with advisors in both the College of Science (call 801-626-6174) and the College of Education (call 801-626-6269).

Admission Requirements
Declare your program of study (see page 18). Teaching majors must satisfy Teacher Education admission and certification requirements (see Teacher Education Department).

General Education
Refer to pages 36-41 for either Bachelor of Science requirements. The following courses required for the Botany Teaching major also will satisfy general education requirements: BTNY LS1403, COMM HU1020, CHEM PS/SI1110 or PS1210, PHYS PS/SI1010.

All Botany majors are required to develop a portfolio. The portfolio requirements are explained in detail when a student takes BTNY 2121.

Course Requirements for B.S. Degree

Botany Core Courses Required (16 credit hours)
- BTNY LS1403 Environment Appreciation (3)
- BTNY SI2104 Plant Form and Function (4)
- BTNY SI2114 Evolutionary Survey of Plants (4)
- BTNY 2121 Career Planning for Botanists (1)
- BTNY DV2303 Ethnobotany (3)
- BTNY 2600 Laboratory Safety (1)

Additional Botany Courses Required (22 credit hours)
- BTNY 3105 Anatomy and Morphology of Vascular Plants (5)
- BTNY 3303 Plant Genetics (3)
- BTNY 3454 Plant Ecology (4)
- BTNY 3523 Marine Biology (3)
- BTNY 3624 Taxonomy of Vascular Plants (4)
- BTNY 4950 Advanced Field Botany (2)
- BTNY 4990 Seminar in Botany (1)

Support Courses Required (27 credit hours)
- CHEM PS/SI1110/SI1120 Elem Chemistry/Elem Organic Bio-Chem (10)
- or CHEM PS/SI1210/SI1220 Principles of Chemistry (10)
- MATH QL1050 College Algebra (4)
- CHEM 4570 Science Teaching Methods (3)
- or GEO 4570 Science Teaching Methods (3)
- or PHYS 4570 Science Teaching Methods (3)
- or ZOOL 4570 Science Teaching Methods (3)
- HIST 3550 History & Philosophy of Science (3)
- or ZOOL 2800 History of the Life Sciences (3)
- COMM HU1020 Principles of Public Speaking (3)
- MICR LS/SI2054 Principles of Microbiology (4)

Suggested Course Sequence
Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

Botany

DEPARTMENTAL HONORS
- Program Prerequisite: Enroll in the General Honors Program and complete 9 hours of General Honors courses (see Honors Program).
- Grade Requirements: Maintain an overall GPA of 3.5.
- Credit Hour Requirements: Fulfill requirements for the Botany departmental or teaching major, of which at least 12 hours must be completed on an Honors basis.

A student may receive Botany Honors credit in the following:* 
- BTNY 3105 Anatomy & Morphology of Vascular Plants (5)
- BTNY 3204 Plant Physiology (4)
- BTNY 3214 Soils (4)
- BTNY 3303 Plant Genetics (3)
- BTNY 3454 Plant Ecology (4)
- BTNY 3504 Mycology (4)
- BTNY 3514 Algology (4)
- BTNY 3523 Marine Biology (3)
- BTNY 3624 Taxonomy of Vascular Plants (4)
- BTNY 3644 Intermountain Flora (4)
- BTNY 4113 Plant Evolution (3)
- BTNY 4252 Cell Culture (2)

In addition, complete requirements for a Botany Thesis (BTNY 4840, BTNY 4850, and BTNY 4970).

*In order to obtain "Honors" credit in selected upper division courses in Botany, an Honors Student must meet the following criteria:
1. Seek permission from the course instructor to obtain Honors credit for the upper division course in question at the outset of the course.
2. Enter into a "contractual" agreement with the instructor as to the nature of the project. Generally, these projects could involve: a) Field Research, b) Laboratory/Greenhouse Research, c) Library Research, or any combination of the above. A final written report and/or oral presentation is expected following the specific criteria spelled out in the Botany Department Oral Presentation Criteria form. The nature of the written report format is to be worked out with the individual professor involved.
3. A qualitative and quantitative component, above and beyond that expected of a student in the class taking the course for regular course credit, is to be met by the Honors student. The qualitative component will usually involve a minimum of a B+ grade while the quantitative component is to be worked out between the student and the professor at the outset of the course.

Examples of such projects appear below:
- Ethnobotany of a specific native group of peoples is to be carried out
- An extensive semester-long field research project, involving the
- Select at least two approved upper division Botany courses for a minimum

BOThany MINOR/BIS

- Grade Requirements: An overall GPA of 2.00 in all courses used toward the minor.
- Credit Hour Requirements: Minimum 19 credit hours in Botany courses.

Course Requirements for Minor/BIS

Botany Courses Required (12 credit hours)
- BTNY SI2104 Plant Form and Function (4)
- BTNY SI2114 Evolutionary Survey of Plants (4)
- BTNY DV2303 Ethnobotany (3)
- BTNY 2600 Laboratory Safety (1)

Botany Electives
Select at least two approved upper division Botany courses for a minimum of 7 credit hours.
Botany Teaching Minor

» Grade Requirements: A grade of "C-" or higher in courses used toward the minor.
» Credit Hour Requirements: Minimum 22 credit hours in Botany courses.

Students who select the Botany Teaching Minor must satisfy the Teacher Education admission and certification requirements (see Teacher Education Department).

Course Requirements for Minor

Botany Courses Required (22 credit hours)
- BTNY LS1403 Environment Appreciation (3)
- BTNY SI2104 Plant Form and Function (4)
- BTNY SI2114 Evolutionary Survey of Plants (4)
- BTNY DV2303 Ethnobotany (3)
- BTNY 2600 Laboratory Safety (1)
- BTNY 3624 Taxonomy of Vascular Plants (4)
- CHEM 4570 Science Teaching Methods (3)
  or GEO 4570 Science Teaching Methods (3)
  or PHYS 4570 Science Teaching Methods (3)
  or ZOOL 4570 Science Teaching Methods (3)

Urban and Regional Planning Emphasis

This program provides a special emphasis in Urban and Regional Planning for majors in Botany, Economics, Engineering, Geography, Geology, Microbiology, Political Science, Sociology, Zoology and Related Fields. (See the Interdisciplinary Programs section of the catalog.)

Botany Courses - BTNY

BTNY LS1203. Plant Biology (3) Su, F, S
An introductory course for non-majors that emphasizes unique features of plant biology. Included are discussions on: the origins of life; important plants of the world and their habitats; plant diversity, structure, function, and reproduction; plants and environmental science; plants that changed history; practical botany; and botany as a science. Three lecture/demonstration hours per week.

BTNY LS1303. Plants in Human Affairs (3) Su, F, S
This class provides a general introduction to the importance and function of plants in human affairs. It includes an overview of science as a way of knowing, plant forms and functions, plant reproduction, and use of economically and sociologically important plants. Flowering and non-flowering plants and products such as fruits, forages, grains, medicines, herbs and spices, textile fibers, lumber, algae, and foliage plants are studied. Ecological concepts as they relate to the growth and production of world food crops will also be included. The course has a strong emphasis on the historical development of exploitation of certain plants and the role plants played in exploration and international development. This class cannot be used to fulfill requirements for a Botany major or minor. Three hours of lecture per week.

BTNY LS/SI1370. Principles of Life Science (3) S
A survey course for elementary education majors. Course content includes cells, cell chemistry, genetics, plant and animal anatomy, plant and animal classification, physiology, immune systems, evolution, and ecology. Unifying concepts of all living things will be emphasized. Recommended for students intending to major in elementary education. This class cannot be used to fulfill requirements for a Botany major or minor. Two hours of lecture and one 3-hour laboratory per week.

BTNY LS1403. Environment Appreciation (3-4) Su, F, S
Development of awareness of the consequences of the impact of modern science through technology upon our environments and how we respond to issues related to threats to our biological life-support system. A definition of a quality environment is developed, with student input, and an analysis of the existing quality of our environment is made in light of this definition which challenges our collective wisdom to identify those things which we do well and to prescribe remedies for shortcomings. This course can be taken for 3 or 4 credits with the fourth credit based on a major research paper or project on an environmental issue. Three hours of lecture per week. Cannot be repeated for upper division credit (BTNY 3403).

BTNY SI2104. Plant Form and Function (4) F, S
A study of the structure, function, and reproduction of seed plants. The role of plants in making life on earth possible is an important theme. This course is designed for science majors and is a prerequisite for selected upper division Botany courses. Two hours of lecture and two 2-hour labs per week. Botany majors are advised to take BTNY 2121 prior to or concurrently with this course.

BTNY SI2114. Evolutionary Survey of Plants (4) F, S
A study of the diversity, ecology, and reproduction of plants in the context of the evolution of life on earth. The role of plants in making life on earth possible is an important theme. This course is designed for science majors and is a prerequisite for selected upper division Botany courses. Two hours of lecture and two 2-hour labs per week. Botany majors are advised to take BTNY 2121 prior to or concurrently with this course.

BTNY 2121. Career Planning for Botanists (1) F, S
A course designed for majors to introduce them to expected student learning outcomes, assessment of these expected outcomes, advise and/or mentoring, keys to success in getting a job or into graduate school, career resources available, and how to start and develop the Botany Student Portfolio. One lecture per week. Botany majors are advised to take this course concurrently with BTNY SI2104 or BTNY SI2114.

BTNY 2203. Home and Garden Plants (3) S
Basic principles of plant science with special reference to care of home and garden plants. Includes a general study of lighting, watering, soils, fertilizer, pruning and shaping, propagation, controlling pests, and planting designs. Two hours of lecture and one 3-hour laboratory per week.

BTNY DV2303. Ethnobotany (3) F, S, Su
A global study of how plants are used by indigenous peoples for food, fiber, fabric, shelter, medicine, weapons, and tools. Plants that are well known to science as well as those with purported uses by villagers, shamans, curanderos and medicine men/women will be studied. Students will learn fundamental botanical principles, how to conduct field work and how to collect plants and prepare them for use. Ethical questions concerning conservation, biodiversity and the continued loss of indigenous plants and cultures will also be discussed. Three lecture/demonstrations per week.

BTNY 2413. Introduction to Natural Resource Management (3) F
Introduces students, especially those interested in forestry and range management, to concepts and ideologies in the utilization and preservation of forests, range, soils, wildlife, water and fisheries, and the human impact on these resources. Three hours of lecture per week.
BTNY 2503. Biology of the Plant Cell (3) F
A study of the structure, function, & biogenesis of the major subcellular structures of plant cells. Three hours of lecture per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered) or BTNY SI2104.

BTNY 2600. Laboratory Safety (1) F, S
An interdisciplinary, team-taught course that will be an overview of the major chemical, biological and physical safety issues related to science laboratories and field work. Class will meet once per week and will be taught in a lecture/demonstration format.

BTNY 2830. Readings in Botany (1) F, S
Cannot be repeated.

BTNY 2920. Short Courses, Workshops, Institutes, and Special Programs (1-4)
Consult the class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

BTNY 2950. Elementary Field Botany (1-2) S
Fundamentals of Botany as observed during field trips. Trips will be preceded by lectures and exercises designed to prepare the student for maximizing the learning experience in the field. The course involves extensive pre- and post-trip exercises and evaluation.

BTNY 3105. Anatomy and Morphology of Vascular Plants (5) F
The development of cell types, tissues, organs, and reproductive structures in higher plants. Variations in the development and morphology of plant organs will be examined. Three hours of lecture and two 2-hour labs per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104.

BTNY 3204. Plant Physiology (4) S (even numbered years)
A study of the physiological processes of plants, including carbon metabolism, mineral assimilation, water relations, and phytohormones. Two hours of lecture and two 3-hour labs per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered) or BTNY SI2104, CHEM PS/SI1050 or CHEM SI1120 or CHEM 2310, and MATH QL1050 or MATH QL1080.

BTNY 3214. Soils (4) F
Fundamentals of soils as related to agriculture, natural resource management, and horticulture. Three hours of lecture and one 3-hour lab per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104, or GEO PS/SI1110, and CHEM PS/SI1050 or CHEM PS/SI1110 or CHEM PS/SI1210.

BTNY 3303. Plant Genetics (3) S (odd numbered years)
The principles of classical (Mendelian) and molecular genetics as applied to plants. Two hours of lecture and one 2-hour lab/discussion per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered) or BTNY SI2104 or GEO PS/SI1110, and CHEM PS/SI1050 or CHEM PS/SI1110 or CHEM PS/SI1210, and MATH QL1050 or MATH QL1080.

BTNY 3403. Environment Appreciation (3) Su, F, S
Development of awareness of the consequences of the impact of modern science through technology upon our environments and how we respond to issues related to threats of our biological life-support system. A definition of a quality environment is developed, with student input, and an analysis of the existing quality of our environment is made in light of this definition which challenges our collective wisdom to identify those things which we do well and to prescribe remedies for shortcomings. Three hours of lecture per week. An in-depth research paper on an environmental issue and an in-class lecture are required. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 or BTNY SI2114. Cannot be repeated for lower division credit (BTNY LS1403).

BTNY 3454. Plant Ecology (4) F
Nature and development of plant communities and their relations to the environmental factors controlling them. Three hours of lecture and one 3-hour lab per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2114, and MATH QL1050 or QL1080.

BTNY 3473. Plant Geography (3) S
A study of a global and regional distributions of major plant groups and communities as affected by past and present climates, biological, ecological and geomorphic factors. Three lectures per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered) or BTNY SI2114.

BTNY 3504. Mycology (4) F (odd numbered years)
Structure, taxonomy, biology, and physiology of the fungi. Two hours of lecture and two 2-hour labs per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114, or MCR LS/SI2054.

BTNY 3514. Algology (4) F (even numbered years)
A study of the biology of algae, their morphology, cytology, development, taxonomy, ecology, economic and experimental uses. Two hours of lecture and two 2-hour labs per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114, or MCR LS/SI2054, or ZOOL 4480.

BTNY 3523. Marine Biology (3) S
A study of marine biology and ecology, relating to the plant and animal populations of the sea to their various habitats, including the pelagic environment, the sea bottom, sea shores, and estuaries. Two hours of lecture and one 2-hour lab per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2114, or ZOOL SI1110, or MCR LS/SI2054, or GEO SI3010.

BTNY 3624. Taxonomy of Vascular Plants (4) S
A study of the basic principles and concepts of vascular plant systematics with emphasis on the identification and classification of flowering plants. Two hours of lecture and two 2-hour labs per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2114.

BTNY 3641A. Intermountain Flora - Woody Plants (1) F (odd numbered years)
A taxonomic study of plants that are of major importance to the management of wildland resources. Students will learn to identify 60-70 taxa of indigenous trees and shrubs. Considers federal laws for the regulation of rare and endangered species and habitat designation. Can be repeated for a maximum of 4 hours. Two hours of lecture/lab per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2114.

BTNY 3641B. Intermountain Flora - Wetland Plants (1) F (even numbered years)
A taxonomic study of plants that are of major importance to the management of wildland resources. Students will learn to identify 60-70 taxa of herbaceous flowering plants. Considers federal laws for the regulation of rare and endangered species and habitat designation. Can be repeated for a maximum of 4 hours. Two hours of lecture/lab per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2114.
BTNY 3641D. Intermountain Flora - Grasses (1) S (odd numbered years)
A taxonomic study of plants that are of major importance to the management of wildland resources. Students will learn to identify 60-70 taxa of indigenous and introduced grasses. Considers federal laws for the regulation of rare and endangered species and habitat designation. Can be repeated for a maximum of 4 hours. Two hours of lecture/lab per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2114.

BTNY 4113. Plant Evolution (3) F
A study of current thinking in evolution emphasizing systems theory as it relates to the origin of botanical form and the creation of biological diversity. Three lectures per week. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), and BTNY SI2104 and BTNY SI2114, and BTNY 3105.

BTNY 4252. Cell Culture (2) F (cross-listed with Microbiology)
Basic methods and applications for culturing plant and animal cells in vitro. Two 2-hour combined lecture and laboratory sessions per week. Prerequisite: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104, or MICR LS/SI2054.

BTNY 4750. Topics in Botany (1-5)
An intensive exploration of selected issues in the discipline. The specific title and credit authorized will appear on the student transcript. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114, and any specified courses selected by the instructor.

BTNY 4800. Individual Research (2) F, S
Course may be repeated. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114 and BTNY 2121, two upper division Botany courses, and approval of instructor.

BTNY 4830. Readings in Botany (2) F, S
Course may be repeated. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114 and BTNY 2121, two upper division Botany courses, and approval of instructor.

BTNY 4840. Thesis Readings (2) F, S
Literature search and evaluation, culminating in the writing of a thesis proposal. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114 and BTNY 2121, two upper division Botany courses, and approval of thesis advisor.

BTNY 4850. Thesis Research (2) F, S
Independent research related to a student's approved thesis proposal. May be repeated as long as satisfactory progress is being made on the thesis topic. Prerequisite: BTNY 4840 and approval of thesis advisor.

BTNY 4920. Short Courses, Workshops, Institutes, and Special Programs (1-4)
Consult the class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript. Prerequisites: BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY SI2114 and BTNY 2121, and any specified courses selected by the instructor.

BTNY 4950. Advanced Field Botany (1-5) S
A concentrated study of the flora of a specific geographical region or an organized extended field trip under supervision. The course involves extensive pre- and post-trip exercises and evaluation. Prerequisite: At least one upper division Botany course and specified courses selected by the instructor for a specific field trip as indicated in the schedule, and with consent of the instructor.

BTNY 4970. Botany Thesis (2) F, S
Written and oral presentation of thesis research results and evaluation. Also includes final evaluation of the student's portfolio and taking of Botany graduation assessment examination. Prerequisites: BTNY 4850 and approval of thesis advisor.

BTNY 4990. Seminar in Botany (1) F, S
Written and oral presentation of thesis research results and evaluation. Also includes final evaluation of the student's portfolio and taking of Botany graduation assessment examination. The course is to be taken the last semester of the senior year. Prerequisite: Completion of or concurrent enrollment in courses needed to meet the minimum requirements for a degree in Botany.

BTNY 5030. Botany for Teachers (2-5)
Science content course for teachers in M.Ed. Science Emphasis Program. To register, select another departmental course and develop a contract detailing additional work required for graduate credit. Course may be repeated. Contract must be approved by instructor, department chair, and Director of the Master of Education Program.
### Chemistry Major / Teaching Major

**BACHELOR DEGREE (B.S.)**

- **Program Prerequisite:** Not required for Chemistry major. Chemistry Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).
- **Minor:** Not required for Options I and II; required for Teaching Major.
- **Grade Requirements:** Average GPA of 2.00 or better in Chemistry courses.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation – 71 of these are required within Option 1, 66 are required within Option 2, and 41 are required within the teaching major. A total of 33 upper division credit hours is required for Option 1 and Option 2 (courses numbered 3000 and above) – 29 of these are required within Option 1 and 24 within Option 2. A total of 40 upper division credit hours is required for the teaching major.

### Advisement

It is recommended that a student consult with a chemistry advisor annually. Call 801-626-6952 for information and to arrange an appointment.

### Admission Requirements

Declare your program of study (see page 18). There are no special admission or application requirements for the Chemistry major. Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).

### General Education

Refer to pages 36-41 for Bachelor of Science requirements. The following core courses required for the Chemistry major will also satisfy general education requirements: ChemPS1210 and PHYS PS/SI2210, or PHYS PS/SI2220.

### Course Requirements for B.S.

#### Chemistry Core Courses Required (24 credit hours)

- CHEM PS/SI1210/SI1220 Principles of Chemistry (10)
- CHEM 2310/2320 Organic Chemistry (10)
- CHEM 3000 Quantitative Analysis (4)

#### OPTION 1 (ACS CERTIFIED)

**Additional Chemistry Courses Required (29 credit hours)**

- CHEM 3020 Computer Applications in Chemistry (1)
- CHEM 3050 Instrumental Analysis (3)
- CHEM 3060 Applied Analysis (1)
- CHEM 3070 Biochemistry I (4)
- CHEM 3400 Molecular Symmetry and Applied Math for Physical Chemistry (3)
- CHEM 3410/3420 Physical Chemistry (8)
- CHEM 4540 Spectrometric & Separation Methods (4)
- CHEM 4600 Inorganic Chemistry (4)
- CHEM 4700 Special Topics in Chemistry (1)

**Support Courses Required (18 credit hours)**

- MATH SI2120-SI2220 Calculus I & II (8)
- PHYS PS/SI2210/SI2220 Physics for Scientists (10)

CHEM 2600 (1) is highly recommended.

Study of Foreign Language and/or computer science is highly recommended for students who plan to pursue graduate studies in chemistry.

### OPTION 2

**Additional Chemistry Courses Required (16 credit hours)**

- CHEM 3020 Computer Applications in Chemistry (1)
- CHEM 3050 Instrumental Analysis (3)
- CHEM 3060 Applied Analysis (1)
- CHEM 3400 Molecular Symmetry and Applied Math for Physical Chemistry (3)
- CHEM 3410 Physical Chemistry I (4)
- CHEM 4200 Physical Chemistry II (4)

**Chemistry Electives (select at least 8 credit hours)**

- CHEM 3070 Biochemistry I (4)
- CHEM 3080 Biochemistry II (3)
- CHEM 3090 Biochemical Techniques (1)
- CHEM 4540 Spectrometric & Separation Methods (4)
- CHEM 4600 Inorganic Chemistry (4)
- CHEM 4700 Special Topics in Chemistry (1)

### Support Courses Required (18 credit hours)

- MATH SI2120-SI2220 Calculus I & II (8)
- PHYS PS/SI2210/SI2220 Physics for Scientists (10)

Chemistry 2600 (1) is highly recommended.

Additional upper division courses should be chosen to support career plans. Students should consult with chemistry advisor.

### TEACHING MAJOR

**Additional Chemistry Courses Required (4 credit hours)**

- CHEM 2600 Lab Safety (1)
- CHEM 4570 Science Teaching Methods (3)

**Electives (select at least 7 credit hours)**

- CHEM 3050 Instrumental Analysis (3)
- CHEM 3060 Applied Analysis (1)
- CHEM 3070 Biochemistry I (4)
- CHEM 3080 Biochemistry II (3)
- CHEM 3410 Physical CHEM I (note prereqs) (4)
- CHEM 4320 Physical Chemistry II (4)

**Support Courses Required (6 credit hours)**

- COMM HU1020 Principles of Public Speaking (3)
- HIST 3350 History & Philosophy of Science (3)

Consult with an advisor early in program to choose elective courses which will fulfill teaching endorsement requirements.

### Suggested Course Sequence

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

**Physical Science Composite Teaching Major**

**BACHELOR DEGREE**

See the Department of Physics section in this catalog for program requirements.

### Chemistry

#### DEPARTMENTAL HONORS

- **Program Prerequisite:** Enroll in the General Honors Program and complete 9 hours of General Honors courses (see the Honors Program on page 43).
- **Grade Requirements:** Maintain an overall GPA of 3.3.
» **Credit Hour Requirements:** Fulfill requirements for either Option 1 or Option 2 of the departmental major, of which at least 12 hours must be completed on an Honors basis. A student may receive Chemistry Honors credit in the following courses:*  

- **CHEM PS/SI1210-1220** Principles of Chemistry (10)  
- **CHEM 2310-2320** Organic Chemistry (10)  
- **CHEM 3000** Quantitative Analysis (4)  
- **CHEM 3050** Instrumental Analysis (3)  
- **CHEM 3060** Applied Analysis (1)  
- **CHEM 3070-3080** Biochemistry (7)  
- **CHEM 3090** Biochemical Techniques (1)  
- **CHEM 3410-3420** Physical Chemistry (8)  
- **CHEM 4540** Spectrometric & Separation Methods (4)  
- **CHEM 4600** Inorganic Chemistry (4)  
- **CHEM 4700** Special Topics in Chemistry (1)  
- **CHEM 4710** Chemical Preparations (1-3)  
- **CHEM 4800** Research & Independent Study (1-5)  
- **CHEM 4990** Senior Seminar (1)  

In addition, complete a Chemistry Honors Senior Project in CHEM 4800 for a minimum of 2 hours (credit received in CHEM 4800 may count as part of the required 12 hours).  

*Permission from the department chair should be sought before registering in a course for Honors credit. A written agreement should be reached with the appropriate professor regarding the work expected for Honors credit. (See the Honors Program on page 43.) This written contract must include regularly scheduled sessions with the professor. In addition, students will be required to complete a project associated with the course. Projects for each chemistry course (other than CHEM 3000) will generally require about 20 hours of productive effort. Projects for CHEM 4800 will generally require about 10 hours of productive effort. The following are suggestions for the type of project but other may be agreed upon by the student and the professor:  
1. The Honors student will do extra reading or a literature search and write a paper.  
2. The Honors student will perform additional laboratory experiments and write a paper.  
3. The Honors student will perform a research project and write a report.  
4. The Honors student will present an oral report to a class or other appropriate group.

### CHEMISTRY

#### MINOR & BIS EMPHASIS

» **Grade Requirements:** A minimum passing grade of "D-" will be accepted in any course used toward the minor. A minimum grade of "C" must be achieved in the BIS emphasis.  

» **Credit Hours Requirements:** A minimum of 18 credit hours is required for the minor and 18 credit hours are required for BIS emphasis.

### Course Requirements for Minor/BIS Emphasis

**Chemistry Courses Required (10 credit hours)**  
- **CHEM PS/SI1210** Principles of Chemistry I (5)  
- **CHEM SI1220** Principles of Chemistry II (5)

**Minor Electives/BIS Electives (select at least 8 credit hours)**  
- **CHEM 2310** Organic Chemistry I (5)  
- **CHEM 2320** Organic Chemistry II (5)  
- **CHEM 2600** Laboratory Safety (1)  
- **CHEM 2990** CHEM Tech Seminar (1)  
- **CHEM 3000** Quantitative Analysis (4)  
- **CHEM 3020** Computer Appl. in Chemistry (1)  
- **CHEM 3050** Instrumental Analysis (3)  
- **CHEM 3060** Applied Analysis (1)  

### CHEMISTRY

#### TEACHING MINOR

» **Grade Requirements:** Even though a minimum passing grade of "D-" will be accepted in any course used toward the minor, an overall GPA of 3.00 is required for admission to the Teacher Education program.  

» **Credit Hour Requirements:** A minimum of 22 credit hours is required. Students who select the Chemistry Teaching Minor must satisfy the Teacher Education admission and certification requirements (see Teacher Education Department).

### Course Requirements for Teaching Minor

**Courses Required (19 credit hours)**  
- **CHEM PS/SI1210** Principles of Chemistry I (5)  
- **CHEM SI1220** Principles of Chemistry II (5)  
- **CHEM 2310** Organic Chemistry (5)  
- **CHEM 3000** Quantitative Analysis (4)  

**Support Course Required (3 credit hours)**  
- **HIST 3350** History & Philosophy of Science (3)  

If a student is not obtaining a Teaching Major in Sciences, the following course is also required:  
- **CHEM 4570** Secondary Science Teaching Methods (3)

### CHEMICAL TECHNICIAN

#### ASSOCIATE OF APPLIED SCIENCE (A.A.S.)

» **Grade Requirements:** Minimum overall GPA of 2.00 or "C".  

» **Credit Hour Requirements:** A total of 63 credit hours is required for graduation – 35 of these are required within the program.

### Advisement

It is recommended that a student consult with a chemistry advisor annually. Call 801-626-6952 for information and to arrange an appointment.

### General Education

Refer to pages 36-41 for Associate of Applied Science requirements. The following course required for the Chemical Technician program will also satisfy part of the general education requirement for physical sciences: CHEM PS/SI1210.

### Course Requirements for A.A.S. Degree

**Courses Required (21 credit hours)**  
- **CHEM PS/SI1210** Principles of Chemistry I (5)  
- **CHEM SI1220** Principles of Chemistry II (5)  
- **CHEM 2600** Laboratory Safety (1)  
- **CHEM 2990** CHEM Tech Seminar (1)  
- **CHEM 3000** Quantitative Analysis (4)  
- **CHEM 3020** Computer Applications in Chemistry (1)  
- **CHEM 3050** Instrumental Analysis (3)  
- **CHEM 3060** Applied Analysis (1)  

**Support Course Required (4 credit hours)**  
- **minimum MATH 1010** Intermediate Algebra (4) or equivalent

**Elective Courses (Select at least 10 credit hours; at least 4 credit hours must be 2000-level or higher)**  
- **CHEM 2310** Organic Chemistry I (5)  
- **CHEM 2320** Organic Chemistry II (5)  
- **CHEM 2890** Cooperative Work Experience (1-6)  
- **CHEM 3070** Biochemistry I (4)  
- **CHEM 3080** Biochemistry II (3)
CHEM 4540 SPECTROMETRIC & SEPARATION METHODS (4)
CHEM 4890 COOPERATIVE WORK EXPERIENCE (1-6)
MICR LS/SI2054 PRINCIPLES OF MICROBIOLOGY (4)
MICR 3053 MICROBIOLOGICAL PROCEDURES (3)
MICR 3254 IMMUNOLOGY (4)
MICR 4154 MICROBIAL GENETICS (4)
MICR 4252 CELL CULTURE (2)
BTNY LS1403 ENVIRONMENT APPRECIATION (3-4)
BTNY SI2104 PLANT FORM AND FUNCTION (4)
BTNY 2503 BIOLOGY OF THE PLANT CELL (3)
GEO PS/SI1110 DYNAMIC EARTH: PHYSICAL GEOLOGY (3)
GEO SI1115 PHYSICAL GEOLOGY LABORATORY (1)
GEO 2050 EARTH MATERIALS (4)
MICR LS/SI2010 COLLEGE PHYSICS I (5)
or PHYS PS/SI2210 PHYSICS FOR SCIENTISTS AND ENGINEERS I (5)
or PHYS PS/SI2220 PHYSICS FOR SCIENTISTS & ENGINEERS II (5)
ZOOI 2200 HUMAN PHYSIOLOGY (4)
ZOOI 3200 CELL BIOLOGY (4)
ZOOI 3300 GENETICS (4)
ZOOI 4300 MOLECULAR GENETICS (4)
CJ 1530 INTRODUCTION TO FORENSIC SCIENCE (3)
CJ 4110 FORENSIC SCIENCE I (4)
CJ 4120 FORENSIC SCIENCE II (4)

Other courses may be used to fill these 10 hours of electives if approved by the Chemistry Department Chair.

**Suggested Course Sequence**

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

**CHEMICAL TECHNICIAN**

**INSTITUTIONAL CERTIFICATE (CERTIFICATE OF PROFICIENCY)**

- Grade Requirements: Minimum overall GPA of 2.00 or "C".
- Credit Hour Requirements: A total of 41 credit hours is required.

**Course Requirements for Institutional Certificate**

**Courses Required (21 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM PS/SI1210-1220</td>
<td>Principles of Chemistry (10)</td>
</tr>
<tr>
<td>CHEM 2600</td>
<td>Laboratory Safety (1)</td>
</tr>
<tr>
<td>CHEM 2990</td>
<td>Chemical Technician Seminar (1)</td>
</tr>
<tr>
<td>CHEM 3000</td>
<td>Quantitative Analysis (4)</td>
</tr>
<tr>
<td>CHEM 3020</td>
<td>Computer Applications in Chemistry (1)</td>
</tr>
<tr>
<td>CHEM 3050</td>
<td>Instrumental Analysis (3)</td>
</tr>
<tr>
<td>CHEM 3060</td>
<td>Applied Analysis (1)</td>
</tr>
</tbody>
</table>

**Support Courses Required (10 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
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</thead>
<tbody>
<tr>
<td>ENGL EN1010</td>
<td>Intro to Writing (3)</td>
</tr>
<tr>
<td></td>
<td>One additional course in oral or written communications (3)</td>
</tr>
<tr>
<td></td>
<td>Minimum MATH 1010 Intermediate Algebra (4) or equivalent</td>
</tr>
</tbody>
</table>

**Elective Courses (Select 10 credit hours; at least 4 credit hours must be 2000-level or higher)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 2310</td>
<td>Organic Chemistry I (5)</td>
</tr>
<tr>
<td>CHEM 2320</td>
<td>Organic Chemistry II (5)</td>
</tr>
<tr>
<td>CHEM 2890</td>
<td>Cooperative Work Experience (1-6)</td>
</tr>
<tr>
<td>CHEM 3070</td>
<td>Biochemistry I (4)</td>
</tr>
<tr>
<td>CHEM 3080</td>
<td>Biochemistry II (3)</td>
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<tr>
<td>CHEM 3090</td>
<td>Biomedical Techniques (1)</td>
</tr>
<tr>
<td>CHEM 4540</td>
<td>Spectrometric &amp; Separation Methods (4)</td>
</tr>
<tr>
<td>CHEM 4890</td>
<td>Cooperative Work Experience (1-6)</td>
</tr>
<tr>
<td>MICR LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>MICR 3053</td>
<td>Microbiological Procedures (3)</td>
</tr>
<tr>
<td>MICR 3254</td>
<td>Immunology (4)</td>
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<tr>
<td>MICR 4154</td>
<td>Microbial Genetics (4)</td>
</tr>
<tr>
<td>MICR 4252</td>
<td>Cell Culture (2)</td>
</tr>
<tr>
<td>BTNY LS1403</td>
<td>Environment Appreciation (3-4)</td>
</tr>
<tr>
<td>BTNY SI2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>BTNY 2503</td>
<td>Biology of the Plant Cell (3)</td>
</tr>
<tr>
<td>GEO PS/SI1110</td>
<td>Dynamic Earth: Physical Geology (3)</td>
</tr>
<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory (1)</td>
</tr>
<tr>
<td>GEO 2050</td>
<td>Earth Materials (4)</td>
</tr>
<tr>
<td>PHYS PS/SI2010</td>
<td>College Physics I (5)</td>
</tr>
</tbody>
</table>
or PHYS PS/SI2210  | PHYSICS FOR SCIENTISTS AND ENGINEERS I (5)
or PHYS PS/SI2220  | PHYSICS FOR SCIENTISTS & ENGINEERS II (5)
| ZOOI 2200           | Human Physiology (4)                             |
| ZOOI 3200           | Cell Biology (4)                                 |
| ZOOI 3300           | Genetics (4)                                     |
| ZOOI 4300           | Molecular Genetics (4)                           |
| CJ 1350             | Introduction to Forensic Science (3)             |
| CJ 4110             | Forensic Science I (4)                           |
| CJ 4120             | Forensic Science II (4)                          |

**CHEMISTRY COURSES - CHEM**

**CHEM PS1010. Introductory Chemistry (3) Su, F, S**

- A lecture-demonstration course for students with no previous chemistry background who are not majoring in areas requiring further chemistry. Three hours of lecture-demonstration a week.

**CHEM PS/SI1050. Introduction to General, Organic & Biochemistry (5) Su,F,S**

- An introduction to general, organic and biochemistry designed primarily for students of nursing and other majors that require no more than one semester of chemistry. Four hours of lecture and one 3-hour lab a week.

**CHEM PS/SI1110. Elementary Chemistry (5) F,S**

- Fundamentals of inorganic chemistry and introduction to organic chemistry. The first course in a two-semester sequence designed primarily for students of nursing, engineering technology and some fields of science and health professions who will take no more than one year of chemistry. Four hours of lecture and one 3-hour lab a week.

**CHEM 1115. Elementary Chemistry Lab (1)**

- CHEM 1115 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 1115 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM lecture without the lab should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 1110 lecture.

**CHEM SI1120. Elementary Organic Bio-Chemistry (5) S**

- Elementary study of the compounds of carbon and chemical compounds and reactions of biological systems. Four hours of lecture and one 3-hour lab a week. Prerequisite: CHEM PS/SI1110 or equivalent.

**CHEM 1125. Elementary Organic Bio-Chemistry Lab (1)**

- CHEM 1125 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 1125 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM lecture without the lab should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 1120 lecture.
CHEM 1200. Preparation for College Chemistry (3) Su, F, S
A course designed to provide the minimal prerequisite skills needed for entry into CHEM PS/SI1210. Three hours of lecture per week.

CHEM PS/SI1210. Principles of Chemistry I (5) Su, F, S
The first course in a series designed primarily for science majors and others who will take more than one year of chemistry such as premedical students, clinical laboratory scientists and some engineering students. The fundamental principles of chemistry with laboratory emphasis upon qualitative and quantitative methods of analysis. Four hours of lecture and one 3-hour lab a week. Prerequisite: MATH 1010 or equivalent and a chemistry course equivalent to high school chemistry or CHEM 1200.

CHEM 1215. Principles of Chemistry I Lab (1)
CHEM 1215 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 1215 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 1210 lecture without the lab or High School AP students should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 1210.

CHEM SI1220. Principles of Chemistry II (5) Su, F, S
Second semester of principles of chemistry. Four hours of lecture and one 3-hour lab a week. Prerequisite: CHEM 1210.

CHEM 1225. Principles of Chemistry II Lab (1)
CHEM 1225 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 1225 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 1220 lecture without the lab, or High School AP students should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 1220 lecture.

CHEM PS/SI1360. Principles of Physical Science (3) F
A lecture/laboratory course designed to provide an introduction to the scientific method and its application to the study of selected topics in physics and chemistry. Two hours of lecture and one 3-hour lab per week. Recommended for Elementary Education majors.

CHEM 2310. Organic Chemistry I (5) Su, F, S
Fundamental principles of organic chemistry, including structure and reactivity of carbon based molecules. Four hours of lecture and one 3-hour lab a week. Prerequisite: CHEM SI1220.

CHEM 2315. Organic Chemistry I Lab (1)
CHEM 2315 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 2315 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 2310 lecture without the lab should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 2310 lecture.

CHEM 2320. Organic Chemistry II (5) Su, F, S
Second semester of organic chemistry. A continuation of structure and reactivity analysis, along with structure elucidation techniques. Four hours of lecture and one 3-hour lab a week. Prerequisite: CHEM 2310.

CHEM 2325. Organic Chemistry II Lab (1)
CHEM 2325 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 2325 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 2320 lecture without the lab should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 2320 lecture.

CHEM 2600. Laboratory Safety (1)
An interdisciplinary, team-taught course that will be an overview of the major chemical, biological and physical safety issues related to science laboratories and field work. Class will meet once per week and will be taught in a lecture/demonstration format.

CHEM 2890. Cooperative Work Experience (1-6)
Open to all students in the Chemistry Department who meet the minimum Cooperative Work Experience requirements of the department. Provides academic credit for on-the-job experience. Grade and amount of credit will be determined by the department.

CHEM 2920. Short Courses, Workshops, Institutes and Special Programs (1-4)
Consult the class schedule for the current offering under this number. The specific title with the credit authorized will appear on the student transcript.

CHEM 2990. Chemical Technician Seminar (1) S
A course designed to provide the skills necessary to enter the job market as a Chemical Technician. Prerequisite: CHEM SI1220. One hour of lecture/discussion a week.

CHEM 3000. Quantitative Analysis (4) F, S
Theory and methods of gravimetric and volumetric analysis and simple instrumentation. Includes statistical evaluation of results. Three hours of lecture and one 3-hour lab per week. Prerequisite: CHEM SI1220. Prerequisite or co-requisite: CHEM 3020.

CHEM 3005. Quantitative Analysis Lab (1)
CHEM 3005 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 3005 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 3000 lecture without the lab should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently be enrolled in CHEM 3000 lecture.

CHEM 3020. Computer Applications in Chemistry (1) F, S
A course designed to provide students computer skills for applications including computation and electronic data bases searches. It is required that this course be taken before or with CHEM 3000. One hour of lecture/discussion a week. Prerequisite: CHEM SI1210.

CHEM 3050. Instrumental Analysis (3) F, S
Modern instrumental methods of chemical analysis for majors and non-majors. Two hours of lecture and one 3-hour lab per week. Prerequisite: CHEM SI1220 and CHEM 3020. Prerequisite or co-requisite: CHEM 3000.

CHEM 3060. Applied Analysis (1) F, S
Applied Analysis using modern methods of analysis with an emphasis on speed and accuracy. One 3-hour lab per week. Prerequisite: CHEM 3000. Prerequisite or co-requisite: CHEM 3050.

CHEM 3070. Biochemistry I (4) F, S
Structure and function of biomolecules including proteins, nucleic acids, fats and carbohydrates. A focus on proteins as energy transforming and catalytic devices; their role in metabolism, defense and other biochemical processes. Three lectures and one three hour lab a week. Prerequisite: CHEM 2310.

CHEM 3080. Biochemistry II (3) S
A detailed study of the molecular basis of life: nucleic acids, biosynthetic pathways, molecular aspects of disease and pharmacology. Three lectures a week. Prerequisite: CHEM 2320, CHEM 3070.
CHEM 3090. Biochemical Techniques (1) S
Advanced techniques including instrumentation for biochemistry. One 3-hour lab per week. Prerequisites CHEM 2320 and Chem3070. To be taken concurrently with CHEM 3080.

CHEM 3400. Molecular Symmetry and Applied Math for Physical Chemistry (3)
An introduction to molecular symmetry, experimental error analysis, and physical chemistry applications of algebra, linear algebra, and differential equations. Prerequisite: MATH SI2200.

CHEM 3410. Physical Chemistry I (4) F
Three hours of lecture and one 3-hour lab a week. Prerequisites: CHEM 3000, CHEM 3400, and PHYS SI2220.

CHEM 3420. Physical Chemistry II (4) S
Three hours of lecture and one 3-hour lab a week. Prerequisite: CHEM 3410.

CHEM 4540. Spectrometric and Separation Methods (4) S
Theory and practice of spectrometric and separation methods in the study of chemical systems. Three hours of lecture and one 3-hour lab per week. Prerequisite: CHEM 3420 or permission of instructor.

CHEM 4550. Geochemistry (3)
The chemistry of the earth and geochemical processes operating in the lithosphere, hydrosphere, and atmosphere with a synthesis of these ideas to account for the chemical evolution of the earth. Applications to mineral stability and chemical reactions, geochemical cycles, and isotope geochemistry. Three hours of lecture a week. Prerequisites: CHEM SI1220 and GEO 2050 or consent of instructor.

CHEM 4570. Secondary School Science Teaching Methods (3) S
Acquaintance with the various methods and curriculum of secondary school science. Two hours of lectures and one 3-hour lab a week. It is recommended that this course be completed before student teaching. Prerequisite: CHEM 3000 or approval of instructor, and admission to the Teacher Education Program.

CHEM 4600. Inorganic Chemistry (4) S
A study of the elements and their compounds based on the periodic table, current theories and laboratory work. Prerequisites: CHEM 3420 or permission of instructor. Three hours of lecture and one 3-hour lab a week.

CHEM 4700. Special Topics in Chemistry (1-3) F, S
This course may be repeated for credit. Prerequisite: CHEM 3420 or permission of instructor.

CHEM 4710. Chemical Preparations (1-3)
Synthesis and determination of the properties of selected chemical compounds. Three to nine hours of lab a week. Prerequisite: Permission of the instructor.

CHEM 4800. Research and Independent Study in Chemistry (1-3) Su, F, S
Open to qualified students for one or more semesters.

CHEM 4890. Cooperative Work Experience (1-6)
A continuation of CHEM 2890. Open to all students.

CHEM 4920. Short Courses, Workshops, Institutes and Special Programs (1-4)
Consult the class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

CHEM 4990. Senior Seminar (1)
Limited to senior chemistry majors.

CHEM 5030. Chemistry for Teachers (3-5)
Science content course for teachers in the M. Ed Science Emphasis Program. To register, select another departmental course and develop a contract detailing additional work required for graduate credit. Course may be repeated. Contract must be approved by instructor, department chair, and Director of the Master of Education Program.

DEPARTMENT

CHEMISTRY

Chair: Dr. W. Adolph Yonkee
Location: Science Lab Building, Room SL 202M
Telephone Contact: Susan Swider, 801-626-7139

Professors: Jeffrey Eaton, James R. Wilson, W. Adolph Yonkee;
Associate Professors: Richard Ford, Marek Matyjasik; Assistant
Professor: Michael Hernandez

CHEMISTRY

The Geosciences are concerned with the Earth, its origin, composition, and evolution through time as well as studying the processes that affect the Earth and the life forms that have lived on it in the past. Many geoscience applications use computer technology (GIS and Remote Sensing) for mapping the Earth and modeling the processes that affect the planet. The department offers bachelor degrees in Geology, Applied Environmental Geosciences, and Earth Science Teaching and an option in the Physical Science Composite Teaching Major. A Geology Minor, Earth Science Teaching Minor, and a Geospatial Analysis Minor are available. An Institutional Certificate in Geomatics (Applied Computer Mapping) is also available.

GEOL OGY MAJOR

BACHELOR DEGREE (B.S. OR B.A.)

Advisor: Dr. Jeffrey Eaton, 801-626-6225

- Program Prerequisite: None
- Minor: Required for Option A; Not required for Option B
- Grade Requirements: A grade of "C-" or better in courses required for this major in addition to an overall GPA for all courses of 2.00 or higher.
- Credit Hour Requirements: A total of 120 credit hours is required for graduation – 69 to 71 of these are required within the major for Option A, and 75 to 77 of these are required in the major for Option B. A total of 40 upper division credit hours is required (courses numbered 3000 and above) – 29 to 32 of these are required within the major for Option A, and 35 to 38 are required within the major for Option B.

* Students may benefit from having a minor in such fields as chemistry, physics, mathematics, computer science, geospatial analysis, or a life science, and should consult with an advisor prior to choosing an option.

Advisement
All Geology students are required to meet with a faculty advisor (see above) at least annually for course and program advisement. Call 801-626-7139 for more information or to schedule an appointment.

Admission Requirements
Declare your program of study (see page 18). There are no special admission or application requirements for this program. However, students should meet with an advisor to plan and declare their program of study.

General Education
Refer to pages 36-41 for either Bachelor of Science or Bachelor of Arts requirements. MATH QL1050 or MATH QL1080 is recommended for the Quantitative Literacy requirement. The following courses...
required for the Geology major will also satisfy general education requirements: CHEM PS/SI1210, GEO PS/SI1110, PHYS PS/SI2010, and PHYS PS/SI2210.

**Students planning to attend graduate school should also take MATH QL1050 or MATH QL1080, and PHYS PS/SI2010, and PHYS PS/SI2210.**

### Course Requirements for B.S. or B.A. Degree

#### Geosciences Courses Required (35 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS/SI1110</td>
<td>Dynamic Earth: Physical Geology (3)</td>
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<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory (1)</td>
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</tr>
<tr>
<td>GEO 1220</td>
<td>Historical Geology (4)</td>
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<td>GEO 2050</td>
<td>Earth Materials (4)</td>
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<td>GEO 3060</td>
<td>Structural Geology (4)</td>
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<tr>
<td>GEO 3150</td>
<td>Geomorphology (4)</td>
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<tr>
<td>GEO 3550</td>
<td>Sedimentology &amp; Stratigraphy (4)</td>
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</tr>
<tr>
<td>GEO 4060</td>
<td>Geoscience Field Methods (3)</td>
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<tr>
<td>GEO 4300</td>
<td>Igneous &amp; Metamorphic Petrology (4)</td>
<td></td>
</tr>
<tr>
<td>GEO 4510</td>
<td>Geology Field Camp (4)</td>
<td></td>
</tr>
</tbody>
</table>

#### Electives Courses

*(9 hours for Option A; 15 hours for Option B)*

**Option A** - Select 9 hours from the following courses and complete a minor.

**Option B** - Select 15 hours from the following courses.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS1060</td>
<td>Environmental Geosciences (3)</td>
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</tr>
<tr>
<td>GEO 1065</td>
<td>Environmental Geosciences Lab (1)</td>
<td></td>
</tr>
<tr>
<td>GEO 3010</td>
<td>Oceanography and Earth Systems (3)</td>
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<tr>
<td>GEO 3080</td>
<td>Water Resources (3)</td>
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<td>GEO 3180</td>
<td>Paleontology (4)</td>
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<td>GEO 3210</td>
<td>Quaternary Environmental Change (3)</td>
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<td>GEO 3250</td>
<td>Geology of Utah (3)</td>
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<td>GEO 3400</td>
<td>Remote Sensing I (4)</td>
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<td>GEO 3880</td>
<td>Groundwater (4)</td>
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<td>Ancient Environments &amp; Paleocology (3)</td>
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<td>GEO 4100</td>
<td>Engineering Geology (3)</td>
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<td>Environmental Assessment (3)</td>
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<td>GEO 4210</td>
<td>Intro to Computer Mapping and GIS (4)</td>
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<td>Technical and Application Issues in GIS (4)</td>
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<td>GEO 4400</td>
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<td>Geochemistry (3)</td>
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<td>GEO 4630</td>
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<td>GEO 4750</td>
<td>Special Topics in Geosciences (1-4)</td>
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<td>GEO 4800</td>
<td>Independent Study (1-3)</td>
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<tr>
<td>GEO 4970</td>
<td>Senior Thesis (2)</td>
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* or up to two of the following courses from related areas

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<thead>
<tr>
<th>Course</th>
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<tr>
<td>BTNY 3214</td>
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<td>CHEM 2310</td>
<td>Organic Chemistry I (5)</td>
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<td>CHEM 3000</td>
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<td>GEOG 4410</td>
<td>Land Use Planning Techniques (3)</td>
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<td>GEOG 4420</td>
<td>Advanced Planning Techniques (3)</td>
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<tr>
<td>MICR 3484</td>
<td>Environmental Microbiology (4)</td>
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</tbody>
</table>

* No more than 4 combined credit hours from GEO 4800 and 4970 may be counted toward the major requirements.

#### Support Courses Required (25-27 credit hours)

- CHEM PS/SI1210/SI1220 Principles of Chemistry (10) 
- PHYS PS/SI2010/SI2020 General Physics (10) 
- or PHYS PS/SI2210/SI2220 Physics for Scientists & Engineers (10) *

* or

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<thead>
<tr>
<th>Course</th>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>MATH QL1050</td>
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<tr>
<td>MATH 1060</td>
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or

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<th>Course</th>
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<tbody>
<tr>
<td>MATH QL1080</td>
<td>Precalculus (5)</td>
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</table>

* Students planning to attend graduate school should take PHYS PS/SI2210/SI2220, Physics for Scientists & Engineers, instead of the General Physics series (PHYS PS/SI2010/SI2020).

**Students planning to attend graduate school should also take MATH SI1210/SI1220, Calculus I and II (8).**

The physical chemistry sequence, CHEM 3410-3420 (8), is recommended for students planning advanced study in geochemistry, mineralogy, or mineral deposits. Advanced course work in zoology or botany is recommended for students planning advanced work in paleontology, stratigraphy, or related fields.

### Suggested Course Sequence

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

### Applied Environmental Geoscience

#### Bachelor Degree (B.S.)

Advisors: Dr. Marek Matyjasik, 801-626-7726, Dr. James R. Wilson, 801-626-6208

- **Program Prerequisite:** None.
- **Minor:** Not required.
- **Grade Requirements:** A grade of "C-" or better in each courses required by this major in addition to a minimum cumulative GPA for all courses of 2.0.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation – 84 to 87 of these are required within the major. A total of 40 upper division credit hours is required (courses numbered 3000 and above) – 31 to 34 of these are required within the major.

### Admission Requirements

All Geoscience students are required to meet with a faculty advisor at least annually for course and program advise. Call 801-626-7139 for more information or to schedule an appointment.

### General Education

Refer to pages 36-41 for Bachelor of Science or Bachelor of Arts requirements. MATH QL1050 or MATH QL1080 is recommended for the Quantitative Literacy requirement. The following courses required for the Applied Environmental Geoscience major will also satisfy general education requirements: CHEM PS/SI1210, GEO PS1060, GEO PS/SI1110, PHYS PS/SI2010, and PHYS PS/SI2210.

### Course Requirements for B.S. Degree

#### Courses Required (38 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>GEO PS1060</td>
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<td>GEO PS/SI1110</td>
<td>Dynamic Earth: Physical Geology (3)</td>
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<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory (1)</td>
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<tr>
<td>GEO 1220</td>
<td>Historical Geology (4)</td>
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<tr>
<td>GEO 2050</td>
<td>Earth Materials (4)</td>
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<tr>
<td>GEO 3080</td>
<td>Water Resources (3)</td>
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<td>GEO 3150</td>
<td>Geomorphology (4)</td>
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<tr>
<td>GEO 3550</td>
<td>Sedimentology &amp; Stratigraphy (4)</td>
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<tr>
<td>GEO 4060</td>
<td>Geoscience Field Methods (3)</td>
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<tr>
<td>GEO 4300</td>
<td>Igneous &amp; Metamorphic Petrology (4)</td>
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<td>GEO 4510</td>
<td>Geology Field Camp (4)</td>
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- Select two of the following courses

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<tr>
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<td>Remote Sensing I (4)</td>
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<tr>
<td>GEO 4210</td>
<td>Intro to Computer Mapping &amp; GIS (4)</td>
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<tr>
<td>GEO 4220</td>
<td>Technical &amp; Application Issues in GIS (4)</td>
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** Select two of the following courses

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<tbody>
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</table>

** Students planning to attend graduate school should also take MATH SI1210/SI1220, Calculus I and II (8).**
Suggested Course Sequence

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.
### Geology Courses Required (12 credit hours)
- GEO 4750: Special Topics in the Geosciences (2-4)
- GEO 4800: Independent Research (1-3)
- GEO 4950: Advanced Geoscience Fieldtrips (1-3)

### Required Support Courses (25-27 credit hours)
- CHEM PS/SI1210/SI1220: Principles of Chemistry (10)
- PHYS PS/SI2010/SI2020: General Physics (10)
  - or PHYS PS/SI2210/SI2220: Physics for Scientists & Engineers (10)

### Credit Hour Requirements:
- Minimum of 20 credit hours in Geosciences courses.

### Grade Requirements:
- A grade of "C-" or better in courses used toward the minor.

### Advisor: Dr. Michael Hernandez 626-6186

#### Geosciences Electives (minimum 7 credit hours)
Select at least two classes from the following:
- GEO PS1060: Environmental Geosciences (3)
- GEO 1065: Environmental Geosciences Lab (1)
- GEO 3060: Structural Geology (4)
- GEO 3080: Water Resources (3)
- GEO 3150: Geomorphology (4)
- GEO 3180: Paleontology (4)
- GEO 3210: Quaternary Environmental Change (3)
- GEO 3350: Sedimentology & Stratigraphy (4)
- GEO 4010: Ancient Environments & Paleocology (3)

#### Earth Science Teaching

**Advisor: Dr. Richard Ford 626-6942**

- **Grade Requirements:** A grade of "C-" or better in courses used toward the minor.
- **Credit Hour Requirements:** Minimum of 20 credit hours in Geosciences courses.

Students who select the Earth Science Teaching Minor must satisfy the Teacher Education admission and certification requirements (see Teacher Education Department).

#### Course Requirements for Minor

<table>
<thead>
<tr>
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<tr>
<td>GEO PS1060: Environmental Geosciences</td>
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<tr>
<td>GEO 1065: Environmental Geosciences Lab</td>
<td>(1)</td>
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<tr>
<td>GEO 3060: Structural Geology</td>
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<tr>
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<tr>
<td>GEO 4010: Ancient Environments &amp; Paleocology</td>
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### Geology Courses Required (12 credit hours)
- GEO SI1110: Dynamic Earth: Physical Geology (3)
- GEO SI115: Physical Geology Laboratory (1)
- GEO 1220: Historical Geology (4)
- GEO 2050: Earth Materials (4)

### Course Requirements for Minor

#### Geology Courses Required (12 credit hours)
- GEO PS/SI1110: Dynamic Earth: Physical Geology (3)
- GEO SI115: Physical Geology Laboratory (1)
- GEO 1220: Historical Geology (4)
- GEO 2050: Earth Materials (4)

### Recommended Support Courses
any additional upper division Geoscience course (numbered 3000 and above)
- BTNY 3214: Soils (4)
- BTNY 3303: Plant Genetics (3) *
- BTNY 3473: Plant Geography (3)
- GEOG 3060: World Environmental Issues (3)
- HIST 3350: History & Philosophy of Science (3)
- ZOOI LS1010: Animal Biology (3) *

* Completion of ZOOI LS1010 and BTNY 3303 will allow students to receive the Integrated Science teaching endorsement (7th grade) in addition to the Earth Science endorsement (8th & 9th grade).
### GEO/PS/SI1110 Dynamic Earth: Physical Geology (3)
- **Description:** An introduction to the nature of the fossil record and a review of the major events in the history of life, including the rise of dinosaurs and mass extinctions. Writing intensive course requiring a term paper using library resources. Three lectures per week.

### GEO/PS/SI1060 Environmental Geosciences (3)
- **Description:** The scientific interaction of humans and earth systems including topics of natural hazards; soil, water, energy and mineral resources; and issues of global change. Three lectures per week.

### GEO PS/SI1030. Earthquakes and Volcanoes (3) Su, F, S
- **Description:** The causes, distribution, and effects of earthquakes and volcanoes within the framework of global plate tectonics. Development of problem solving and analytical thinking skills are emphasized through homework assignments related to geologic processes. Three lectures per week.

### GEO PS/SI1110. Dynamic Earth: Physical Geology (3) Su, F, S
- **Description:** Fundamental principles of geology emphasizing physical aspects of the Earth including earth materials, plate tectonics, and the effects of water, wind and ice on the Earth’s surface. Useful for all students, and recommended for the first geology course for students with majors/minors in geosciences, science teaching, archaeology, and pre-engineering. Three lectures per week. Optional field trip to observe local geologic features.

### GEO SI1115. Physical Geology Laboratory (1) F, S
- **Description:** Laboratory and field exercises involving analysis of geologic data related to environmental issues or problems. Application of the scientific method and development of basic computational and map interpretation skills will be stressed. One three-hour lab per week. Prerequisite: GEO PS/SI1060, or concurrent enrollment.

### GEO PS/SI1110. Dynamic Earth: Physical Geology (3) Su, F, S
- **Description:** The history of the Earth and the methods used to interpret this history. Short field trips required. Three lectures per week. Prerequisite: GEO PS/SI1110 or GEOG PS/SI1000, or concurrent enrollment in either class.

### GEO PS/SI1350. Principles of Earth Science (3) F, S
- **Description:** Overview of Earth’s systems, including weather, climate, seasons, rocks and minerals, processes that change Earth’s surface, earthquakes, volcanoes, and plate tectonics. Data collection and analysis are included. Two lectures and one three-hour lab per week. Designed for Elementary Education majors.

### GEO 2890. Cooperative Work Experience (1-6)
- **Description:** Open to all students in Geosciences who meet the minimum Cooperative Work Experience requirements of the department. Provides

### Additional Information
- **Course Requirements for Institutional Certificate**
  - **Geosciences Courses Required (16 credit hours):**
    - GEO 3400 Remote Sensing I (4)
    - GEO 4210 Intro to Computer Mapping & GIS (4)
    - GEO 4220 Technical & Application Issues in GIS (4)
  - **Computer Science Courses Required (6 credit hours):**
    - Select at least 6 hours from the following:
      - CS SI1023 Selected Programming Language (4)
      - CS SI1410 Object-Oriented Programming (4)
      - IST SI1115 Software Development I (3)
      - IST 3210 Database Design and Implementation (4)
      - IST 3720 Software Development II (3)
    - Other applicable computer programming or database courses may be considered at the discretion of the Certificate Program Director.

- **Geosciences Courses - GEO**
  - **Overview:**
    - Select at least 6 hours from the following:
      - CS SI1023 Selected Programming Language (4)
      - CS SI1410 Object-Oriented Programming (4)
      - IST SI1115 Software Development I (3)
      - IST 3210 Database Design and Implementation (4)
      - IST 3720 Software Development II (3)
  - **Other applicable computer programming or database courses may be considered at the discretion of the Certificate Program Director.**

- **Program Requirements:**
  - **Advisor:** Dr. Michael Hernandez 626-8186
  - **Credit Hour Requirements:**
    - Minimum of 16 credit hours from the Department of Geosciences, and 6 credit hours from the Department of Computer Science and/or Department of Information Systems & Technologies.
  - **Grade Requirements:** A grade of ‘C’ or better in all courses used toward the certificate (a grade of ‘C-’ is not acceptable). An overall GPA of 2.75 is required for the six core courses in the Certificate Program.

- **Additional Information:**
  - Reference to the Geospatial Analysis program and Remote Sensing and Geographic Information Systems Laboratory (RSGISL) may be found at: http://departments.weber.edu/geosciences.
GEO 2920. Short Courses, Workshops, Institutes and Special Programs (1-4) (offered as needed)
Consult the semester class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

GEO 2950. Geoscience Fieldtrips (1-3) F, S
Application of basic Geoscience field methods during fieldtrips. Readings, written and oral reports, and/or examinations may be required. Prerequisite: consent of instructor.

GEO SI3010. Oceanography and Earth Systems (3) S (alternate years)
Study of the world’s oceans as a framework for examining the major issues in Earth system science. Topics include plate tectonics and the origin of ocean basins, atmosphere-ocean linkages and feedbacks, El Niño events, the ocean’s role in biogeochemical cycles, structure and organization of marine ecosystems, and the scientific basis for understanding human impacts on marine systems. Three lectures per week. Prerequisite: GEO PS1110 or GEO PS1130 or GEOG PS1010.

GEO 3060. Structural Geology (4) F (alternate years)
Origin and characteristics of structural features in deformed rock. Topics include basic principles of stress, strain, and rock deformation; analysis of faults and folds; and relations to major tectonic features of Earth. Field trips required. Three lectures and one three-hour lab per week. Prerequisites: GEO 2050 and either MATH QL1050 or MATH QL1080; or consent of instructor.

GEO 3080. Water Resources (3) F
A detailed examination of the water cycle, including, precipitation, surface water, groundwater, glaciers, water conservation, water management, and water pollution with special emphasis on the water resources of Utah and neighboring areas. Three lectures per week. Prerequisite: GEO SI1115.

GEO 3150. Geomorphology (4) S
A study of landforms, surficial deposits, and geomorphic processes operating in fluvial, coastal, eolian, and glacial environments. Laboratory exercises employ maps, aerial photographs, and field analysis to understand the interactive nature of geomorphic processes and landform development. Three lectures and one three-hour lab per week. Prerequisite: GEO 2050 and MATH QL1050 or QL1080.

GEO 3180. Paleontology (4) F (alternate years)
Characteristics of important fossil groups and their geologic distribution and paleoecology. Emphasis on the invertebrate record with some treatment of vertebrates and plants. Three lectures and one three-hour lab per week. Prerequisite: GEO 1220 or ZOOL SI1110 or consent of instructor.

GEO 3210. Quaternary Environmental Change (3) S (alternate years)
Overview of the geologic and paleoclimatic history of the Earth during the last 2 million years (the "Ice Age"), focusing on the interactions between geological, climatological, and biological processes and systems. Topics include the methods used to date Quaternary deposits, nature of Quaternary glaciations, use of proxy data to model past climates, causes of Quaternary climatic oscillations, history of Pleistocene Lake Bonneville, and the increasing role of humans as agents of environmental change. Field trips required. Three lectures per week. Prerequisite: GEO 1220 or GEOG PS1010 or ANTH SS2030.

GEO 3250. Geology of Utah (3) F (alternate years)
The study of Utah’s geologic history, rocks, minerals, fossils, and landforms and their relationship to regional and global events. Field trips required. Three lectures per week. Prerequisite: GEO 1220.

GEO 3400. Remote Sensing I (4) F
An introduction to traditional photographic analysis and digital image processing of remotely sensed imagery (satellite and low-altitude aerial platforms) for earth scientists. An assessment of the electromagnetic spectrum with regard to spectral ranges of reflected and emitted energy as a means of identifying, interpreting, and analyzing earth surface phenomena. Image processing techniques are introduced through ERDAS Imagine software. Prerequisites: MATH QL1040 or consent of instructor. Three lectures and one three-hour lab per week.

GEO 3550. Sedimentology and Stratigraphy (4) S
The processes, origin, classification, identification, and basic petrology of sedimentary rocks and the principles, concepts, and applications of stratigraphy. Field trips required. Three lectures and one three-hour lab per week. Prerequisites: GEO 1220 and GEO 2050; or consent of instructor.

GEO 3880. Groundwater (4) S
Origin, occurrence, behavior, and use of groundwater, with special emphasis on practical applications in Utah. Three lectures and one three-hour lab per week. Prerequisites: GEO SI1115 and either MATH QL1050 or MATH QL1080; or consent of instructor.

GEO 4010. Ancient Environments and Paleoecology (3) (offered as needed)
A multi-disciplinary seminar course that will explore both physical and biological methods of interpreting ancient environments and ecology. Three lectures per week. Prerequisite: GEO 3180, or GEO 3550, or ZOOL 3450, or BTNY 3454, or CHEM 3070, or consent of instructor.

GEO 4060. Geoscience Field Methods (3) F
A capstone course in the collection and analysis of field data for various Geoscience applications. Topics include introductory surveying, geologic mapping of bedrock and surficial deposits, measuring stratigraphic sections, GPS surveying, groundwater monitoring, and analysis of geologic hazards. Results are presented in maps, computer graphics, written reports, and oral presentations. One hour of lecture and six hours of lab/field work per week. Prerequisites: GEO 2050, GEO 3150, and GEO 3550.

GEO 4100. Engineering Geology (3) S
Introduction to basic concepts in engineering geology and geo-technical engineering; emphasizes problem solving as the primary method. Three lectures per week. Prerequisite: GEO PS1060 and GEO 1065, or GEO 2050, or consent of instructor.

GEO 4150. Environmental Assessment (3)
Interdisciplinary study of geology applied to transport of contaminants in groundwater, environmental site assessment and remediation. Three hours of lecture per week. Prerequisite: GEO PS1060 and GEO 1065, or GEO 2050, or consent of instructor.

GEO 4210. Introduction to Computer Mapping and Geographic Information Systems (4) F
Principles of spatial analysis including data base design, data input, and spatial modeling in the context of an information system using the ArcGIS family of software. The nature of computer mapping is examined with an emphasis on scale, minimum mapping unit, topology, and projected mapped features. Three lectures and one three-hour lab per week. Prerequisites: MATH QL1040 and proficiency in the Windows operating system, or consent of instructor.
GEO 4220. Technical and Application Issues in GIS (4) S
A capstone course in spatial analysis in which data entry, data
manipulation, spatial modeling, and analysis are addressed through
the completion of the research project addressing a specific problem
using GIS and the computer as a modeling instrument. Advanced
level, computer-intensive applications are employed using the
ArcGIS family of software. Three lectures and one three-hour lab per
week. Prerequisite: GEO 4210.

GEO 4300. Igneous and Metamorphic
Petrology (4) S (alternate years)
The origin, classification, and identification of igneous and meta-
morphic rocks, and understanding of igneous and metamorphic
processes. Laboratory includes analysis of rocks in thin section and
an introduction to optical mineralogy. Three lectures and one three-
hour lab per week. Prerequisites: GEO 2050 and CHEM SI1220; or
consent of instructor.

GEO 4400. Remote Sensing II: Advanced
Digital Image Processing (4) S
A laboratory intensive assessment of digital (raster) imagery using
advanced computer-assisted digital processing procedures with an
emphasis on quantitative statistical analysis through ERDAS Imag-
image processing software. The focus is on feature classification
of multi spectral imagery, principle components analysis, georectifi-
cation, and error assessment. Three lectures and one three-hour lab
per week. Prerequisite: GEO 3400.

GEO 4510. Geology Field Camp (4) Su (alternate years)
Integrated approach to collecting field data and interpreting geo-
logic processes and history. Includes geologic mapping and analysis
of bedrock, surficial deposits, and geographic structures using aerial
photographs, topographic maps, and surveying techniques. Results
presented in written reports, maps, and graphical formats. About
forty hours of lab per week for about 4 weeks. Prerequisites: GEO
3060, GEO 3550, and GEO 4060; or consent of instructor.

GEO 4550. Geochemistry (3) S (alternate years)
The chemical evolution of the Earth and geochemical processes
operating in the lithosphere, hydrosphere, and atmosphere. Appli-
cations to chemical reactions, mineral stability, aqueous solutions,
geochemical cycles, and isotope geochemistry. Three lectures per
week. Prerequisites: CHEM SI1220 and GEO 2050; or consent of
instructor.

GEO 4570. Secondary School Science
Teaching Methods (3) F
Acquaintance with the various methods and curriculum of sec-
ondary school science. Two lectures and one three-hour lab per week. It
is recommended that this course be completed before student teach-
ing. Prerequisites: GEO 1220, GEO 2050, GEO 3010, and admission
to the Teacher Education Program; or consent of instructor.

GEO 4600. Geophysics (3) (offered as needed)
Principles and techniques of geophysical exploration, including
gravity, magnetic, electric, and seismic methods. Course includes
field collection and computer modeling of geophysical data. Three
lectures per week. Field trips required. Prerequisites: GEO 3060 and
MATH SI1220; or consent of instructor.

GEO 4630. Global Tectonics (3) (offered as needed)
Large-scale structure and dynamics of the Earth. Framework of plate
tectonics including plate motion, processes at plate boundaries, and
driving mechanisms. Processes of crustal deformation and evolution
of orogenic belts over time, with examples from North America. Three
lectures per week. Field trips required. Prerequisites: GEO
2050 and GEO 3060; or consent of instructor.

GEO 4750. Special Topics in Geosciences (1-4)
An opportunity to examine in depth topics in the Geosciences not
regularly offered as part of the standard course offerings. The spec-
ific title and credit authorized will appear on the student transcript.
The course may be repeated for credit. Prerequisites: GEO PS/SI1110,
GEO SI1115, and any specific courses selected by the instructor.

GEO 4800. Independent Research (1-3) Su, F, S
Prerequisite: Consent of instructor prior to registration. (May be
repeated for a maximum of five credit hours.)

GEO 4890. Cooperative Work Experience (1-6)
A continuation of GEO 2890. Open to all students.

GEO 4920. Short courses, Workshops, Institutes and
Special Programs (1-4) (offered as needed)
Consult the semester class schedule for the current offering under
this number. The specific title and credit authorized will appear on
the student transcript.

GEO 4950. Advanced Geoscience Fieldtrips (1-3) F, S
Application of Geoscience field methods during fieldtrips. Readings,
written and oral reports, and/or examinations required. Prerequi-
site: consent of instructor.

GEO 4970. Senior Thesis (2) F, S
A thesis to be written by a student at the culmination of a period
of individual field/laboratory and library research, under the direc-
tion of a specific faculty person. Prerequisites: Senior standing and
departmental approval of the thesis topic.

GEO 5030. Geology for Teachers (2-4) (offered as needed)
Science content course for teachers in the M.Ed Science Emphasis
Program. To register, select another departmental course and devel-
oped a contract detailing additional work required for graduate credit.
Course may be repeated. Contract must be approved by instructor,
department chair, and Director of the Master of Education Program.
A. To enroll in mathematics courses MATH QL1030, MATH QL1040, MATH QL1050, MATH 1060, or MATH QL1080 a student must have either:
1. Received a Math ACT score of 23 or above, within the past 24 months
or
2. Scored sufficiently high on a placement exam at the WSU testing center within the past twelve months.*
   or
3. Completed the prerequisite course with a grade of “C” or higher within the past 12 months.

Students who score below 23 on the Math ACT will be placed into developmental courses, if applicable, based on the information outlined in the WSU Assessment & Placement Standards document. The purpose of this policy is to help students succeed academically by matching their skills and knowledge with the appropriate academic course(s) in math. For specific information about the policy go to the online Policies and Procedures Manual (weber.edu/ppm/6-02.htm).

B. To enroll in Mathematics courses numbered 1210 through 2210, a student must have within the past twelve months either:
1. Obtained the appropriate AP Calculus score described below:
   a) Five on the BC test places the student in MATH 2210 or higher
   b) Three or four on the BC test places the student in MATH SI1220
   c) Four or five on the AB test places the student in MATH SI1220
   d) Three on the AB test places the student in MATH SI1210 or
   2. Scored sufficiently high on a placement exam at the WSU testing center.*
   or
3. Completed the prerequisite course(s) with a grade of “C” or higher.

*A student may take the placement exam a maximum of three times within the previous three years.

Failure to comply with this policy will normally result in the cancellation of the students math course registration.

It is recommended that students have their programs (majors and minors) approved before registering for upper division courses.

**Mathematics Major**

**Bachelor Degree (B.S. or B.A.)**

**Program Prerequisite:** Not required for Regular and Applied Mathematics Emphases. Mathematics Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).

**Minor:** Required for the departmental major.

**Grade Requirements:** A grade of “C” or better in courses required for this major (a grade of “C-” is not acceptable), in addition to an overall 2.0 GPA and a 2.0 GPA in mathematics classes numbered 1210 or above. Mathematics Teaching majors must achieve an overall GPA of 3.00 for admission to the Teacher Education program.

**Credit Hour Requirements:** A total of 120 credit hours is required for graduation – 40-46 of these are required within the major. A total of 40 upper division credit hours is required (courses numbered 3000 and above) – at least nine credit hours of upper division Mathematics must be completed at Weber State University.

**Advisement**

All Mathematics majors should see the Mathematics Department to be assigned an advisor. They should meet with their advisors at least once a year to help plan their programs and check on their progress. Call 801-626-6095 for more information or to schedule an appointment.

**Admission Requirements**

Declare your program of study (see page 18) with your advisor. There are no special admission or application requirements for the Regular or Applied mathematics emphases. Mathematics Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).

**General Education**

Refer to pages 36-41 for either Bachelor of Science or Bachelor of Arts requirements. PHYS PS/SI2210 will fulfill requirements for both the major and general education. PSY SS1010 (3) in the Social Sciences area is recommended for the Mathematics Teaching Emphasis.

**Mathematics Sequences**

**A. Probability and Statistics Sequence**
MATH 3410 Probability & Statistics (3)
MATH 3420 Probability & Statistics (3)

**B. Combinatorics Sequence**
MATH 3610 Graph Theory (3)
MATH 3620 Enumeration (3)

**C. Differential Equations Sequence**
MATH 3710 Boundary Value Problems (3)
MATH 3730 Partial Differential Equations (3)
or MATH 3750 Dynamical Systems (3)

**D. Algebra Sequence**
MATH 4110 Intro to Modern Algebra I (3)
MATH 4120 Intro to Modern Algebra II (3)

**E. Analysis Sequence**
MATH 4210 Intro Real Analysis (3)
MATH 4220 Intro Real Analysis (3)

**F. Numerical Analysis Sequence**
MATH 4610 Numerical Analysis (3)
MATH 4620 Numerical Analysis (3)

**Course Requirements for Regular Emphasis B.S. or B.A. Degree**

**Mathematics Courses Required (30 credit hours)**
MATH SI1210 Calculus I (4)
MATH SI1220 Calculus II (4)
MATH 2210 Calculus III (4)
MATH 2270 Elementary Linear Algebra (3)
MATH 2280 Ordinary Differential Equations (3)
MATH 4110 Modern Algebra I (3)
MATH 4120 Modern Algebra II (3)
or MATH 4320 Topology (3)
MATH 4210/4220 Intro Real Analysis (6)

**Mathematics Electives (at least 12 credit hours)**
Complete any upper division Mathematics courses (not including any required courses) so that required mathematics courses and mathematics electives total at least 42 credit hours.

**Support Courses Required (10 credit hours)**
PHYS PS/SI2210 Physics for Scientists & Engineers I (5)
PHYS SI2220 Physics for Scientists & Engineers II (5)

**Graduate School Preparation**

It is highly recommended that students planning on graduate work in Mathematics take Linear Algebra (MATH 3350) and Topology (MATH 4320) in addition to the above. See the Mathematics Department for counseling.
Course Requirements for Applied Mathematics Emphasis B.S. or B.A. Degree

Mathematics Courses Required (30 credit hours)

MATH 2110 Calculus I (4)
MATH 2120 Calculus II (4)
MATH 2270 Elementary Linear Algebra (3)
MATH 2280 Ordinary Differential Equations (3)
MATH 3410 Probability & Statistics (3)
MATH 3550 Mathematical Modeling (3)
MATH 3710 Boundary Value Problems (3)
or MATH 3750 Dynamical Systems (3)
MATH 4610 Numerical Analysis (3)

Mathematics Electives (at least 12 credit hours)
Complete any upper division Mathematics courses, not including courses taken to satisfy the required courses, so that the mathematics electives and required mathematics courses total at least 42 credit hours. The required and elective courses must include 2 complete mathematics sequences chosen from sequences A, B, C, E, or F above.

Support Courses Required (14 credit hours)

PHYS PS/SI2210 Physics for Scientists & Engineers I (5)
PHYS SI2220 Physics for Scientists & Engineers II (5)
CS SI1410 Object Oriented Programming (4)
A minor is required in either Physics, Computer Science, or Electronics Engineering Technology. Other minors having a strong mathematical base are acceptable if the courses to be taken are pre-approved by the chair of the Mathematics Department.

Graduate School Preparation
It is recommended that students planning on graduate work in Applied Mathematics take the Analysis sequence (E), Linear Algebra (MATH 3350), and the Differential Equations sequence (C). See the Mathematics Department for counseling.

Course Requirements for Mathematics Teaching Emphasis B.S. or B.A. Degree

Mathematics Courses Required (42 credit hours)

MATH 2110 Calculus I (4)
MATH 2120 Calculus II (4)
MATH 2210 Foundations of Algebra (3)
MATH 2270 Elementary Linear Algebra (3)
MATH 2280 Ordinary Differential Equations (3)
MATH 3110 Foundations of Probability and Statistics (3)
MATH 3120 Euclidean & non-Euclidean Geometry (3)
MATH 3160 Number Theory (3)
MATH 4210 Intro Real Analysis (3)
MTHE 3010 Methods & Technology for Teaching Secondary Mathematics (3)
MTHE 4010 Capstone Mathematics for High School Teachers I (3)
MTHE 4020 Capstone Mathematics for High School Teachers II (3)

Support Courses Required (5-10 credit hours)

Complete either
PHYS PS/SI2210 Physics for Scientists & Engineers I (5)
or
CHEM PS/SI1210 Principles of Chemistry (5)
& CHEM SI1220 Principles of Chemistry (5)
A minor is required. A student must also complete requirements for a secondary education degree as determined by the Jerry and Vickie Myers College of Education.

Mathematics Courses Required (30 credit hours)

MATH 2110 Calculus I (4)
MATH 2120 Calculus II (4)
MATH 2270 Elementary Linear Algebra (3)
MATH 2280 Ordinary Differential Equations (3)

Electives (9-10 credit hours)

Take three courses chosen from the following:
MATH 2210 Calculus III (4)
MATH 2280 Ordinary Differential Equations (3)

This completes the minimum requirements for the Mathematics Minor (Regular Emphasis).
MATH 1010. Intermediate Algebra (4)  Su, F, S
Graphs; linear equations and systems; exponents and radicals; polynomial, rational, and logarithmic functions; applications. Prerequisite: MATH ND0955, MATH ND0960 or placement test.

MATH 1020. Fundamentals of Geometry (3)  Su, F, S
An introduction to the definitions, methods, and logic of geometry. Prerequisite: MATH ND0960 or placement test.

MATH 1030. Contemporary Mathematics (3)  Su, F, S
Topics from mathematics which convey to the student the beauty and utility of mathematics, and which illustrate its application to modern society. Topics include geometry, statistics, probability, and growth and form. Prerequisite: MATH 1010 or ACT Math score 23 or higher or placement test.

MATH 1040. Introduction to Statistics (3)  Su, F, S
Basic concepts of probability and statistics with an emphasis on applications. Prerequisite: MATH 1010 or Math ACT score 23 or higher or placement test.

MATH 1050. College Algebra (4)  Su, F, S
Selected topics in algebra including inequalities, logarithms, theory of equations, matrices, determinants and progressions. Prerequisite: MATH 1010 or Math ACT score of 23 or higher or placement test.

MATH 1060. Trigonometry (3)  Su, F, S
Trigonometric functions, equations, identities, and applications. Complex numbers and polar coordinates. Prerequisite: MATH 1010 or Math ACT score of 23 or higher or placement test.

MATH 1080. Pre-calculus (5)  Su, F, S
A course covering college algebra and trigonometry concepts preparatory to calculus. Prerequisite: MATH 1010 or Math ACT score of 23 or higher or placement test.

MATH 1200. Mathematics Computer Laboratory (1)  F
Computer solution of mathematics problems using a computer algebra system. Prerequisites: MATH QL1050 and 1060, or MATH QL1080, or Co-requisite: MATH SI1210.

MATH 2110. Foundations of Algebra (3)  Su, F, S
Introduction to Abstract Algebra, Number Theory and Logic with an emphasis on problem solving and proof writing. Prerequisite: MATH QL1050.

MATH 2120. Calculus I (4)  Su, F, S
Limits, continuity, differentiation, integration. Prerequisite: MATH QL1050 and 1060 or MATH QL1080 or placement test. Co-requisite: MATH 1200 or ability to use a computer algebra system.

MATH 2120. Calculus II (4)  Su, F, S
Transcendental functions, techniques of integration, analytic geometry, infinite series. Prerequisite: MATH SI1210. Co-requisite: MATH 1200 or ability to use a computer algebra system.

MATH 1630. Discrete Mathematics Applied to Computing (4)
An overview of the fundamentals of algorithmic, discrete mathematics applied to computation using a contemporary programming language. Topics include logic, proofs, sets, functions, counting, relations, graphs, trees, Boolean algebra, and models of computation. This course includes programming. Prerequisites: MATH QL1050 or MATH QL1080, and CS1130 or ability to program in a contemporary computer language and the consent of the instructor.
MATH 3050. History of Mathematics (3) A survey of the history of mathematics and its impact on world culture with emphasis on mathematical motivations, original methods and applications. Prerequisite: MATH SI1220.

MATH 3120. Euclidean and Non-Euclidean Geometry (3) F Axiomatic development of geometry; Euclidean and non-Euclidean. Prerequisite: MATH SI1220 and either passing a placement exam or MATH 1020.

MATH 3160. Number Theory (3) S An overview of beginning number theory including the integers, modulo arithmetic, congruences, Fermat's theorem and Euler's theorem. Prerequisite: MATH SI1210.

MATH 3350. Linear Algebra (3) F or S Theory and applications of linear algebra including abstract vector spaces and canonical forms of matrices. Prerequisite: MATH 2270.

MATH 3410, 3420. Probability and Statistics (3-3) F, S Introductory probability theory and mathematical statistics, including applications. Prerequisite for MATH 3410: MATH SI1220. Prerequisites for MATH 3420: MATH 2210 and 3410.

MATH 3550. Introduction to Mathematical Modeling (3) F or S Formulation, solution and interpretation of mathematical models for problems occurring in areas of physical, biological and social science. Prerequisite: MATH 2210, MATH 2270 or 2280, or consent from instructor.

MATH 3610. Graph Theory (3) F Principles of Graph Theory including methods and models, special types of graphs, paths and circuits, coloring, networks, and other applications. Prerequisite: MATH SI1210.

MATH 3620. Enumeration (3) S Principles of Enumeration including counting principles, generating functions, recurrence relations, inclusion-exclusion, and applications. Prerequisite: MATH SI1210.


MATH 3730. Partial Differential Equations (3) S (alternate years) Partial differential equations. First and second order equations, characteristics and classifications, methods of solution, applications. Prerequisite: MATH 3710.

MATH 3750. Dynamical Systems (3) S (alternate years) Linear and nonlinear systems of differential equations, qualitative behavior and stability of solutions, applications. Prerequisite: MATH 2270 and MATH 2280.

MATH 3810. Complex Variables (3) F or S or Su Analysis and applications of a function of a single complex variable. Analytic function theory, path integration, Taylor and Laurent series and elementary conformal mapping are studied. Prerequisite: MATH 2210.

MATH 4110. Modern Algebra I (3) F Logic, sets, and the study of algebraic systems including groups, rings, and fields. Prerequisite: MATH 2270.

MATH 4120. Modern Algebra II (3) S Continuation of MATH 4110: advanced topics from groups, rings, and fields including the Sylow theorems and Galois theory. Prerequisite: MATH 4110.

MATH 4210, 4220. Introductory Real Analysis (3-3) F, S Develop the analysis underlying calculus. In-depth study of limits, continuity, integration, differentiation, sequences and series. Other topics may include Lebesgue measure and integration and Fourier Analysis. Prerequisite: MATH 2210 and 2270 for 4210; MATH 4210 for 4220.

MATH 4320. Topology (3) F or S Introduction to point-set topology, including metric and topological spaces, continuity, homeomorphisms, compact and connected spaces, and complete metric spaces. Other topics may include the Baire Category Theorem and Tietze Extension Theorem. Prerequisite: MATH 2210 and 2270.

MATH 4610, 4620. Numerical Analysis (3-3) F, S Introduction to numerical methods. Use of the digital computer in solving otherwise intractable problems. Prerequisite: MATH 2270 and CS SI1410 or other approved programming language; MATH 4610 for 4620.

MATH 4750. Topics in Mathematics (2-4) This course will vary with the demand and may be taken more than once for a maximum of 8 credit hours. Prerequisite: Consent of the instructor.

MATH 4910. Senior Research Project (3) Mathematical research project for seniors. Students may not register for this course the last semester before they intend to graduate. Prerequisite: Instructor approval.

MATH 4920. Short Courses, Workshops, Institutes and Special Programs (1-4) Consult the semester class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

**MATHEMATICS EDUCATION COURSES - MTHE**

Courses numbered above 5000 are restricted to in-service teachers and credit should not be given for students who have received credit for the corresponding undergraduate course.

MTHE 3010. Methods and Technology for Teaching Secondary Mathematics (3) F Basic topics in secondary mathematics are taught to prospective teachers using a variety of methods of presentation and up-to-date technology, including the use of graphing calculators and computers. Prerequisite: MATH SI1220.

MTHE 3020. Methods and Technology for Teaching Advanced Secondary Mathematics (3) S Aspects of teaching advanced mathematics in a high school setting, including methods of presentation, exploration, assessment and classroom management. An emphasis is placed on the use of computers, graphing calculators, and other technology. Prerequisite: MTHE 3010.


<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTHE SI3080</td>
<td>Number Theory for Elementary Teachers (3) S</td>
<td>Survey of elementary number theory concepts with applications to topics of interest plus teaching suggestions. Prerequisite: MATH 2010 and MATH 2020.</td>
</tr>
<tr>
<td>MTHE 4010</td>
<td>Capstone Mathematics for High School Teachers I (3) S</td>
<td>Prospective high school teachers revisit mathematics topics from the secondary school curriculum and examine them from an advanced perspective. The major emphasis is on topics from algebra. Prerequisites: MATH 2110 and MATH 3120.</td>
</tr>
<tr>
<td>MTHE 4020</td>
<td>Capstone Mathematics for High School Teachers II (3) S</td>
<td>Prospective high school teachers revisit mathematics topics from the secondary school curriculum and examine them from an advanced perspective. The major emphasis is on topics from geometry. Prerequisite: MTHE 4010.</td>
</tr>
<tr>
<td>MTHE SI4100</td>
<td>Intuitive Calculus for Elementary Teachers (3) F</td>
<td>Prerequisite: MATH 2010 and MATH 2020.</td>
</tr>
<tr>
<td>MTHE 4700</td>
<td>Senior Project in Elementary Mathematics Teaching (3) F, S</td>
<td>Projects in preparing, teaching and revising sequential mathematics lessons for elementary students. Prerequisite: MATH 2010 and MATH 2020.</td>
</tr>
<tr>
<td>MTHE 5010</td>
<td>Methods and Technology for Teaching Secondary Mathematics (3)</td>
<td>Topics in secondary mathematics are taught to in-service teachers using a variety of methods and technology to make them better prepared for teaching secondary mathematics. Expository presentations about a current mathematics education research area are expected.</td>
</tr>
<tr>
<td>MTHE 5210</td>
<td>Calculus with Analytic Geometry (4)</td>
<td>Analytic geometry, differentiation, integration, and applications. Prerequisite: MATH QL1050 and 1060 or MATH QL1080 or placement test.</td>
</tr>
<tr>
<td>MTHE 5220</td>
<td>Calculus with Analytic Geometry (4)</td>
<td>Transcendental functions, techniques of integration, conic sections, polar coordinates, infinite series, introduction to partial derivatives. Prerequisite: MTHE 5210.</td>
</tr>
<tr>
<td>MTHE 5230</td>
<td>Mathematics Computer Laboratory (1)</td>
<td>Computer solution of mathematics problems. May be taken concurrently with any lower division mathematics course. Prerequisite: Approval of instructor.</td>
</tr>
<tr>
<td>MTHE 5310</td>
<td>Multivariable and Vector Calculus (4)</td>
<td>Vectors, vector valued functions, motion in space, multivariable functions, partial derivatives, multiple integrals, integration in vector fields. Prerequisite: MTHE 5220.</td>
</tr>
<tr>
<td>MTHE 5350</td>
<td>Linear Algebra and Differential Equations (4)</td>
<td>Introduction to Linear Algebra and Differential Equations. Systems of linear equations, matrices, vector spaces, eigenvalues. First and second order differential equations and models, higher order linear equations, linear systems. Prerequisite: MTHE 5220.</td>
</tr>
<tr>
<td>MTHE 6120</td>
<td>Euclidean and Non-Euclidean Geometry (3)</td>
<td>Axiomatic development of geometry; Euclidean and non-Euclidean. Prerequisite: MTHE 5220.</td>
</tr>
<tr>
<td>MTHE 6160</td>
<td>Number Theory (3)</td>
<td>An overview of beginning number theory including the integers, modulo arithmetic, congruencies, Fermat's theorem and Euler's theorem. Prerequisite: MTHE 5210.</td>
</tr>
<tr>
<td>MTHE 6350</td>
<td>Linear Algebra (3)</td>
<td>Theory and applications of linear algebra including abstract vector spaces and canonical forms of matrices. Prerequisite: MTHE 5350.</td>
</tr>
<tr>
<td>MTHE 6410, 6420</td>
<td>Probability and Statistics (3-3)</td>
<td>The mathematical content of probability and statistics at the undergraduate post calculus level. An understanding of the application of probability and statistics is also stressed. Co-requisite: MTHE 5310 or prerequisite of MTHE 5220 and consent of instructor. Further prerequisites: MTHE 6410 for 6420.</td>
</tr>
<tr>
<td>MTHE 6550</td>
<td>Introduction to Mathematical Modeling (3)</td>
<td>Formulation, solution and interpretation of mathematical models for problems occurring in areas of physical, biological and social science. Prerequisite: MTHE 5310 and 5350.</td>
</tr>
<tr>
<td>MTHE 6610</td>
<td>Graph Theory (3)</td>
<td>Principles of Graph Theory including methods and models, special types of graphs, paths and circuits, coloring, networks, and other applications. Prerequisite: MTHE 5210.</td>
</tr>
<tr>
<td>MTHE 6620</td>
<td>Enumeration (3)</td>
<td>Principles of Enumeration including counting principles, generating functions, recurrence relations, inclusion-exclusion, and applications. Prerequisite: MTHE 5210.</td>
</tr>
<tr>
<td>MTHE 6630</td>
<td>Boundary Value Problems (3)</td>
<td>Series solutions, Fourier series, separation of variables, orthogonal functions. Prerequisite: MTHE 5350.</td>
</tr>
<tr>
<td>MTHE 6640</td>
<td>Differential Equations II (3)</td>
<td>Matrix approach to linear systems, nonlinear systems, Laplace transforms. Prerequisite: MTHE 5350.</td>
</tr>
<tr>
<td>MTHE 6650</td>
<td>Complex Variables (3)</td>
<td>Analysis and applications of a function of a single complex variable. Analytic function theory, path integration, Taylor and Laurent series and elementary conformal mapping are studied. Prerequisite: MTHE 5310 and 5350.</td>
</tr>
<tr>
<td>MTHE 6660</td>
<td>Modern Algebra I (3)</td>
<td>Logic, sets, and the study of algebraic systems including groups, rings, and fields. Prerequisite: MTHE 5350.</td>
</tr>
<tr>
<td>MTHE 6670</td>
<td>Modern Algebra II (3)</td>
<td>Continuation of MATH 4110: advanced topics from groups, rings, and fields including the Sylow theorems and Galois theory. Prerequisite: MTHE 6660.</td>
</tr>
<tr>
<td>MTHE 6680, 6690</td>
<td>Introductory Real Analysis (3-3)</td>
<td>Develop the analysis underlying calculus. In-depth study of limits, continuity, integration, differentiation, sequences and series. Other topics may include Lebesgue measure and integration and Fourier Analysis. Prerequisite: MTHE 5310 and 5350 for 6680; MTHE 6680 for 6690.</td>
</tr>
<tr>
<td>MTHE 6700</td>
<td>Topology (3)</td>
<td>Introduction to point-set topology, including metric and topological spaces, continuity, homeomorphisms, compact and connected spaces, and complete metric spaces. Other topics may include the Baire Category Theorem and Tietze Extension Theorem. Prerequisite: MTHE 5310 and 5350.</td>
</tr>
</tbody>
</table>
MTHE 6710, 6720. Numerical Analysis (3-3) Introduction to numerical methods. Use of the digital computer in solving otherwise intractable problems. Prerequisite: MTHE S350 and CS SI1410 or other approved programming language; MTHE 6710 for 6720.

MTHE 6730. Partial Differential Equations (3) First order equations, characteristics and classifications, Green's identities, models, transforms. Prerequisite: MTHE 6630.

DEPARTMENT
Microbiology

Chair: Dr. Craig J. Oberg
Location: Science Lab, Room 302M
Telephone Contact: Carrie Minnoch 801-626-6949
Professors: Glenn W. Harrington, Craig J. Oberg, Mohammad Sondossi;
Associate Professors: William Lorowitz, Karen G. Nakaoka;
Assistant Professors: Matthew J. Domek, Michele D. Zwolinski

Microbiology is the study of microorganisms (bacteria, viruses, algae, fungi, and protozoa) including their structure, metabolism, distribution, and ecological relationships. Knowledge gained by microbiologists leads to a better understanding of molecular-level life processes and to beneficial applications in agriculture, industry, and medicine. The field is expanding, with special emphasis being given to genetic engineering, biotechnology, cell culture, disease and the immune response, production and storage of food, research and development and quality assurance of industrial products, disposal and detoxification of wastes, and the monitoring of environmental quality.

MICROBIOLOGY MAJOR
BACHELOR DEGREE (B.S.)

Program Prerequisite: Not required.
Minor: Required support courses for the major also satisfy a minor in Chemistry.
Grade Requirements: An average GPA of 2.00 or better in microbiology courses required for this major in addition to an overall GPA of 2.00 or higher.
Credit Hour Requirements: A total of 120 credit hours is required for graduation – a minimum of 71 of these is required within the major. A total of 40 upper division credit hours is required (courses numbered 3000 and above).

Advisement
All Microbiology students are encouraged to meet with a faculty advisor at least annually for course and program advisement. Call 801-626-6949 for more information or to schedule an appointment.

Admissions Requirements
Declare your program of study (see page 18). There are no special admission or application requirements for this program.

General Education
Refer to pages 36-41 for Bachelor of Science requirements. The following courses required for the Microbiology major also will satisfy general education requirements: MICR LS/SI2054, CHEM PS/SI1210, PHY/SI1010 or PHY/SI2010, BTNY LS1203, and ZOOL LS1010.

Course Requirements for B.S. Degree

**Microbiology Courses Required (19 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICR 3053</td>
<td>3</td>
<td>Microbiological Procedures (3)</td>
</tr>
<tr>
<td>MICR 32054</td>
<td>4</td>
<td>Principles of Microbiology (4)</td>
</tr>
</tbody>
</table>

**Microbiology Elective Courses (20 credit hours)**

- **Category A (8 credit hours minimum)**
  - MICR 3254  Microbiology (4)
  - MICR 3305  Medical Microbiology (5)
  - MICR 3348  Environmental Microbiology (4)
  - MICR 3502  Environmental Health (2)
  - MICR 3833  Food Microbiology (3)
  - MICR 4252  Cell Culture (2)
  - MICR 4354  Industrial Microbiology & Biotech (4)
  - MICR 4554  Virology (4)

- **Category B**
  - MICR 2600  Laboratory Safety (1)
  - MICR 2920  Short Courses, Workshops, . . . (1)
  - MICR 3340  Info Resources in the Life Sciences (2)
  - MICR 4800P  Directed Research (1-2)
  - MICR 4830P  Directed Readings (1-2)
  - MICR 4920  Short Courses, Workshops, . . . (1)
  - MICR 4991  Seminar (1)

No more than 3 credit hours of MICR 4800 and no more than 2 credit hours of MICR 4830 may count toward the major.

- **Category C (8 credit hours maximum)**
  - Elective courses in other life science departments

**Required Support Classes (32-42 credit hours)**

- **Category A (8 credit hours minimum)**
  - CHEM PS/SI1210/SI1220  Principles of Chemistry (10)
  - CHEM 2310  Organic Chemistry (5)
  - CHEM 3070  Biochemistry I (4)
  - MATH QL1050  College Algebra (4)
  - MATH QL1080  Precalculus (5)
  - MATH SI1210  Calculus I (4)
  - PHYS PS/SI1010  Elementary Physics (3)
  - PHYS PS/SI2010/SI2020  General Physics w/lab (10)
  - PHYS PS/SI2210/SI2220  Physics for Scientists & Engineers (10)
  - BTNY LS1203  Plant Biology (3)
  - BTNY SI2104  Plant Form and Function (4)
  - BTNY SI2114  Evolutionary Survey of Plants (4)
  - ZOOL LS1010  Animal Biology (3)
  - ZOOL SI1110  Principles of Zoology I (4)
  - ZOOL SI1120  Principles of Zoology II (4)

**Suggested Course Sequence**

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

**SPECIAL EMPHASIS**

Microbiology majors pursuing the career programs below should consult appropriate advisors and include the specified courses while fulfilling the requirements for the Microbiology major.

**Biotechnology or Industrial Microbiology**

Students interested in biotechnology or industrial microbiology careers should include the following:

- MICR 3484  Environmental Microbiology (4)
- MICR 3853  Food Microbiology (3)
- MICR 4252  Cell Culture (2)
- MICR 4354  Industrial Microbiology & Biotech (4)
- ZOOL 3300  Genetics (4)
and consider the following
- BTNY 3504 Mycology (4)
- BTNY 3514 Algology (4)
- BTNY 3523 Marine Biology (3)
- CHEM 3050 Instrumental Analysis (3)

**Public Health**

Students emphasizing Public Health should include the following
- MICR LS1153 Elementary Public Health (3)
- MICR 3254 Immunology (4)
- MICR 3305 Medical Microbiology (5)
- MICR 3502 Environmental Health (2)
- MICR 3853 Food Microbiology (3)
- MICR 4354 Industrial Microbiology & Biotech (4)
- MICR 4554 Virology (4)
- ZOOL 4500 Parasitology (4)

and medical and ecological course electives

**Pre-Medical, Pre-Dental, and Pre-Physician’s Assistant**

Pre-medical, pre-dental, and pre-physician’s assistant students should include the following
- MATH 1010/1010 College Algebra (4)
  *or equivalent of a full year of college math

  - ENGL 1010/2010 College Writing (6)
  - ENGL 2100 Technical Writing (3)
  - or ENGL 2250 Fiction Writing (3)
  - or ENGL 3210 Advanced College Writing (3)
  - or COMM HU1020 Principles of Public Speaking (3)
  - PHYS PS/SI1210 General Physics w/lab (10)
  - or PHYS PS/SI2210/2220 Physics for Sci & Eng w/lab (10)
  - ZOOL 2200 Human Physiology (4)
  - ZOOL 3200 Cell Biology (4)
  - ZOOL 3300 Genetics (4)

  - MICR 3254 Immunology (4)
  - MICR 3305 Medical Microbiology (5)
  - MICR 4554 Virology (4)
  - PSY SS1010 Introductory Psychology (3)
  - ZOOL SS1110/1120 Principles of Zoology I & II (8)

Medical schools do not accept AP or CLEP credits in English or science courses.

**Microbiology**

Students planning to attend graduate school should include the following
- PHYS PS/SI2100/SI2120 General Physics w/lab (10)
  - or PHYS PS/SI2210/2220 Physics for Sci & Eng w/lab (10)

and consider the following
- MATH SI1210/SI1220 Calculus (8)
- CHEM 3000 Quantitative Analysis (4)

and electives in data processing, statistics, and other biological sciences

**Microbiology**

**DEPARTMENTAL HONORS**

- Program Prerequisite: Enroll in the General Honors Program and complete at least 10 hours of General Honors courses (see the Honors Program on page 43).
- Grade Requirements: Maintain an overall GPA of 3.3.
- Credit Hour Requirements: Fulfill the requirements for the Microbiology departmental major, of which at least 12 hours must be completed on an Honors basis. A student may receive Microbiology Honors credit in any upper division Microbiology course with the exception of MICR 4890, 4920, and 4991.

  * Credit for MICR 4800 and MICR 4830 may be repeated for a maximum of 2 hours each for Honors. In addition, complete a Microbiology Directed Research Project.

  * Permission from the department chair should be obtained before registering in a course for Honors credit. A written agreement should be reached with the appropriate professor regarding the work expected for Honors credit. (See the Honors Program on page 43.)

**Microbiology**

**MINOR**

- Grade Requirements: A grade of 'C-' or better in courses used toward the minor.
- Credit Hour Requirements: Minimum of 18 hours in Microbiology courses, LS2054 and above.

**Biotechnician Training Program**

**ASSOCIATE OF SCIENCE DEGREE AND CERTIFICATE**

The Department of Microbiology participates with the Departments of Botany and Zoology in the Associate of Science degree and 3rd year Certificate in Biotechnician training for the biotechnology industry. This program is described elsewhere in this College of Science section of the catalog.

**MICROBIOLOGY COURSES - MICR**

**MICR LS1113. Introductory Microbiology (3)**

Su, F, S

An introduction to microorganisms, their biology, and their relationships to health, technology, and the environment, with practical applications. Three lecture/demonstrations per week.

**MICR LS1153. Elementary Public Health (3)**

Su, F, S

Principles and practices of public health, emphasizing prevention and control of communicable and degenerative diseases, and environmental health problems. Three lectures/demonstrations per week.

**MICR LS/SI1370. Principles of Life Science (3)**

Su, F

Course content includes metabolism, genetics, anatomy, physiology, evolution, and ecology. Unifying concepts of all living things will be emphasized. Three hours of lecture and two 3-hour labs with a recitation per week. Recommended for Elementary Education majors.

**MICR LS/SI2054. Principles of Microbiology (4)**

Su, F, S

Morphology, reproduction, cultivation, metabolism, genetics, and ecology of microorganisms, with many applications. This introductory microbiology course is designed for science majors. Three lectures and one 2-hour lab per week. Prerequisite: CHEM PS/SI1210 or CHEM PS/SI1110 or equivalent.

**MICR 2600. Laboratory Safety (1)**

F, S

An interdisciplinary, team-taught course that will be an overview of the major chemical, biological and physical safety issues related to science laboratories and field work. Class will meet once per week and will be taught in a lecture/demonstration format. Students opting for two credit hours will be required to complete a directed assignment related to their area of concentration. Both credit hours must be taken concurrently.

**MICR 2890. Cooperative Work Experience (1-5)**

Su, F, S

Open to all students in the Microbiology Department who meet the minimum Cooperative Work Experience requirements of the department. Provides academic credit for on-the-job experience. Grade and amount of credit will be determined by the department.

**MICR 2920. Short Courses, Workshop, Institutes and Special Programs (1-3)**

Consult the semester class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.
MICR 3053. Microbiological Procedures (3) F, S
Microscopy, staining methods, preparation of media, sterilization, preservation and maintenance of cultures, culture identification, enumeration methods, instrumentation. Two lectures and one 2-hour lab per week. Prerequisites: MICR LS/SI2054 and MATH QL1050.

MICR 3154. Microbial Ecology (4) F, S
Factors determining the growth and distribution of microorganisms in their natural habitats. Microbial diversity and their interactions with other living organisms and their surroundings. Microbial activities in nature, including biogeochemical cycles. Three lectures and one three-hour lab. Prerequisite: MICR LS/SI2054.

MICR 3254. Immunology (4) F
The study of the immune response in mammals. Three lectures and one 3-hour lab per week. Prerequisite: MICR LS/SI2054 or consent of instructor.

MICR 3305. Medical Microbiology (5) S
Characteristics of pathogenic microorganisms and mechanisms by which they cause disease in higher animals. Three lectures and two two-hour labs per week. Prerequisite: MICR 3254.

MICR 3340. Information Resources in the Life Sciences (2) S
A practical introduction to the literature and information resources of the life sciences. Students will expand their research skills and be able to develop effective research strategies to find and synthesize information available in academic libraries. Cross listed in Botany, Library Sciences and Zoology. Two lecture hours per week. Prerequisite: ENGL EN2010. Cross listed with Botany and Zoology.

MICR 3484. Environmental Microbiology (4) S
Applied, environmental microbiology and biotechnology including transport of microorganisms through environment, microbial pathogens and toxins in environment. Biodeterioration, contamination control, and biosafety. Pollution microbiology, environmental management, bioremediation, waste treatment, biological insecticides. Microbiology of man-made environments. Three lectures and one three-hour lab per week. Prerequisite: MICR LS/SI2054.

MICR 3502. Environmental Health (2) F
Air and water quality, solid and hazardous waste management, food protection, environmental inspection and testing. Two lectures per week. Prerequisite: MICR LS1113 or MICR LS/SI2054 or consent of instructor.

MICR 3603. Advanced Microbiology for the Health Professions (3) Su, F, S
Characteristics of microorganisms and parasites - emphasizing mechanisms by which they cause disease in humans. Intended for students in the Clinical Laboratory Sciences program and those working that field.

MICR 3853. Food Microbiology (3) F
Role of microorganisms in food production, preservation, and spoilage. Two lectures and one 2-hour lab per week. Prerequisite: MICR LS/SI2054.

MICR 4054. Microbial Physiology (4) F
Structure, function, and metabolism of microorganisms, with emphasis upon the bacteria. Three lectures and one 3-hour lab per week. Prerequisite: MICR LS/SI2054 and completion of or concurrent registration in CHEM 3070.

MICR 4154. Microbial Genetics (4) S
Genetics of microorganisms and its applications, including mutagenesis, gene transfer systems, recombination, plasmids, recombinant DNA technology, and transposons. Three lectures and one 3-hour lab per week. Prerequisite: MICR LS/SI2054. CHEM 3070 recommended.

MICR 4252. Cell Culture (2) S (cross-listed with Botany)
Basic methods and applications for culturing plant and animal cells in vitro. Two 2-hour combined lecture and laboratory sessions per week. Prerequisite: MICR LS/SI2054, or BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY SI2104 and BTNY 2121.

MICR 4354. Industrial Microbiology and Biotechnology (4) S
Beneficial and detrimental involvement of microorganisms in industrial processes, microbial products, biotechnology, contamination control, and antimicrobial agents including antibiotics. Three lectures and one 3-hour lab per week. Prerequisites: MICR LS/SI2054, CHEM 2310 or CHEM 3070. MICR 3053 recommended.

MICR 4554. Virology (4) S
Virus structure, classification, genetics, replication and other interactions with the host, with emphasis on bacteriophage and animal viruses. Two lectures and one three-hour lab per week. Prerequisite: MICR LS/SI2054.

MICR 4800. Directed Research (1-2) F, S
Independent research under the advisement of a faculty member. Repeatable to a maximum of 3 credits. Prerequisite: consent of instructor and a minimum of 6 credits of upper division microbiology course work.

MICR 4830. Directed Readings (1-2) Su, F, S
Independent readings on advanced special topics under the direction of a faculty member. Repeatable to a maximum of 2 credits. Prerequisite: consent of instructor and a minimum of 6 credits of upper division microbiology course work.

MICR 4890. Cooperative Work Experience (1-5) Su, F, S
(See MICR 2890 for description.)

MICR 4920. Short Courses, Workshops, Institutes and Special Programs (1-3)
Consult the semester class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

MICR 4991. Microbiology Seminar (1) F, S
Current topics in Microbiology. One hour per week. Prerequisites: Previous upper division courses in the department.

MICR 5034. Microbiology for Teachers (4)
Science content course for teachers in the M.Ed. Science Emphasis Program.

DEPARTMENT

Physics

Chair: Dr. Brad Carroll
Location: Science Lab, Room 202
Telephone: Nereyda Hesterberg 801-626-6163
Web Site: http://physics.weber.edu

Professors: Farhang Amiri, Bradley W. Carroll, J. Ronald Galli, Dale A. Ostlie, Daniel V. Schroeder, John E. Sohl, Walther N. Spjeldvik; Associate Professors: Colin Inglefield, Adam Johnstone; Assistant Professors: John Armstrong, Michelle L. Arnold, Stacy Palen

Physics is the study and application of the fundamental laws of nature, including the laws of motion, gravity, electromagnetism, heat, and microscopic interactions. These laws govern the behavior of objects at all scales, from the smallest subatomic particles to the entire observable universe. In between, physicists study nuclear reactions, the interactions of atoms with light, properties of solids, the chaotic dynamics of fluids, and the evolution of stars and galaxies, among many other applications.
Our courses in physics introduce all of the most important fundamental laws and many of their applications. Equally valuable, however, are the skills that students develop in these courses, from analytical thinking and problem solving to experimental design and interpretation. Majoring in physics can thus prepare a student for a variety of careers in research, education, business, industry, and government.

The Department offers three major programs: Physics, Applied Physics, and Physics Teaching. The Physics major places emphasis on understanding nature at the deepest possible level. It also provides a strong foundation for graduate work in pure physics. The Applied Physics major places more emphasis on physical phenomena and hands-on experience. Thus, it is more suitable for those planning to go either directly into industrial employment or into graduate programs in certain applied fields. Since the course requirements for these two majors overlap considerably, students can easily switch from one major to the other any time before their senior year. The Physics Teaching major is designed specifically for those planning to teach physics at the secondary school level.

Students who are majoring in other disciplines are encouraged to consider a minor in physics, which includes a year of introductory physics plus eight credit hours of additional physics courses. These electives may be chosen to emphasize basic theory, experimental techniques, or applied subfields such as optics and astrophysics.

**Physics Major**

**BACHELOR DEGREE (B.S. OR B.A.)**

- **Program Prerequisite:** Not required for Physics or Applied Physics. Physics Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).

- **Minor:** No minor is required; however, a math minor is automatically satisfied by the requirements for the Physics major, and a math minor may be satisfied with one additional upper division math course beyond the minimum required for the Applied Physics major.

- **Grade Requirements:** An overall GPA of 2.00 is required for Physics and Applied Physics majors. Physics Teaching majors must achieve an overall GPA of 3.00 for admission to the Teacher Education program. Also refer to the general grade requirements for graduation on page 36.

- **Credit Hour Requirements:** A total of 120 semester credit hours is required for graduation – 75 of these are required within the Physics major, 72 within the Applied Physics Major, and 43 hours are required within the Physics Teaching major, plus the credits required by the Teacher Education department. Forty upper-division credit hours are required (courses numbered 3000 and above) – 31 of these are required within the Physics major, 26 to 31 within the Applied Physics major, and 12 upper-division physics hours within the Physics Teaching major (in addition to upper-division hours within Teacher Education).

**Advisement**

All Physics, Applied Physics, and Physics Teaching majors are strongly encouraged to meet with the chair at least annually for course and program advisement. Call 801-626-6163 for more information or to schedule an appointment. Physics Teaching majors are encouraged to also meet with a Jerry and Vickie Moyes College of Education advisor (call 801-626-6269).

**Admissions Requirements**

Declare your program of study (see page 18). There are no special admission or application requirements for the Physics and Applied Physics majors. Teaching majors must meet the Teacher Educationadmission and certification requirements (see Teacher Education Department).

**General Education**

Refer to pages 36-41 for specific requirements. The following courses required for the Physics and Applied Physics majors will satisfy general education requirements: PHYS PS/SI1210, CHEM PS/SI1210 and MATH SI1210. The following courses required for the Physics Teaching Major will satisfy general education requirements: PHYS PS/SI1010, PS1030, PS/SI2210, and Math1210.

**Course Requirements for B.S. or B.A. Degree**

**Physics Major**

**Physics Courses Required (41 credit hours)**

- PHYS PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
- PHYS 2300 Scientific Computing with C++ and Fortran (3)
- PHYS 2710 Introductory Modern Physics (3)
- PHYS 3180 Thermal Physics (3)
- PHYS 3410 Electronics for Scientists (4)
- PHYS 3500 Analytical Mechanics (3)
- PHYS 3510 Electromagnetic Theory (3)
- PHYS 3540 Mech. & Electromagnetic Waves (3)
- PHYS 3640 Advanced Physics Lab (2)
- PHYS 4610 Quantum Mechanics (3)
- PHYS 4620 Atomic, Nuclear, & Particle Physics (3)
- PHYS 4990 Seminar in Physics (1)

**Physics Electives (3 credit hours)**

Select 3 credit hours from the following 3000 and 4000 level courses.

- PHYS 3160 Astrophysics (3)
- PHYS 3190 Applied Optics (3)
- PHYS 3200 Solid State Physics (3)
- PHYS 3300 Computational Physics (3)
- PHYS 3420 Data Acquisition and Analysis (3)
- PHYS 4800 Individual Research Problems (1-3)
- PHYS 4830* Readings in Physics (1-3)
* as approved by instructor
- PHYS 4970 Senior Thesis (2)
- PHYS 4990 Senior Thesis (2)

**Support Courses Required (31 credit hours)**

- CHEM PS/SI1210/SI1220 Principles of Chemistry (10)
- MATH SI1210 Calculus I (4)
- MATH SI1220 Calculus II (4)
- MATH 2210 Calculus III (4)
- MATH 2270 Elementary Linear Algebra (3)
- MATH 2280 Ordinary Differential Equations (3)
- MATH 3710 Boundary Value Problems (3)

**Course Requirements for B.S. or B.A. Degree**

**Applied Physics Major**

**Physics Courses Required (38 credit hours)**

- PHYS PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
- PHYS 2300 Scientific Computing with C++ and Fortran (3)
- PHYS 2710 Introductory Modern Physics (3)
- PHYS 3190 Applied Optics (3)
- PHYS 3410 Electronics for Scientists (4)
- PHYS 3500 Analytical Mechanics (3)
- PHYS 3510 Electromagnetic Theory (3)
- PHYS 3540 Mech. & Electromagnetic Waves (3)
- PHYS 3640 Advanced Physics Lab (2)
- PHYS 4800 Individual Research Problems (3)
- PHYS 4990 Seminar in Physics (1)
Physics Electives (9 credit hours)
Select a minimum of nine credit hours with departmental approval from the following

PHYS 2600  Laboratory Safety (1)
PHYS 3160  Astrophysics (3)
PHYS 3180  Thermal Physics (3)
PHYS 3200  Solid State Physics (3)
PHYS 3300  Computational Physics (3)
PHYS 3420  Data Acquisition and Analysis (3)
PHYS 4610  Quantum Mechanics (3)
PHYS 4620  Atomic, Nuclear & Particle Physics (3)
PHYS 4830*  Readings in Physics (1-3)

* as approved by instructor

Support Courses Required (25 credit hours)
CHEM/SI1210/SI1220 Principles of Chemistry (10)
MATH SI2120 Calculus I (4)
MATH SI2220 Calculus II (4)
MATH 2210 Calculus III (4)
MATH 2280 Ordinary Differential Equations (3)

Course Requirements for B.S. or B.A. Degree

Physics Teaching Major

Physics Courses Required (23 credit hours)
PHYS PS/SI1010 Elementary Physics (3)
PHYS PS/SI1040 Elementary Astronomy (3)
PHYS PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
PHYS 2600 Laboratory Safety (1)
PHYS 2710 Introductory Modern Physics (3)
PHYS 4570 Secondary School Science Teaching Methods (3)

Physics Electives (9 credit hours)
Select nine credit hours in approved Physics classes (courses numbered 3000 and above, excluding PHYS 4570).

Support Courses Required (25 credit hours)
COMM HU1020 Principles of Public Speaking (3)
MATH SI2120/SI2220 Calculus I, II (8)

Students must also complete the Teacher Education Certification Program (31 credit hours) and a Teaching minor.

Suggested Course Sequence
Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

Physical Science

Bachelor Degree (B.S. or B.A.)

Program Prerequisite: Composite Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).

Minor: Not required.

Grade Requirements: A grade of ‘C’ or better in courses required for this major (a grade of ‘C-’ is not acceptable). Also refer to the general grade requirements for graduation on page 36. Teaching majors must also achieve an overall GPA of 3.00 for admission to the Teacher Education program.

Credit Hour Requirements: A total of 120 credit hours are required for graduation – a minimum of 66 of these is required within the major. A total of 40 upper division credit hours is required (courses numbered 3000 and above) – a minimum of 10 of these is required within the major.

Advisement
Teaching majors are encouraged to consult with advisors in both the College of Science (call 801-626-6160) and the College of Education (call 801-626-6299).

Admission Requirements
Declare your program of study (see page 18). Physical Science Composite Teaching majors must satisfy Teacher Education admission and certification requirements (see Teacher Education Department).

General Education
Refer to pages 36-41 for specific requirements. PSY SS1010 is recommended in the Social Science area. The following courses required for this major will also satisfy general education requirements:

CHEM PS/SI1210, GEO PS/SI1110 and PHYS PS/SI2210.

Course Requirements for B.S. or B.A. Degree

Required Courses (minimum of 49 credit hours)

• Chemistry (14 credit hours required)
CHEM PS/SI1210/SI1220 Principles of Chemistry (10)
CHEM 3000 Quantitative Analysis (4)

• Geosciences (16 credit hours required)
GEO PS/SI1110 Dynamic Earth/Physical Geology (3)
GEO SI1115 Physical Geology Laboratory (1)
GEO 1220 Historical Geology (4)
GEO 2050 Earth Materials (4)

Elective Courses
Choose one from the following:
GEO 3060 Structural Geology (4)
GEO 3150 Geomorphology (4)
GEO 3180 Paleontology (4)
GEO 3550 Sedimentology & Stratigraphy (4)

• Physics (13 credit hours required)
PHYS PS/SI2210/SI2220 Physics for Scientists & Engineers (10)

Elective Courses (3 credit hours)
Choose at least 3 hours from the following:
PHYS 2710 Introductory Modern Physics (3)
PHYS 3160 Astrophysics (3)
PHYS 3180 Thermal Physics (3)
PHYS 3190 Applied Optics (3)
PHYS 3200 Solid State Physics (3)
PHYS 3300 Computational Physics (3)
PHYS 3410 Electronics for Scientists (4)
PHYS 3420 Data Acquisition and Analysis (3)
PHYS 3500 Analytical Mechanics (3)
PHYS 3510 Electromagnetic Theory (3)
PHYS 3540 Mechanical & Electromagnetic Waves (3)
PHYS 3640 Advanced Physics Lab (2)
PHYS 4610 Quantum Mechanics (3)
PHYS 4620 Quantum Mechanics (3)

Required Electives (6 credit hours minimum)
Students must also complete 6 additional hours in one of the three following areas: Chemistry, Geosciences, or Physics.

Recommended elective courses:

Chemistry
CHEM 2310 Organic Chemistry I (5)
CHEM 2320 Organic Chemistry II (5)
CHEM 3050  Instrumental Analysis (3)
CHEM 3070  Biochemistry I (4)

Geosciences
GEO PS1060  Environmental Geosciences (3)
GEO 1065  Environmental Geosciences Lab (1)
GEO SI5010  Oceanography and Earth Systems (3)
GEO 3060  Structural Geology (4)
GEO 3080  Water Resources (3)
GEO 3150  Geomorphology (4)
GEO 3180  Paleontology (4)
GEO 3250  Geology of Utah (3)
GEO 3400  Remote Sensing (4)
GEO 3550  Sedimentology & Stratigraphy (4)
GEO 3880  Ground Water (4)
GEO 4060  Geoscience Field Methods (2)
GEO 4630  Global Tectonics (3)
GEO 4950*  Advanced Geoscience Fieldtrips (1-3)

*No more than 3 credits may be taken from GEO 4950.

Physics

Select 6 hours from the physics electives listed above. The courses selected for this requirement must be in addition to any course taken to fulfill the physics elective requirement.

Support Courses Required (18 credit hours)
MATH SI1210/SI1220  Calculus I & II (8)
PHYS 2600  Laboratory Safety (1)
or CHEM 2600  Laboratory Safety (1)
or GEO 2600  Laboratory Safety (1)
HIST 3350  History & Philosophy of Science (3)
or ZOOL 2800  History of Life Science (3)
COMM HU1020  Public Speaking (3)
CHEM 4570  Science Teaching Methods (3)
or GEO 4570  Science Teaching Methods (3)
or PHYS 4570  Science Teaching Methods (3)

Students must also complete the Teacher Education Certification Program (32 credit hours).

Course Requirements for Minor
Physics Courses Required (10 credit hours)
PHYS PS/SI2210/SI2220  Physics for Scientists & Engineers (10)

Elective Physics Courses (8 credit hours)
Select at least three Physics courses from the following
PHYS 2710  Introductory Modern Physics (3)
PHYS 3160  Astrophysics (3)
PHYS 3180  Thermal Physics (3)
PHYS 3190  Applied Optics (3)
PHYS 3200  Solid State Physics (3)
PHYS 3300  Computational Physics (3)
PHYS 3410  Electronics for Scientists (4)
PHYS 3420  Data Acquisition and Analysis (3)
PHYS 3500  Analytical Mechanics (3)
PHYS 3510  Electromagnetic Theory (3)
PHYS 3540  Mech. & Electromagnetic Waves (3)
PHYS 3640  Advanced Physics Lab (2)
PHYS 4610  Quantum Mechanics (3)

Support Courses Required (8 credit hours)
MATH SI1210/SI1220  Calculus I & II (8)

DEPARTMENTAL HONORS

» Program Prerequisite: Enroll in General Honors Program and complete at least 9 hours of General Honors courses (see the Honors Program on page 43).

» Credit Hour Requirements: Maintain an overall GPA of 3.5.

» Credit Hour Requirements: Fulfill the requirements of either the Physics departmental major, the Applied Physics major, or the Physics Teaching major, of which at least 12 hours must be completed on an Honors basis. A student may receive Physics Honors credit in any of the Physics courses required for the respective Physics majors.* In addition, complete a Physics Honors senior project (minimum 2 hours).

* Permission from the department chair should be sought before registering in a course for Honors credit. A written agreement should be reached with the appropriate professor regarding the work expected for Honors credit. (See the Honors Program on page 43.)

MINOR

» Grade Requirements: A grade of "C" or better in all courses used toward the minor (a grade of "C-" is not acceptable).

» Credit Hour Requirements: Minimum of 26 credit hours in Physics and support courses. Prior department approval is required.

Course Requirements for Minor
Physics Courses Required (11 credit hours)
PHYS PS/SI2210/SI2220  Physics for Scientists & Engineers (10)
PHYS 2600  Laboratory Safety (1)

Elective Physics Courses (6 credit hours)
Select 6 credit hours in approved Physics courses (numbered 2740 and above)

Support Courses Required (8 credit hours)
MATH SI1210/SI1220  Calculus I & II (8)

If a student is not obtaining a Teaching Major in Physical or Life Science, the following course is also required:
PHYS 4570  Secondary School Science Teaching Methods (3)

PHYSICS COURSES - PHYS

PHYS PS/SI1010. Elementary Physics (3)  Su, F, S
A brief survey of physics at the introductory level. Topics covered include laws of motion, gravity, energy, light, heat, sound, electricity, magnetism, atomic and nuclear physics, radioactivity, and relativity. Three hours of lecture per week.

PHYS PS/SI1040. Elementary Astronomy (3)  Su, F, S
A brief survey of the physical universe using the fundamental laws of physics. Topics include the history of astronomy, the solar system, the sun, the evolution of stars, pulsars, black holes, the Milky Way galaxy, galaxies, quasars, and the Big Bang. Three hours of lecture per week.
PHYS PS/SI1360. Principles of Physical Science (3) S
A lecture/laboratory course designed to provide an introduction to the scientific method and its application to the study of selected topics in physics and chemistry. Two hours of lecture and one 3-hour lab per week. Recommended for Elementary Education majors.

PHYS PS/SI2010. College Physics I (5) Su, F, S
First semester of a two-semester sequence in general physics, primarily for students in pre-medicine, pre-dentistry, technology and other disciplines requiring physics without calculus. This semester covers topics in mechanics, including kinematics, Newton's laws, and the conservation laws of energy, linear momentum, and angular momentum. Also covered are topics in gravity, fluid mechanics, waves, and thermodynamics. Prerequisite: MATH 1060. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week (PHYS 2019).

PHYS 2015. College Physics I Lab (1) Su, F, S
Co-requisite PHYS PS/SI2010. One 3-hour lab per week. Enrollment limited to transfer students.

PHYS SI2020. College Physics II (5) Su, F, S
Second semester of a two-semester sequence in general physics. This semester covers topics in electricity and magnetism, electromagnet, waves, and optics, and atomic physics. Prerequisite: PHYS PS/SI2010. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week (PHYS 2029).

PHYS 2025. College Physics II Lab (1) Su, F, S
Co-requisite PHYS SI2020. One 3-hour lab per week. Enrollment limited to transfer students.

PHYS 2090. Environmental Physics - Energy and Power (3)
An interdisciplinary course dealing with the chemical and physical concepts of energy and power. Emphasis will be placed on the emerging energy crisis, effects upon the environment and the quality of life.

PHYS PS/SI2210. Physics for Scientists and Engineers I (5) F, S
First semester of a two-semester sequence in calculus-based physics, primarily for students in science, math, computer science, and pre-engineering. This semester covers topics in electricity and magnetism, electromagnetic waves, light and optics, relativity, atomic, and nuclear physics. Prerequisite: MATH SI1210. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week (PHYS 2219).

PHYS 2215. Physics for Scientists and Engineers I Lab (1) F, S
Co-requisite PHYS PS/SI2210. One 3-hour lab per week. Enrollment limited to transfer students.

PHYS SI2220. Physics for Scientists and Engineers II (5) F, S
Second semester of a two-semester sequence in calculus-based physics. This semester covers topics in electricity and magnetism, electromagnetic waves, light and optics, relativity, and quantum, atomic, and nuclear physics. Prerequisite: PHYS PS/SI2210. Co-requisite: MATH SI1220. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week (PHYS 2229).

PHYS 2225. Physics for Scientists and Engineers II Lab (1) F, S
Co-requisite PHYS SI2220. One 3-hour lab per week. Enrollment limited to transfer students.

PHYS 2300. Scientific Computing with C++ and Fortran (3) F
Introduction to the C, C++, and Fortran programming languages. General programming theory and practice. Introduction to applications of computers and computer programming in the sciences. Prerequisites: MATH QL1050 and MATH 1060 or MATH QL 1080 or placement test.

PHYS 2600. Laboratory Safety (1) F, S
An interdisciplinary, team-taught course that will be an overview of the major chemical, biological and physical safety issues related to science laboratories and field work. Class will meet once per week and will be taught in a lecture/demonstration format.

PHYS 2710. Introductory Modern Physics (3) S
Relativity, quantum effects, the hydrogen atom, many-electron atoms, molecular and solid-state bonding, quantum effect devices, nuclear structure, nuclear reactions and devices, elementary particles. Prerequisites: PHYS SI2220, MATH SI1220.

PHYS 2800. Introductory Individual Research Problems (1-3) Su, F, S
Time and credit to be arranged. Intended for students working on a directed research project which includes physics at the lower division level for one or more semesters. Prerequisite: Consent of instructor.

PHYS 2830. Introductory Readings in Physics (1-3) Su, F, S
Time and credit to be arranged. Intended for students working on a directed research project which includes physics at the lower division level for one or more semesters. Prerequisite: Consent of instructor.

PHYS 2850. Cooperative Work Experience (1-6) Su, F, S
Open to all students in the Physics Department who meet the minimum Cooperative Work Experience requirements of the department. Provides academic credit for on-the-job experience. Grade and amount of credit will be determined by the department.

PHYS 2890. Cooperative Work Experience (1-6) Su, F, S
Open to all students in the Physics Department who meet the minimum Cooperative Work Experience requirements of the department. Provides academic credit for on-the-job experience. Grade and amount of credit will be determined by the department.

PHYS 2920. Short Courses, Workshops, Institutes and Special Programs (1-4)
Consult the class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

PHYS 3160. Astrophysics (3) F
Selected topics in astrophysics which may include telescopes, celestial mechanics, stellar structure and evolution, stellar pulsation, supernovae, black holes, interstellar medium, galactic structure, active galaxies, quasars, galactic clusters and super clusters, and cosmology. Prerequisite: PHYS SI2220.

PHYS 3180. Thermal Physics (3) S
An introduction to thermodynamics and statistical mechanics. Topics include heat and work; ideal gas; equipartition of energy; entropy; the Boltzmann, Fermi-Dirac, and Bose-Einstein distributions; applications to heat engines, refrigeration, chemical equilibrium, phase transitions, blackbody radiation, and properties of solids. Prerequisite: PHYS SI2220 and MATH SI1220.

PHYS 3190. Applied Optics (3) F
Geometrical and physical optics, lasers, lenses, optical instruments, interference, thin films, holography, diffraction, gratings, crystal diffraction, polarization. Prerequisites: PHYS SI2220, MATH SI1220. Two lectures and one 3-hour lab a week.

PHYS 3200. Solid State Physics (3) S (alternate years - even)
Modern theory of the solid state, with emphasis on crystal structures, energy bands and fermi levels, conduction in metals and semiconductors, Hall effect, photoconductivity, junction diodes and
transistors, field effect transistors, integrated circuit structure and fabrication. Co-requisite: PHYS 2710.

**PHYS 3300. Computational Physics (3) S (alternate years - odd)**

Computational techniques are discussed in the context of addressing important physical problems. Topics may include root-finding algorithms, curve fitting, interpolation methods, linear systems, numerical integrations, differential equations, boundary value problems, finite difference methods, eigenvalue problems, Fourier analysis, and Monte Carlo methods. Prerequisites: PHYS SI2220, PHYS 2300.

**PHYS 3410. Electronics for Scientists (4) F**

An introductory course in electronics for students in physics and other sciences. The course includes D.C. and a.c. circuit analysis using complex impedances and covers basic principles of semiconductor operation, transistors, analog and digital integrated circuits, analog-to-digital conversion techniques used in computer interfacing, and noise. Prerequisite: PHYS SI2220. Three lectures and one 3-hour lab a week.

**PHYS 3420. Data Acquisition and Analysis (3) S (alternate years - odd)**

Intermediate-level course in computer interfacing (data acquisition and analysis) for students in physics and all other sciences. Topics may include: data acquisition with industry-standard software packages, computerized test and measurement, analog-to-digital and digital-to-analog conversion, data acquisition electronics, electronic sensors (thermal sensors, light sensors, etc.), least squares curve fitting, fast Fourier transforms (FFT), Nyquist's theorem, noisy and weak signals. Prerequisite: PHYS SI2020 or SI2220. Two lectures and one 3-hour lab a week.

**PHYS 3500. Analytical Mechanics (3) F**

Particle motion, oscillating systems; planetary motion, stability of orbits; collisions; Euler's equations, gyroscopic motion; Lagrange's equations, Hamilton's equations, theory of vibrations. Prerequisites: PHYS SI2220 and MATH 2280.

**PHYS 3510. Electromagnetic Theory (3) F**

Vector analysis; electrostatics; calculating electric potentials; solving Laplace's equation; multipole expansions; electrostatic fields in matter; magnetostatics; charges in motion; electrodynamics; Faraday's law; Maxwell's equations. Prerequisites: PHYS SI2220, MATH 2210 and MATH 2280.

**PHYS 3540. Mechanical and Electromagnetic Waves (3) S**

Periodic motions, free and forced vibrations; resonance; normal modes; dispersion; boundary conditions; electromagnetic waves and light; the Fresnel equations; electromagnetic radiation from accelerating charges. Prerequisites: PHYS 3500, 3510.

**PHYS 3640. Advanced Physics Laboratory (2) S**

Advanced experiments in the areas of mechanics, electricity and magnetism, modern physics, and nuclear physics. Introduction to computerized data acquisition and data analysis. Two two-hour labs each week. Prerequisite: PHYS SI2220 and PHYS 3410.

**PHYS 4570. Secondary School Science Teaching Methods (3) F**

Acquaintance with the various methods and curriculum of secondary school science. Two lectures and one 3-hour lab a week. It is recommended that this course be completed before student teaching. Prerequisites: PHYS SI2220 or approval of instructor, and admission to the Teacher Education Program.

**PHYS 4610. Quantum Mechanics (3) F**

Wave-particle duality, Schrodinger equation, wave function, quantization rules, one-dimensional motion, one-electron atoms, spin and orbital angular momentum. Prerequisites: PHYS 2710, MATH 2270. Co-requisites: PHYS 3500; MATH 3710.

**PHYS 4620. Atomic, Nuclear, and Particle Physics (3) S**

Approximation methods, multi-electron atoms, atomic radiation, nuclear models, nuclear decay, fission and fusion, nuclear forces, elementary particles, quark model, strong and electroweak interactions, unified field theories. Prerequisite: PHYS 4610.

**PHYS 4800. Individual Research Problems (1-3) Su, F, S**

Time and credit to be arranged. Open to qualified students for one or more semesters. Prerequisite: consent of instructor.

**PHYS 4830. Readings in Physics (1-3) Su, F, S**

Topics which can be studied include (but are not limited to): mechanics, thermodynamics, kinetic theory, statistical mechanics, electronics, electromagnetism, optics, solid-state physics, modern physics, nuclear physics, relativity, cosmology, and astrophysics. These courses may be taken at any time on a personalized basis. Time and credit to be arranged. May be repeated. Prerequisite: consent of instructor.

**PHYS 4890. Cooperative Work Experience (1-6) Su, F, S**

A continuation of PHYS 2890. Open to all students.

**PHYS 4920. Short Courses, Workshops, Institutes and Special Programs (1-4)**

Consult the class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.

**PHYS 4970. Senior Thesis (2) Su, F, S**

An individual research program pursued under faculty supervision. It is expected that one or more semesters of research (PHYS 4800) will precede registration for this course. Course evaluation will include an oral and a written report. Prerequisites: senior class standing and consent of departmental committee.

**PHYS 4990. Seminar in Physics (1) F, S**

Joint sessions of faculty and students devoted to current topics in physics. Students taking this course for credit will make a presentation based on individual library research of a topic agreed on with the faculty advisor. One credit required for physics majors. May be taken twice for credit. Prerequisite: previous upper division physics course.

**PHYS 5030. Physics for Teachers (2-3)**

Science content course for teachers in the M.Ed. Science Emphasis Program. To register, select another departmental course and develop a contract detailing additional work required for graduate credit. Course may be repeated. Contract must be approved by instructor, department chair, and Director of the Master of Education Program.

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**DEPARTMENT**

**Zoology**

Chair: Dr. Samuel I. Zeveloff
Location: Science Lab, Room 402
Telephone Contact: Tara Archer 801-626-6165

Professors: J. Neil Jensen, Ron A. Meyers, John F. Mull, Robert K. Okazaki, Samuel I. Zeveloff; Associate Professors: John F. Cavitt, Jonathan B. Clark; Assistant Professors: Nicole Okazaki, Barbara Trask

Zoology is the study of animals. It includes a tremendous diversity of subdivisions and approaches. These range from using electron microscopy to study cells, to field examinations of natural populations. Some zoologists focus their studies on a specific group of animals; others specialize on problems
or processes, such as those in physiology or genetics, which are common to many groups. Zoologists have made many important contributions to our understanding of the natural world. Furthermore, they benefit humankind through their work in areas such as medicine and environmental conservation.

Although our majors pursue several tracks, many are involved in premedical professional training. We have an excellent record of placing students in the finest medical, dental, veterinary, and physical therapy programs. The faculty strongly encourage majors to pursue guided research, particularly through the department’s thesis program.

All students are urged to consult with the department early in their education. Arrangements can then be made for the student to be matched with an appropriate advisor who can offer course and career suggestions.

DNA Laboratory

The Department of Zoology maintains a DNA Laboratory on the first floor of the Science Laboratory building in the College of Science. It is a modern facility with state-of-the-art equipment for DNA isolation and analysis. The laboratory is used for student course work, faculty-supervised student research, and faculty research. It is the only such facility in the state dedicated to undergraduate use.

**Zoology Major**

**Bachelor Degree (B.S.)**

- **Program Prerequisite:** Not required.
- **Minor:** Required.
- **Grade Requirements:** Zoology majors must have an average GPA of 2.00 or higher. Students are required to earn a grade of "C-" in each prerequisite course before taking the next course.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation – 41 of these are required within Zoology. A total of 40 upper division hours is required (courses number 3000 and above) – 32 of these are required within the major.

**Advisement**

All Zoology students are encouraged to meet with a faculty advisor at least annually for course and program advisement. The department secretary can also assist students. Call 801-626-6165 for more information or to schedule an appointment.

**Admissions Requirements**

Declare your program of study (see page 18). There are no special admission or application requirements for this major.

**General Education**

Refer to pages 36-41 for either Bachelor of Science or Bachelor of Arts education requirements. The following Zoology courses will satisfy general education requirements: ZOOL LS1010, LS1020, and LS1370. Students are encouraged to take general education courses concurrently with courses in the major.

**Course Requirements for B.S. Degree**

**Zoology Courses Required (29 credit hours)**

<table>
<thead>
<tr>
<th>Zoology Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL 31110</td>
<td>Principles of Zoology I (4)</td>
</tr>
<tr>
<td>ZOOL 31120</td>
<td>Principles of Zoology II (4)</td>
</tr>
<tr>
<td>ZOOL 1990</td>
<td>Zoology Orientation (1)</td>
</tr>
<tr>
<td>ZOOL 3200</td>
<td>Cell Biology (4)</td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>Genetics (4)</td>
</tr>
<tr>
<td>ZOOL 3450</td>
<td>Ecology (4)</td>
</tr>
<tr>
<td>ZOOL 3720</td>
<td>Evolution (3)</td>
</tr>
<tr>
<td>ZOOL 3790</td>
<td>Comparative Vertebrate Anatomy (4)</td>
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<tr>
<td>ZOOL 4100</td>
<td>Vertebrate Embryology (4)</td>
</tr>
<tr>
<td>ZOOL 4120</td>
<td>Histology (4)</td>
</tr>
<tr>
<td>ZOOL 4060*</td>
<td>Comparative Physiology (4)</td>
</tr>
<tr>
<td>ZOOL 4210*</td>
<td>Advanced Human Physiology (4)</td>
</tr>
<tr>
<td>ZOOL 4220*</td>
<td>Endocrinology (4)</td>
</tr>
</tbody>
</table>

*If not taken as a required course*

<table>
<thead>
<tr>
<th>Zoology Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ZOOL 4250</td>
<td>Radiation Biology (4)</td>
</tr>
<tr>
<td>ZOOL 4300</td>
<td>Molecular Genetics (4)</td>
</tr>
<tr>
<td>ZOOL 4350</td>
<td>Animal Behavior (4)</td>
</tr>
<tr>
<td>ZOOL 4470</td>
<td>Wildlife Ecology and Management (4)</td>
</tr>
<tr>
<td>ZOOL 4480</td>
<td>Aquatic Ecology (4)</td>
</tr>
<tr>
<td>ZOOL 4500</td>
<td>Parasitology (4)</td>
</tr>
<tr>
<td>ZOOL 4600</td>
<td>Protozoology (4)</td>
</tr>
<tr>
<td>ZOOL 4640</td>
<td>Entomology (4)</td>
</tr>
<tr>
<td>ZOOL 4650</td>
<td>Ichthyology (4)</td>
</tr>
<tr>
<td>ZOOL 4660</td>
<td>Herpetology (4)</td>
</tr>
<tr>
<td>ZOOL 4670</td>
<td>Ornithology (4)</td>
</tr>
<tr>
<td>ZOOL 4680</td>
<td>Mammalogy (4)</td>
</tr>
<tr>
<td>ZOOL 4800*</td>
<td>Problems in Zoology (1-4)</td>
</tr>
<tr>
<td>ZOOL 4830*</td>
<td>Readings in Zoology (1-4)</td>
</tr>
<tr>
<td>ZOOL 4890*</td>
<td>Cooperative Work Experience (1-4)</td>
</tr>
</tbody>
</table>

*No more than 4 combined hours of ZOOL 4800, ZOOL 4830, or ZOOL 4890 may count toward the major.*

**Elective Zoology Courses (12 credit hours)**

Select a minimum of 12 upper division credit hours. Only one of ZOOL 4060, ZOOL 4210 or ZOOL 4220 may be counted, whichever one was not taken as the required course.

<table>
<thead>
<tr>
<th>Zoology Course</th>
<th>Title</th>
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</thead>
<tbody>
<tr>
<td>ZOOL 3340</td>
<td>Information Resources in the Life Sciences (2)</td>
</tr>
<tr>
<td>ZOOL 3470</td>
<td>Zoogeography (3)</td>
</tr>
<tr>
<td>ZOOL 3500</td>
<td>Conservation Biology (3)</td>
</tr>
<tr>
<td>ZOOL 3730</td>
<td>Population Biology (3)</td>
</tr>
<tr>
<td>ZOOL 4050</td>
<td>Comparative Vertebrate Anatomy (4)</td>
</tr>
<tr>
<td>ZOOL 4100</td>
<td>Vertebrate Embryology (4)</td>
</tr>
<tr>
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<td>Histology (4)</td>
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<tr>
<td>ZOOL 4210*</td>
<td>Advanced Human Physiology (4)</td>
</tr>
<tr>
<td>ZOOL 4220*</td>
<td>Endocrinology (4)</td>
</tr>
</tbody>
</table>

Zoology majors must have an average GPA of 2.00 or higher. Students are required to earn a grade of "C-" in each prerequisite course before taking the next course.

**Support Courses Required**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM PS/SI1110</td>
<td>Elementary Chemistry (5)</td>
</tr>
<tr>
<td>&amp; CHEM SI1120</td>
<td>Elementary Organic Bio-Chemistry (5)</td>
</tr>
</tbody>
</table>

or

CHEM PS/SI1210/SI1220 Principles of Chemistry (10) & CHEM 2310/2320 Organic Chemistry (10)

CHEM 3070 may be taken instead of CHEM 2320.

Premedical professional students should take CHEM 1210/1220 and CHEM 2310/2320.
Students planning to attend graduate or professional schools are encouraged to take a class in the Calculus series (MATH SI1210/SI1220). Premedical professional students are required to take one year of mathematics.

Students should take PHYS PS/SI1010 Elementary Physics (3)
or PHYS PS/SI2010/SI2020 General Physics (10)
or PHYS PS/SI2110/SI2120 Calculus Physics (10)

Additional credit hours in Zoology or other electives are needed to bring your total to 120 semester credits and 40 upper division credits.

Furthermore, they should meet with the advisors of these programs, each of whom is listed in that section. The Department of Zoology offers lower and upper level courses that provide superb training for examinations such as the Medical College Admissions Test, as well as medical school courses. Students should meet with the appropriate advisor for specific course suggestions.

Ecological/Environmental Training
Students interested in ecologically or environmentally oriented careers should follow the Zoology major and select courses to fill their elective requirements from the following:

Zoology Course Electives
- ZOOL 3500 Conservation Biology (3)
- ZOOL 4300 Molecular Genetics (4)
- ZOOL 4470 Wildlife Ecology and Management (4)
- ZOOL 4480 Aquatic Ecology (4)
- ZOOL 4640 Entomology (4)
- ZOOL 4650 Ichthyology (4)
- ZOOL 4660 Herpetology (4)
- ZOOL 4670 Ornithology (4)
- ZOOL 4680 Mammary (4)

Support Course Electives in Botany
- BTNY 3624 Taxonomy of Vascular Plants (4)
- BTNY 3473 Plant Geography (3)

Students desiring employment as a conservation officer should minor in Criminal Justice with a Law Enforcement concentration (see Criminal Justice section of the catalog). Students desiring a career as a wildlife biologist or wildlife manager, or intending to pursue advanced studies in ecology or conservation biology following graduation (M.S. or Ph.D. degrees), should minor in Botany. (Consult with the department secretary at 801-626-6165 for information about the advisor of this program).

Biology Composite Teaching Major

BACHELOR DEGREE (B.S. OR B.A.)

Advisor: Dr. Sharon Ohlhorst, Director, Center for Science Education 801-626-6160.

- Program Prerequisite: Must meet the Teacher Education admission and certification requirements (see Teacher Education Department).
- Minor: Not required.
- Grade Requirements: A grade of "C" or better in courses required for this major (a grade of "C-" is not acceptable). An overall GPA of 3.00 is required for admission to the Teacher Education Program.

- Credit Hour Requirements: A total of 126 credit hours is required for graduation – 73 of these are required in the major and 32 hours for Teacher Education Certification. A total of 58 upper division hours is required (courses numbered 3000 and above) – 26 of these are biology courses and 32 are Teacher Education courses.

Advisement
Teaching majors are encouraged to consult with advisors in both the College of Science (call 801-626-6160) and the College of Education (call 801-626-6269).

Admission Requirements
Declarer your program of study (see page 18). Biology Composite Teaching majors must satisfy Teacher Education admission and certification requirements (see Teacher Education Department in this catalog).

General Education
Refer to pages 36-41 or either Bachelor of Science or Bachelor of Arts requirements. The following courses are required for the Biology Composite Teaching Major.

Suggested Course Sequence
Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

Additional credit hours in Zoology or other electives are needed to bring your total to 120 semester credits and 40 upper division credits.

ZOOI 3200, 3300, 3470, 3720, and the physiology requirement do not have to be taken in the order listed above, but ideally should be completed in the sophomore and junior years.

Preprofessional students or students considering graduate school may need to add further or different courses in Chemistry, Physics, and Math. See earlier material and that in the Pre-medical and related sections. Consult with the appropriate advisor.

Special Emphases

Premedical Professional Training
Students considering application to medical, dental, veterinary, physical therapy, optometry, and pharmacy schools should consult the beginning of the College of Science section of this catalog.
Composite Teaching major also will satisfy general education requirements: MICR LS/SI2054, GEO PS/SI1110, CHEM PS/SI1110 or CHEM PS/SI2120, PHYS PS/SI1010, COMM HU1020, and MATH QL1050 (15 credit hours).

Course Requirements for B.S. Degree

Biological Science Courses Required (47 credit hours)
- BTNY SI2104 Plant Form and Function (4)
- or BTNY SI2114 Evolutionary Survey of Plants (4)
- BTNY 3624 Taxonomy of Vascular Plants (4)
- MICR LS/SI2054 Principles of Microbiology (4)
- ZOOL SI1110/1120 Principles of Zoology I & II (8)
- ZOOL 2200 Human Physiology (4)
- ZOOL 3300 Genetics (4)
- ZOOL 3720 Evolution (3)
- ZOOL 4570 Science Teaching Methods (3)
- BTNY 3454 Plant Ecology (4)
- or ZOOL 3450 Ecology (4)
- BTNY 2600 Laboratory Safety (1)
- or MICR 2600 Laboratory Safety (1)

Biology Electives (7 credit hours)

Additional biological science courses needed to meet the minimum 47 credit hour requirement should be discussed in advance with the advisor.

Support Courses Required (26-28 credit hours)
- CHEM PS/SI1110 Elementary Chemistry (5)
- & CHEM SI1120 Elementary Organic Bio-Chemistry (5)
- or CHEM PS/SI1210/SI1220 Principles of Chemistry I & II (10)
- GEO PS/SI1110 Dynamic Earth: Physical Geology (3)
- PHYS PS/SI1010 Elementary Physics (3)
- or PHYS PS/SI2010 College Physics I (5)
- MATH QL1050 College Algebra (4)
- HIST 3350 History & Philosophy of Science (3)
- or ZOOL 2800 History of the Life Sciences (3)
- COMM HU1020 Public Speaking (3)

It is recommended that more advanced courses in Mathematics, Physics and Chemistry be taken, especially if graduate studies are planned.

Suggested Course Sequence

Please refer to this program in the online catalog (weber.edu/catalog) and/or contact the department for a suggested course sequence.

ZOOLOGY

MINOR

- **Grade Requirements**: A grade of "C-" or better in courses used toward the minor.
- **Credit Hour Requirements**: Minimum of 19 credit hours in Zoology courses.

Course Requirements for Minor

Zoology Courses Required (19 credit hours)
- ZOOL SI1110 Principles of Zoology I (4)
- ZOOL SI1120 Principles of Zoology II (4)
- ZOOL 3720 Evolution (3)
- or BTNY 4113 Plant Evolution (3)

Elective Zoology Courses (8 credit hours)
Select 8 credit hours of Zoology courses at or above the 2000 level.

ZOOLOGY

TEACHING MINOR

- **Grade Requirements**: A grade of "C-" or better in courses used toward the minor.
- **Credit Hour Requirements**: A minimum of 22 credit hours.

Students who select the Zoology Teaching Minor must satisfy the Teacher Education admission and certification requirements (see Teacher Education Department).

Course Requirements for Teaching Minor

Zoology Courses Required (11 credit hours)
- ZOOL SI1110 Principles of Zoology I (4)
- ZOOL SI1120 Principles of Zoology II (4)
- ZOOL 3720 Evolution (3)
- or BTNY 4113 Plant Evolution (3)

Elective Zoology Courses (minimum 8)
Select at least 8 credit hours at the 2000 level or above.

Required Support Courses (3 credit hours)
- HIST 3350 History & Philosophy of Science (3)
- or ZOOL 2800 History of Life Sciences (3)

BIOTECHNICIAN TRAINING PROGRAM

ASSOCIATE OF SCIENCE AND CERTIFICATE

The Department of Zoology participates with the Departments of Botany and Microbiology in the Associate of Science degree and 3rd year Certificate in Biotechnician training for the biotechnology industry. This program is described earlier in this College of Science section of this catalog.

URBAN AND REGIONAL PLANNING

EMPHASIS

This program provides a special emphasis in Urban and Regional Planning for majors in Botany, Engineering, Geography, Geosciences, Microbiology, Political Science, Sociology, Zoology, and related fields. (See the Interdisciplinary Programs section of this catalog.)

ZOOLOGY COURSES - ZOOL

ZOOL LS1010. Animal Biology (3)
A non-major’s introduction to the challenges faced by animals as they obtain and use materials, energy, and information from their environment. A central theme will be the diversity of responses resulting from evolutionary processes. The course will also consider...
mechanisms of inheritance and development. Three lecture/discussion hours a week.

ZOOL LS1020. Human Biology (3)
Survey course for non-Zoology majors. Course content includes basic structure and function of the human body, homeostasis, heredity, human evolution, and ecology. Implications pertaining to personal health, bioethical concerns, environmental issues, and their impact on society will be examined. Three lecture/discussion hours a week.

ZOOL SI1110. Principles of Zoology I (4)
A major's introduction to the study of genetics, inheritance, and evolutionary processes. In addition, the diversity and comparative biology of non-vertebrate animals will be examined. Three hours of lecture and one 2-hour lab a week. ZOOL 1990 (Zoology Orientation) must be taken concurrently with this course or Principles II.

ZOOL SI1120. Principles of Zoology II (4)
A major's introduction to cellular processes and the diversity and comparative biology of vertebrate animals. Three hours of lecture and one 2-hour lab a week. Prerequisites: ZOOL SI1110 or permission of instructor. ZOOL 1990 (Zoology Orientation) must be taken concurrently with this course or Principles of Zoology I.

ZOOL LS/SI1370. Principles of Life Science (3)
A survey course recommended for elementary education majors. Course content includes cells, cell chemistry, genetics, plant and animal anatomy, plant and animal classification, physiology, immune systems, evolution, and ecology. Unifying concepts of all living things will be emphasized. Two lecture hours and one 3-hour lab a week.

ZOOL 1990. Zoology Orientation (1)
This seminar consists of faculty, staff, and professional presentations which will inform students of potential research opportunities in the department and career possibilities in the discipline. One hour a week. This course should be taken concurrently with ZOOL SI1110 or SI1120.

ZOOL 2100. Human Anatomy (4)
Structure of the human body organs/systems. Three lecture hours and one 2-hour lab a week.

ZOOL 2200. Human Physiology (4)
Functional consideration of the human body. Recommended for all curricula for which a basic understanding of body functions is required. Three lecture hours and one 2-hour lab a week.

ZOOL 2800. History of Life Sciences (3)
Examination of the ways in which interaction among personalities, instrumentation, and ideas shape the development of biology – past, present, and future. Three lecture hours a week.

ZOOL 2900. Topics in Zoology (1-4)
Variable topics related to zoology as announced in the class schedule; may include medical entomology, biostatistics, primatology, etc., and may be taught with a laboratory section. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 2920. Short Courses, Workshops, Institutes and Special Programs (1-4)
Consult class schedule for offerings under this number. The specific title and credit authorized will appear on the student transcript. Prerequisites vary and are determined by instructor.

ZOOL 3200. Cell Biology (4)
The study of the molecular composition of cells, their evolutionary origins, structural organization, functional variation, and regulatory control. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor. Organic Chemistry recommended.

ZOOL 3300. Genetics (4)
Principles and concepts of classical and modern genetics. A course for biological science majors. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and ZOOL SI1120, or approval of instructor. Algebra and Organic Chemistry strongly recommended.

ZOOL 3340. Information Resources in the Life Sciences (2)
A practical introduction to the literature and information resources of the life sciences. Students will expand their research skills and be able to develop effective research strategies to find and synthesize information available in academic libraries. Cross listed in Botany, Library Sciences and Microbiology. Two lecture hours a week. Prerequisite: ENGL EN2010.

ZOOL 3450. Ecology (4)
Study of the relationships of organisms and their environment. Three lecture hours and one 3-hour lab or field trip a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 3470. Zoogeography (3)
The study of factors controlling the distribution of animals with emphasis on the vertebrates. Three lecture hours a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 3500. Conservation Biology (3)
The study of how biological principles and concepts are used in conservation. Major emphasis on the preservation and management of biodiversity. Connections between biological and societal issues are explored. Three lecture hours a week. Prerequisites: Zool1110 and SI1120, or approval of instructor.

ZOOL 3720. Evolution (3)
The patterns and processes involved in changes in natural populations. Three lecture hours a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 3730. Population Biology (3)
Principles of genetics and ecology at the population level. Three lecture hours a week. Prerequisites: ZOOL SI1110, SI1120, and 3300, or approval of instructor.

ZOOL 4050. Comparative Vertebrate Anatomy (4)
Dissection-based, in-depth comparative study of vertebrate functional anatomy. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4060. Comparative Physiology (4)
A comparative and evolutionary approach to the study of the way animals function in a variety of environments. Three lecture hours and one three-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4100. Vertebrate Embryology (4)
A study of the principles and processes of embryological development in animals. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4120. Histology (4)
Microanatomical study of the structure and function of vertebrate tissues and organs, with an emphasis on human systems. Prerequisites: ZOOL SI1110, SI1120, either 2100 or 4050, or approval of instructor.

ZOOL 4210. Advanced Human Physiology (4)
A study of vertebrate physiological processes with human emphasis, focusing on cardiovascular, digestive, and neuromuscular systems.
Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL 1110 and SI1120, or approval of instructor; a minimum of one year of (preferably Organic) Chemistry.

ZOOL 4220. Endocrinology (4)
The comparative study of the function of the cells, tissues, glands, and organs that secrete hormones and how these hormones affect the physiology of organisms, from invertebrates to vertebrates. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, and either ZOOL 2200 or 4060, or approval of instructor.

ZOOL 4250. Radiation Biology (4)
The study of harmful effects of radiation and practical applications of radioactive tracer techniques to biological problems. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110, SI1120, and beginning courses in chemistry and physics, or approval of instructor.

ZOOL 4300. Molecular Genetics (4)
A cooperative learning approach to concepts, ideas, and issues pertaining to genetic structure and function at the molecular level, with emphasis on eukaryotic organisms. Three lecture hours and one 3-hour lab per week. Prerequisites: ZOOL 3300, MATH QL1050, Organic Chemistry, or approval of instructor.

ZOOL 4350. Animal Behavior (4)
Principles and concepts of animal behavior emphasizing evolution of behavior, and the role of behavior in adaptations of animals to their environment. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4470. Wildlife Ecology and Management (4)
Principles of wildlife ecology and the techniques of wildlife population analysis and manipulation. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110, SI1120, and 3450, or approval of instructor. Writing intensive course.

ZOOL 4480. Aquatic Ecology (4)
Study of the physical, chemical, and biological interactions of freshwater and marine ecosystems. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110, SI1120, and ZOOL 3450, or approval of instructor. Writing intensive course.

ZOOL 4490. Tropical Marine Ecology (4)
Study of the physical, chemical and biological interactions of tropical marine ecosystems, including open oceans, mangrove forests, seagrass beds, and coral reefs. Intensive, three-week, full-time field course taught in the tropics. Independent projects required. Must be able to snorkel or SCUBA dive. Prerequisites: ZOOL 1110, 1120, and 3450, or approval of instructor.

ZOOL 4500. Parasitology (4)
Survey of representative external and internal parasites of humans, domestic animals, and wildlife. Emphasis is on their ecology and epidemiology. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4570. Secondary School Science Teaching Methods (3)
Acquaintance with the various methods and curriculum of secondary school science. Three lectures and one 3-hour lab a week. It is recommended that this course be completed before student teaching. Prerequisites: ZOOL SI1110, and SI1120, or approval of instructor, and admission to the Teacher Education Program.

ZOOL 4600. Protozoology (4)
Structure, function and evolutionary relationships of unicellular organisms. Three lecture hours and one 3-hour lab a week. Prerequisite: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4640. Entomology (4)
Classification and biology of insects as well as their economic importance. Three lecture hours and one 3-hour lab a week. Prerequisite: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4650. Ichthyology (4)
Classification, ecology and biology of fishes and emphasis on local freshwater forms. Field trips required. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4660. Herpetology (4)
Structure, function and evolutionary relationships of amphibians and reptiles. Three lecture hours and one 3-hour lab a week. Prerequisite: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4680. Mammalogy (4)
An introduction to the mammals with special reference to species found in Utah. Three lecture hours and one 3-hour lab a week. Prerequisite: ZOOL SI1110 and ZOOL SI1120, or approval of instructor.

ZOOL 4800. Problems in Zoology (1-4)*
Directed individual research in zoology guided by faculty member. Prerequisites: ZOOL SI1110 and SI1120, and approval of instructor.*

ZOOL 4830. Readings in Zoology (1-4)*
Directed individual readings in the general area of zoology. Specific topic selected in consultation with faculty member. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4890. Cooperative Work Experience (1-4)*
Academic credit for employment in career area related to zoology guided by specific written contract design by student, employer, and Zoology Department Chair. Open to all students; requires approval by Department Chair.

*No more than 4 combined hours of ZOOL 4800, ZOOL 4830, or ZOOL 4890 may count toward the major.

ZOOL 4900. Topics in Zoology (1-4)
Variable topics related to zoology as announced in the class schedule; may include medical entomology, biostatistics, primatology, etc., and may be taught with a laboratory section. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4920. Short Courses, Workshops, Institutes and Special Programs (1-4)
Consult class schedule for offerings under this number. The specific title and credit authorized will appear on the student transcript. Prerequisites vary and are determined by instructor.

ZOOL 4950. Field Zoology (1-3)
Study conducted on an extended, supervised field trip. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor.

ZOOL 4970. Thesis (2)
An extended, individual research project planned and completed under faculty supervision. Normally, two semesters of research (ZOOL 4800) will precede registration for this course. Culmination is an oral and written report of results obtained, with the final draft of the latter being due two weeks prior to the beginning of final exam week. Prerequisites: thesis committee approved research proposal, advanced class standing, and ZOOL SI1110 and SI1120.
ZOOL 4980. Research Design (2)
A basic course in the design and analysis of scientific experiments. Two lecture hours a week. Prerequisites: minimum of two upper division Zoology courses.

ZOOL 4990. Seminar (1)
Presentations and discussion concerning a specific topic in zoology. One hour a week. Prerequisites: ZOOL SI1110 and SI1120, or approval of instructor. One semester required.

ZOOL 5030. Zoology for Teachers
Science content course for teachers in the M.Ed. Science Emphasis Program. To register, select another Zoology course and develop a contract detailing additional work required for graduating credit. Course may be repeated. Contract must be approved by instructor, Department Chair, and Director of the Master of Education Program.