The College of Science provides quality education in the natural sciences and mathematics. The college offers majors and minors in seven departments (Botany, Chemistry, Geosciences, Mathematics, Microbiology, Physics, and Zoology). The college also supports students through its Developmental Mathematics Program. The departments and programs of the College of Science support professional and graduate school preparatory programs, and contribute significantly to the general education of students by improving scientific understanding of the natural world and quantitative literacy. Education is provided through formal classes, laboratory and field experiences, and undergraduate research projects. Student learning is also supported by departmental clubs and professional preparatory organizations. The college promotes science and mathematics teaching through the Center for Science and Mathematics Education, and community outreach through such facilities as the Layton P. Ott Planetarium and Museum of Natural Science.

**Department / Area Listing**

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**Utah Center of Excellence for Chemical Technology**
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- 299

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- 299

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- 301

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- 301

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- 321

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- 327

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**Department Chairs/Directors** (area code 801)
- **Botany**: Dr. Eugene Bozniak 626-6174
- **Chemistry**: Dr. Barry Llewellyn 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 I. Zeveloff 626-6165

**Degrees Offered**

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

**A Bachelor of Science Degree Program is offered in:**
- Applied Environmental Geoscience
- Botany
- 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:**
- Biotechnology

**An Associate of Applied Science degree program is offered in:**
- Chemistry (Technician)

**Minors are offered in:**
- Biology Teaching
- Geospatial Analysis
- Botany
- Mathematics*
- Chemistry* Microbiology
- Earth Science Teaching
- Physics*
- Geology
- Zoology

*Teaching minors are also available

**Institutional Certificates are offered in:**
- Biotechnology (in addition to AS)
- Chemical Technician
- Geomatics (Applied Mapping Sciences)

**Pre-Professional Programs**
- Pre-Agriculture
- Pre-Chiropractic
- Pre-Dentistry
- Pre-Forestry
- Pre-Horticulture
- Pre-Medical
- Pre-Occupational Therapy
- Pre-Optometry
- Pre-Pharmacy
- Pre-Physical Therapy
- Pre-Physician’s Assistant
- Pre-Podiatry
- Pre-Range Management

**Location**: Science Lab, Room 611  
**Telephone Contact**: Maxine Westmoreland 801-626-6159  
**Web Site**: http://colleges.weber.edu/science/
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.

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 and the Biology Teaching Minor.

Mathematics Education courses are listed under the Department of Mathematics.

### 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 6640. The World As A Classroom (1-3) variable title
This course is designed to provide enrichment opportunities for those who undertake either domestic or foreign travel to participate in study tours, research, and other professional development experiences. It offers participants an opportunity to learn outside the classroom in locations available only through travel.

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 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:** 801-626-6653  
**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. Sharon Ohihorst  
**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. 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.

_**Layton P. 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 undergraduate 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-Professional Programs**_

For information see weber.edu/premedical/professionalprograms or call the Pre-Medical Professional Programs office 801-626-7755.

Students pursuing one of the following programs should satisfy the pre-professional requirements while completing a bachelor’s 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 post-graduate programs, students should plan their academic strategies early and with full information.

**Advisement**
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.

<table>
<thead>
<tr>
<th>Emphasis</th>
<th>Advisor</th>
<th>Room</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Chiropractic</td>
<td>Dr. Barbara Trask</td>
<td>SL 407</td>
<td>801-626-7755</td>
</tr>
<tr>
<td>Pre-Dentistry</td>
<td>Dr. Matthew Domek</td>
<td>SL 307M</td>
<td>801-626-6850</td>
</tr>
<tr>
<td>Pre-Medical</td>
<td>Dr. Barbara Trask</td>
<td>SL 407</td>
<td>801-626-7755</td>
</tr>
<tr>
<td>Pre-Optometry</td>
<td>Dr. Barbara Trask</td>
<td>SL 407</td>
<td>801-626-7755</td>
</tr>
<tr>
<td>Pre-Pharmacy</td>
<td>Dr. Don Davies</td>
<td>SL 608</td>
<td>801-626-6224</td>
</tr>
<tr>
<td>Pre-Physical &amp; Occupational Therapy</td>
<td>Valerie Herzog</td>
<td>WH 109</td>
<td>801-626-7656</td>
</tr>
<tr>
<td>Pre-Physician’s Assistant</td>
<td>Dr. Karen Nakaoka</td>
<td>SL 306M</td>
<td>801-626-7509</td>
</tr>
<tr>
<td>Pre-Podiatry</td>
<td>Dr. Barbara Trask</td>
<td>SL 407</td>
<td>801-626-7755</td>
</tr>
<tr>
<td>Pre-Veterinary Medicine</td>
<td>Dr. Ron A. Meyers</td>
<td>SL 409</td>
<td>801-626-6170</td>
</tr>
</tbody>
</table>

**General Education**
Refer to pages 37-43 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 Dr. Ezekiel R. Dumke Family Pre-Medical Program**
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 Recommended (70-71 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL SI1110</td>
<td>Principles of Zoology I (4)</td>
<td></td>
</tr>
<tr>
<td>ZOOL 2100</td>
<td>Human Anatomy (4)</td>
<td></td>
</tr>
<tr>
<td>ZOOL 2200</td>
<td>Human Physiology (4)</td>
<td></td>
</tr>
<tr>
<td>ZOOL 3200</td>
<td>Cell Biology (4)</td>
<td></td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>Genetics (4)</td>
<td></td>
</tr>
<tr>
<td>MCR LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
<td></td>
</tr>
<tr>
<td>CHEM PS/SI2120/SI2220</td>
<td>Principles of Chemistry I &amp; II (10)</td>
<td></td>
</tr>
<tr>
<td>CHEM 2310/2320</td>
<td>Organic Chemistry I &amp; II (10)</td>
<td></td>
</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</td>
<td>College Physics (10)</td>
<td></td>
</tr>
<tr>
<td>ENGL EN1010 &amp; ENGL EN2010</td>
<td>Introductory College Writing (3)</td>
<td></td>
</tr>
<tr>
<td>ENGL 2100</td>
<td>Technical Writing (3)</td>
<td></td>
</tr>
<tr>
<td>ENGL 2250 or ENGL 3210</td>
<td>Creative Writing (3)</td>
<td></td>
</tr>
<tr>
<td>COMM HU1020</td>
<td>Advanced College Writing (3)</td>
<td></td>
</tr>
<tr>
<td>MATH 1060</td>
<td>Trigonometry (3)</td>
<td></td>
</tr>
<tr>
<td>MATH QL1050 or QL1080</td>
<td>College Algebra (4)</td>
<td></td>
</tr>
<tr>
<td>or QL1080</td>
<td>Pre-calculus (5)</td>
<td></td>
</tr>
</tbody>
</table>

AP or CLEP credits in science courses are not acceptable to medical schools.
### Additional Recommended Course Electives

Refer to the pre-medical emphases in the departments of Zoology, Chemistry and Microbiology, and consult with advisors.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL 4050</td>
<td>Comparative Vertebrate Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4100</td>
<td>Embryology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4120</td>
<td>Histology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4210</td>
<td>Advanced Human Physiology</td>
<td>(4)</td>
</tr>
<tr>
<td>MICR 3254</td>
<td>Immunology</td>
<td>(4)</td>
</tr>
<tr>
<td>MICR 3305</td>
<td>Medical Microbiology</td>
<td>(5)</td>
</tr>
<tr>
<td>MICR 4252</td>
<td>Cell Culture</td>
<td>(2)</td>
</tr>
<tr>
<td>MICR 4554</td>
<td>Virology</td>
<td>(4)</td>
</tr>
<tr>
<td>CHEM 3070</td>
<td>Biochemistry I</td>
<td>(4)</td>
</tr>
</tbody>
</table>

### Course Requirements for Pre-Dentistry

#### Courses Required (50-61 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL SI1110/SI1120</td>
<td>Principles of Zoology (Zoology majors)</td>
<td>(8)</td>
</tr>
<tr>
<td>or ZOOL LS1010</td>
<td>Animal Biology (non-major)</td>
<td>(3)</td>
</tr>
<tr>
<td>ZOOL 2100</td>
<td>Human Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 2200</td>
<td>Human Physiology</td>
<td>(4)</td>
</tr>
<tr>
<td>MATH QL1050</td>
<td>College Algebra</td>
<td>(4)</td>
</tr>
<tr>
<td>MATH 1060</td>
<td>Trigonometry</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH SI1210/SI1220</td>
<td>Calculus I &amp; II</td>
<td>(8)</td>
</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</td>
<td>College Physics</td>
<td>(10)</td>
</tr>
<tr>
<td>CHEM PS/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II</td>
<td>(10)</td>
</tr>
<tr>
<td>CHEM 2310/SI2320</td>
<td>Organic Chemistry</td>
<td>(10)</td>
</tr>
<tr>
<td>ENGL EN1010 &amp; ENGL EN2010</td>
<td>Introductory College Writing</td>
<td>(3)</td>
</tr>
<tr>
<td>ENGL 2100</td>
<td>Technical Writing</td>
<td>(3)</td>
</tr>
</tbody>
</table>

#### Electives

Select courses as needed to finish requirements for graduation.

### Course Requirements for Pre-Optometry

#### Courses Required (76-81 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL SI1110/SI1120</td>
<td>Principles of Zoology (Zoology majors)</td>
<td>(8)</td>
</tr>
<tr>
<td>or ZOOL LS1010</td>
<td>Animal Biology (non-major)</td>
<td>(3)</td>
</tr>
<tr>
<td>ZOOL 2100</td>
<td>Human Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 2200</td>
<td>Human Physiology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 3200</td>
<td>Cell Biology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>Genetics</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4050</td>
<td>Comparative Vertebrate Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4120</td>
<td>Histology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4210</td>
<td>Advanced Human Physiology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4500</td>
<td>Parasitology</td>
<td>(4)</td>
</tr>
<tr>
<td>MATH SI1210/SI1220</td>
<td>Calculus I &amp; II</td>
<td>(8)</td>
</tr>
<tr>
<td>MICR LS/SI2054</td>
<td>Principles of Microbiology</td>
<td>(4)</td>
</tr>
<tr>
<td>CHEM PS/SI1110/SI1120</td>
<td>Elementary Chemistry</td>
<td></td>
</tr>
<tr>
<td>or CHEM PS/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II</td>
<td>(10)</td>
</tr>
<tr>
<td>CHEM 2310/SI2320</td>
<td>Organic Chemistry</td>
<td>(10)</td>
</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</td>
<td>College Physics</td>
<td>(10)</td>
</tr>
<tr>
<td>ENGL 2100</td>
<td>Technical Writing</td>
<td>(3)</td>
</tr>
<tr>
<td>PSY SS1010</td>
<td>Intro Psychology</td>
<td>(3)</td>
</tr>
<tr>
<td>PSY 3010</td>
<td>Abnormal Psychology</td>
<td>(3)</td>
</tr>
<tr>
<td>ENGL EN1010</td>
<td>Introductory College Writing</td>
<td>(3)</td>
</tr>
<tr>
<td>ENGL 3100</td>
<td>Technical Writing</td>
<td>(3)</td>
</tr>
<tr>
<td>HLTH 1300</td>
<td>First Aid: Responding to Emergencies</td>
<td>(2)</td>
</tr>
</tbody>
</table>

### Course Requirements for Pre-Physical Therapy

#### Courses Required (54-64 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL SI1110/SI1120</td>
<td>Principles of Zoology (Zoology majors)</td>
<td>(8)</td>
</tr>
<tr>
<td>or ZOOL LS1010</td>
<td>Animal Biology (non-major)</td>
<td>(3)</td>
</tr>
<tr>
<td>ZOOL 2100</td>
<td>Human Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 2200</td>
<td>Human Physiology</td>
<td>(4)</td>
</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</td>
<td>College Physics</td>
<td>(10)</td>
</tr>
<tr>
<td>MICR LS/SI2054</td>
<td>Principles of Microbiology</td>
<td>(4)</td>
</tr>
<tr>
<td>CHEM PS/SI1110/SI1120</td>
<td>Elementary Chemistry</td>
<td></td>
</tr>
<tr>
<td>or CHEM PS/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II</td>
<td>(10)</td>
</tr>
<tr>
<td>MATH 1060</td>
<td>Trigonometry</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH 1210</td>
<td>Calculus</td>
<td>(3)</td>
</tr>
<tr>
<td>MATH 1040</td>
<td>Statistics</td>
<td>(3)</td>
</tr>
<tr>
<td>or PSY SS3600</td>
<td>Statistics in Psychology</td>
<td></td>
</tr>
<tr>
<td>or SOC SS3600</td>
<td>Social Statistics</td>
<td></td>
</tr>
<tr>
<td>PSY SS1010</td>
<td>Intro Psychology</td>
<td>(3)</td>
</tr>
<tr>
<td>PSY 3010</td>
<td>Abnormal Psychology</td>
<td>(3)</td>
</tr>
<tr>
<td>ENGL EN1010</td>
<td>Introductory College Writing</td>
<td>(3)</td>
</tr>
<tr>
<td>ENGL 3100</td>
<td>Technical Writing</td>
<td>(3)</td>
</tr>
<tr>
<td>HLTH 1300</td>
<td>First Aid: Responding to Emergencies</td>
<td>(2)</td>
</tr>
</tbody>
</table>

### Course Requirements for Pre-Veterinary Medicine

#### Courses Required (68 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMM HU1020</td>
<td>Principles of Public Speaking</td>
<td>(3)</td>
</tr>
<tr>
<td>COMM HU2110</td>
<td>Interpersonal &amp; Small Group Communication</td>
<td>(3)</td>
</tr>
<tr>
<td>ZOOL SI1110/SI1120</td>
<td>Principles of Zoology (Zoology majors)</td>
<td>(8)</td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>Genetics</td>
<td>(4)</td>
</tr>
<tr>
<td>MATH 1010</td>
<td>Intermediate Algebra</td>
<td>(4)</td>
</tr>
<tr>
<td>MATH QL1050</td>
<td>College Algebra</td>
<td>(4)</td>
</tr>
<tr>
<td>MICR LS/SI2054</td>
<td>Principles of Microbiology</td>
<td>(4)</td>
</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</td>
<td>College Physics</td>
<td>(10)</td>
</tr>
<tr>
<td>CHEM PS/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II</td>
<td>(10)</td>
</tr>
<tr>
<td>CHEM 2310/SI2320</td>
<td>Organic Chemistry</td>
<td>(10)</td>
</tr>
<tr>
<td>CHEM 3070</td>
<td>Biochemistry I</td>
<td>(4)</td>
</tr>
<tr>
<td>BTNY SI2104</td>
<td>Plant Form and Function</td>
<td>(4)</td>
</tr>
<tr>
<td>or BTNY SI2114</td>
<td>Evolutionary Survey of Plants</td>
<td>(4)</td>
</tr>
</tbody>
</table>

#### Recommended Electives (none required)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZOOL 3200</td>
<td>Cell Biology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4050</td>
<td>Comparative Vertebrate Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4060</td>
<td>Comparative Vertebrate Anatomy</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4100</td>
<td>Vertebrate Embryology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4120</td>
<td>Histology</td>
<td>(4)</td>
</tr>
<tr>
<td>ZOOL 4500</td>
<td>Parasitology</td>
<td>(4)</td>
</tr>
<tr>
<td>MICR 3254</td>
<td>Immunology</td>
<td>(4)</td>
</tr>
<tr>
<td>MATH SI1210/SI1220</td>
<td>Calculus I &amp; II</td>
<td>(8)</td>
</tr>
</tbody>
</table>

### Course Requirements for Pre-Chiropractic

Use pre-medical requirements and follow the catalog from the chiropractic school of your choosing.

---

**Electives**

Electives should include general education graduation requirements. More advanced classes in the sciences may be taken at the option of the student.
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 – 38 of these 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 38-43 for Associate of Science requirements. These should include either ECON A11740, 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 AS program in two years and take the laboratory intensive courses for the Institutional Certificate in their third year.

Course Requirements for AS Degree

Courses Required (37 credit hours)

<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>MICR 3053</td>
<td>Microbiological Procedures (3)</td>
</tr>
<tr>
<td>BTNY SI2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>or BTNY SI2114</td>
<td>Evolutionary Survey of Plants (4)</td>
</tr>
<tr>
<td>ZOOL SI1110</td>
<td>Principles of Zoology I (4)</td>
</tr>
<tr>
<td>ZOOL SI1120</td>
<td>Principles of Zoology II (4)</td>
</tr>
<tr>
<td>CHEM PS/SI2120/SI2220</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
<tr>
<td>PHYS PS/SI1010</td>
<td>Elementary Physics (3)</td>
</tr>
<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
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<tr>
<td>or MICR 2600</td>
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</tr>
<tr>
<td>MATH QL1050</td>
<td>College Algebra (4)</td>
</tr>
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</table>

Course Requirements for Institutional Certificate

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

Required Courses (22 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 3204</td>
<td>Plant Physiology (4)</td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>Genetics (4)</td>
</tr>
<tr>
<td>CHEM 2310/2320</td>
<td>Organic Chemistry I &amp; II (10)</td>
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<tr>
<td>MICR 4154</td>
<td>Microbial Genetics (4)</td>
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<tr>
<td>or ZOOL 4300</td>
<td>Molecular Genetics (4)</td>
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Electives (select 8 credit hours)

<table>
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<tbody>
<tr>
<td>CHEM 3000</td>
<td>Quantitative Analysis (4)</td>
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<tr>
<td>CHEM 3050</td>
<td>Instrumental Analysis (3)</td>
</tr>
<tr>
<td>CHEM 3070</td>
<td>Biochemistry I (4)</td>
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<table>
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<tr>
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<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICR 3254</td>
<td>Immunology (4)</td>
</tr>
<tr>
<td>MICR 4252</td>
<td>Cell Culture (2)</td>
</tr>
<tr>
<td>MICR 4354</td>
<td>Industrial Microbiology &amp; Biotechnology (4)</td>
</tr>
<tr>
<td>MICR 4554</td>
<td>Virology (4)</td>
</tr>
<tr>
<td>BTNY 3105</td>
<td>Anatomy &amp; Morphology of Vascular Plants (5)</td>
</tr>
<tr>
<td>BTNY 3504</td>
<td>Mycology (4)</td>
</tr>
<tr>
<td>ZOOL 3200</td>
<td>Cell Biology (4)</td>
</tr>
<tr>
<td>ZOOL 4120</td>
<td>Histology (4)</td>
</tr>
<tr>
<td>ZOOL 4220</td>
<td>Endocrinology (4)</td>
</tr>
<tr>
<td>or ZOOL 4210</td>
<td>Advanced Human Physiology (4)</td>
</tr>
<tr>
<td>ZOOL 4500</td>
<td>Parasitology (4)</td>
</tr>
<tr>
<td>or MICR 3305</td>
<td>Medical Microbiology (5)</td>
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</table>

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICR 4252</td>
<td>Cell Culture (2)</td>
</tr>
<tr>
<td>MICR 4354</td>
<td>Industrial Microbiology &amp; Biotechnology (4)</td>
</tr>
<tr>
<td>MICR 4554</td>
<td>Virology (4)</td>
</tr>
<tr>
<td>BTNY 3105</td>
<td>Anatomy &amp; Morphology of Vascular Plants (5)</td>
</tr>
<tr>
<td>BTNY 3504</td>
<td>Mycology (4)</td>
</tr>
<tr>
<td>ZOOL 3200</td>
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<tr>
<td>ZOOL 4120</td>
<td>Histology (4)</td>
</tr>
<tr>
<td>ZOOL 4220</td>
<td>Endocrinology (4)</td>
</tr>
<tr>
<td>or ZOOL 4210</td>
<td>Advanced Human Physiology (4)</td>
</tr>
<tr>
<td>ZOOL 4500</td>
<td>Parasitology (4)</td>
</tr>
<tr>
<td>or MICR 3305</td>
<td>Medical Microbiology (5)</td>
</tr>
</tbody>
</table>

Department

Botany

Chair: Dr. Eugene G. Bozniak
Location: Science Lab, Room SL402M
Telephone: 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 need 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 cuisine 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 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 cumulative.
and representational in nature. Within the portfolio, students can document their acquisition of a variety of skills, including critical 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.

The Botany Department also cooperates in offering a Biology Composite Teaching Major; this program prepares individuals who are interested in teaching Biology at the secondary school level (described under the Zoology Department in this catalog).

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 at another institution in order to obtain baccalaureate degrees in these fields. The catalog of the school to which the student plans to 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.

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 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)
- 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 2413 Introduction to Natural Resource Management (3)
- BTNY 2600 Laboratory Safety (1)
Select two of the following:
- BTNY 3204 Plant Physiology (4)
- BTNY 3214 Soils (4)
- BTNY 3454 Plant Ecology (4)
- BTNY 3624 Taxonomy of Vascular Plants (4)

Required Support Courses (24-26 credit hours)
- CHEM PS/SI1210 Principles of Chemistry (10)
- GEO PS/SI1110 Physical Geology (3)
- MATH QL1050 College Algebra (4)
or MATH QL1080 Pre-Calculus (5)
- or MATH SI1210 Calculus (4)
or MATH SI1040 Introduction to Statistics (3)
Select One Group:
- MICR LS/SI2054 Principles of Microbiology (4)
  & MICR 3484 Environmental Microbiology (4)
or
- GEO SI1115 Physical Geology Laboratory (1)
  & GEO PS/SI1130 Introduction to Meteorology (3)
  & GEO 2050 Earth Materials (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.

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)
- 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 2413 Introduction to Natural Resource Management (3)
- BTNY 2600 Laboratory Safety (1)
Select two of the following:
- BTNY 3214 Soils (4)
- BTNY 3454 Plant Ecology (4)
- BTNY 3624 Taxonomy of Vascular Plants (4)
Required Support Courses (37-39 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM PS/SI1210,1220</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 (1)</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>or MATH QL1080</td>
<td>Pre-Calculus (5)</td>
</tr>
<tr>
<td>or MATH SI2120</td>
<td>Calculus (4)</td>
</tr>
<tr>
<td>or MATH QL1040</td>
<td>Introduction to Statistics (3)</td>
</tr>
<tr>
<td>PHYS PS/SI2010/SI2020</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.

BIOTECHNICIAN TRAINING PROGRAM

ASSOCIATE OF SCIENCE 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 Biotechnician training for the biotechnology industry. This program is described earlier in this College of Science section of the catalog.

BOTANY MAJOR

BACHELOR’S DEGREE (BS)

» Program Prerequisite: Not required.
» Minor: A minor is required. Botany majors in 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 37.
» Credit Hour Requirements: A total of 120 credit hours is required for graduation – required within the major are 91-96 credit hours for Track A (minor included), 67-87 credit hours for Track B (minor not included) and 70-85 credit hours for Track C (minor not included). A total of 40 upper division credit hours is required (courses numbered 3000 and above) – required within the major are 29-38 upper division credit hours for Track A, 22-37 upper division credit hours for Track B and 28-37 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 17). There are no special admission or application requirements for this program.

General Education

Refer to pages 37-43 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 PS210.

All Botany majors are required to develop a portfolio. The portfolio requirements are explained in detail when a student takes BTNY 2121. The final evaluation of the portfolio takes place in BTNY 4980.

Course Requirements for BS Degree

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<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>
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<tr>
<td>BTNY SI2114</td>
<td>Evolutionary Survey of Plants (4)</td>
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<tr>
<td>BTNY 2121</td>
<td>Career Planning for Botanists (1)</td>
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<tr>
<td>BTNY DV2303</td>
<td>Ethnobotany (3)</td>
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<tr>
<td>BTNY 2600</td>
<td>Laboratory Safety (1)</td>
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</table>

TRACK A

Botany Courses Required (15 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
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<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>Algalogy (4)</td>
</tr>
<tr>
<td>BTNY 3523</td>
<td>Marine Biology (3)</td>
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<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>Biotechnology (3)</td>
</tr>
<tr>
<td>BTNY 4800</td>
<td>Individual Research (3)</td>
</tr>
<tr>
<td>or BTNY 4850</td>
<td>Thesis Research (2)</td>
</tr>
<tr>
<td>BTNY 4830</td>
<td>Readings in Botany (2)</td>
</tr>
<tr>
<td>or BTNY 4840</td>
<td>Thesis Readings (2)</td>
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<tr>
<td>BTNY 4890</td>
<td>Cooperative Work Experience (5)</td>
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<tr>
<td>BTNY 4950</td>
<td>Advanced Field Botany (2)</td>
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<tr>
<td>BTNY 4970</td>
<td>Botany Thesis (2)</td>
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<tr>
<td>or BTNY 4990</td>
<td>Seminar in Botany (1)</td>
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</tbody>
</table>

Required Support Courses (44-49 credit hours)

This program includes a minor in Chemistry.

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM PS/SI1210/SI1220</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>
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<tr>
<td>or MATH QL1080</td>
<td>Pre-Calculus (5)</td>
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<tr>
<td>or MATH QL1210</td>
<td>Calculus I (4)</td>
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<tr>
<td>or MATH QL1040</td>
<td>Introduction to Statistics (3)</td>
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<tr>
<td>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>
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</table>

Select two of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>GEO PS/SI1110</td>
<td>Physical Geography (3)</td>
</tr>
<tr>
<td>or GEOG PS/SI1000</td>
<td>Natural Environments of the Earth (3)</td>
</tr>
<tr>
<td>MICR LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>ZOOL SI1110</td>
<td>Principles of Zoology I (4)</td>
</tr>
<tr>
<td>ZOOL SI1120</td>
<td>Principles of Zoology II (4)</td>
</tr>
</tbody>
</table>

Calculus and Statistics are recommended.
## TRACK B

### Botany Courses Required (20 credit hours)
- **BTNY 2413** Introduction to Natural Resource Management (3)
- **BTNY 3214** Soils (4)
- **BTNY 3454** Plant Ecology (4)
- **BTNY 3624** Taxonomy of Vascular Plants (4)
- **BTNY 4950** Advanced Field Botany (2)
- **BTNY 4980** Portfolio Summative Assessment (3)

### Elective Botany Courses (11 credit hours minimum; 6 lower division credit hours maximum)
- **BTNY 2203** Home and Garden Plants (3)
- **BTNY 2503** Biology of the Plant Cell (3)
- **BTNY 3105** Anatomy and Morphology of Vascular Plants (5)
- **BTNY 3204** Plant Physiology (4)
- **BTNY 3303** Plant Genetics (3)
- **BTNY 3473** Plant Geography (3)
- **BTNY 3504** Mycology (4)
- **BTNY 3514** Algology (4)
- **BTNY 3523** Marine Biology (3)
- **BTNY 3641** Intermountain Flora (1-4)
- **BTNY 4113** Plant Evolution (3)
- **BTNY 4252** Cell Culture (2)
- **BTNY 4750** Topics in Botany (2)
- **BTNY 4800** Individual Research (2)
- **BTNY 4830** Readings in Botany (2)
- **BTNY 4840** Thesis Readings (2)
- **BTNY 4890** Cooperative Work Experience (5)
- **BTNY 4990** Seminar in Botany (1)
- **BTNY 4970** Botany Thesis (2)

### Required Support Courses (20-40 credit hours)
- **CHEM PS/SI1050** Introduction to General, Organic & Biochemistry (5)
- **CHEM PS/SI1110** Elementary Chemistry (5)
- **CHEM SI1210** Principles of Chemistry I (5)
- **CHEM SI2120** Principles of Chemistry II (5)
- **CHEM 2310** Organic Chemistry I (5)
- **CHEM 3484** Physical Geology (3)
- **CHEM PS/SI1100** Natural Environments of the Earth (3)
- **CHEM PS/SI1110** Elementary Organic Bio-Chemistry (5)
- **CHEM PS/SI1210** Principles of Chemistry I (5)
- **CHEM PS/SI2120** Principles of Chemistry II (5)
- **CHEM SI2210** Organic Chemistry I (5)
- **MATH QL1040** Introduction to Statistics (3)
- **MATH QL1050** College Algebra (4)
- **MATH QL1080** Pre-Calculus (5)
- **MATH SI1210** Calculus I (4)
- **PHYS PS/SI1010** Physical Science (3)
- **PHYS PS/SI1110** Physical Geology (3)
- **PHYS PS/SI1120** Physical Geology Laboratory (1)
- **PHYS SI2020** College Physics I & II (10)
- **PHYS SI2220** Physics for Scientists & Engineers (10)
- **PHYS SI2220** Physics for Scientists & Engineers (10)

### Select One Group:
- **MICR LS/SI2054** Principles of Microbiology (4)
- **& MICR 3484** Environmental Microbiology (4)
- **& GEO SI1115** Physical Geology Laboratory (1)
- **& GEO PS/SI1130** Introduction to Meteorology (3)
- **& GEO 1220** Historical Geography (4)
- **& GEOG 3450** Cartography (3)
- **& GEOG 3460** Advanced Cartography (3)
- **& ZOOL SI1110** Principles of Zoology I (4)
- **& ZOOL SI1120** Principles of Zoology II (4)

## TRACK C

### Botany Core Courses Required (13 credit hours)
- **BTNY LS1403** Environment Appreciation (3)
- **or BTNY 3403** 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 2600** Laboratory Safety (1)

### Botany Courses Required (14 credit hours)
- **BTNY 3303** Plant Genetics (3)
- **BTNY 3454** Plant Ecology (4)
- **BTNY 3624** Taxonomy of Vascular Plants (4)
- **BTNY 4980** Portfolio Summative Assessment (3)

### Elective Botany Courses (20 credit hours minimum; 6 lower division credit hours maximum)
- **BTNY 2203** Home and Garden Plants (3)
- **BTNY 2503** Ethnobotany (3)
- **BTNY 2413** Introduction to Natural Resource Management (3)
- **BTNY 3105** Anatomy and Morphology of Vascular Plants (5)
- **BTNY 3204** Plant Physiology (4)
- **BTNY 3303** Plant Genetics (3)
- **BTNY 3473** Plant Geography (3)
- **BTNY 3504** Mycology (4)
- **BTNY 3523** Marine Biology (3)
- **BTNY 3533** Intermountain Flora (1-4)
- **BTNY 4113** Plant Evolution (3)
- **BTNY 4252** Cell Culture (2)
- **BTNY 4750** Topics in Botany (2)
- **BTNY 4800** Individual Research (2)
- **BTNY 4830** Readings in Botany (2)
- **BTNY 4840** Thesis Readings (2)
- **BTNY 4890** Cooperative Work Experience (5)
- **BTNY 4990** Seminar in Botany (1)
- **BTNY 4970** Botany Thesis (2)

### Required Support Courses (23-38 credit hours)
- **CHEM PS/SI1110** Elementary Chemistry (5)
- **CHEM SI1120** Principles of Chemistry I (5)
- **CHEM SI1210** Principles of Chemistry II (5)
- **CHEM 2310** Organic Chemistry I (5)
- **MATH QL1040** Introduction to Statistics (3)
- **MATH QL1050** College Algebra (4)
- **MATH QL1080** Pre-Calculus (5)
- **MATH SI1210** Calculus I (4)
- **PHYS PS/SI1010** Physical Science (3)
- **PHYS PS/SI2020** College Physics I & II (10)

### Select two of the following:
- **PHYS PS/SI1110** Physical Geology (3)
- **& MICR LS/SI2054** Principles of Microbiology (4)
- **& 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.
**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:

a. Ethnobotany of a specific native group of peoples is to be carried out through library research involving ten more primary sources and two more books than that expected of a regular student. The final report and/or oral presentation will be expected to meet the course criteria for a minimum of a B+ (regular student must meet the criteria for a minimum of a C-).

b. An extensive semester-long field research project, involving the sampling of at least two more parameters than a regular student would in a similar environment with the qualitative difference for the report/oral presentation expected as outlined above.

(See the Honors Program on page 45.)

**Botany Electives**

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

**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.

**Biology**

**TEACHING MINOR**

The Botany and Zoology Teaching Minors have been consolidated into a Biology Minor. See the Department of Zoology in this catalog for program requirements.

**Urban and Regional Planning Emphasis**

**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, advisement 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) F, S**
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) F**
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 MICR LS/SI2504, and CHEM PS/SI1050 or CHEM SI1120 or CHEM 2310, and MATH QL1050 or MATH QL1080.
BTN 3403. Environment Appreciation (3) Su, F, S
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.

BTN 3441B. Intermountain Flora - Montane Forbs (1) S (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.

BTN 3441C. 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 riparian and marsh 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.

BTN 3441D. 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.

BTN 4113. Plant Evolution (3) F
An exploration of fundamentals and issues of evolution through natural selection as it relates to plants including reproduction strategies, co-evolution, evolution of ecosystems, biochemical evolution and genomic evolution. Prerequisites: BTNY SI2104, BTNY SI2114, BTNY 3105, and BTN 3303 or ZOOL 3300.

BTN 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 BTN 3104, or MICR LS/SI2054.

BTN 4570. Secondary School Science Teaching Methods (3)
Acquaintance and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: Admission to the Teacher Education Program.

BTN 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 course selected by the instructor.

BTN 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 4890. Cooperative Work Experience (1-6)
Open to all students in the Botany 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. Prerequisite: Two upper-division Botany courses.

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 extended, organized 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 4980. Portfolio Summative Assessment (3) F, S
Final evaluation of the Botany Student Portfolio. Prerequisites: Completion of or concurrent enrollment in courses needed to meet the minimum requirements for a degree in Botany.

BTNY 4990. Seminar in Botany (1) F, S
Oral presentation of either library research or individual research. 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 MEd 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.
**Course Requirements for BS**

**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 (33 credit hours)**
- CHEM 3020 Computer Applications in Chemistry (1)
- CHEM 3030 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 (2)*
- CHEM 4800 Research and Independent Study in Chemistry (2)*
- CHEM 4990 Senior Seminar (1)

*Variable credit course. Repeat as necessary to obtain the required number of credits.

**Support Courses Required (18 credit hours)**
- MATH PS/SI2110/SI2120 Calculus I & Calculus II (8)
- PHYS PS/SI2210/SI2220 Physics for Scientists (10)
- CHEM 2600 Laboratory Safety (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 (21 credit hours)**
- CHEM 3020 Computer Applications in Chemistry (1)
- CHEM 3030 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 3420 Physical Chemistry II (4)
- CHEM 4700 Special Topics in Chemistry (2)*
- CHEM 4800 Research and Independent Study in Chemistry (2)*
- CHEM 4990 Senior Seminar (1)

*Variable credit course. Repeat as necessary to obtain the required number of credits.

**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)

**Support Courses Required (18 credit hours)**
- MATH PS/SI2110/SI2120 Calculus I & II (8)
- PHYS PS/SI2210/SI2220 Physics for Scientists (10)
- or PHYS PS/SI2010/SI2020 General Physics (10)

Chemistry 2600 Laboratory Safety (1) is highly recommended.

Additional upper division courses should be chosen to support career plans. Students should consult with the Chair of the Chemistry Department.

**TEACHING MAJOR**

**Additional Chemistry Courses Required (8 credit hours)**
- CHEM 2600 Lab Safety (1)
- CHEM 3570 Foundations of Science Education (3)
- CHEM 4570 Science Teaching Methods (3)
- CHEM 4800 Independent Research (1)

**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 3420 Physical Chemistry II (4)

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

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

Student must also complete requirements for a secondary education license as determined by the Jerry and Vicki Moyes College of Education.

**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.

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**PHYSICAL SCIENCE COMPOSITE TEACHING MAJOR**

**BACHELOR'S DEGREE**

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

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**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 45).
- 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 45.) 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 4800) will generally require about 10 hours of productive effort. For CHEM 4800, each credit hour will generally require about 45 hours of productive effort as well as a formal written report. 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.

If a student is not obtaining a Teaching Major in Sciences, the following courses are also required:

- CHEM 2600 Laboratory Safety (1)
- CHEM 3570 Foundations of Science Education (3)
- CHEM 4570 Secondary Science Teaching Methods (3)

### 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)
- CHEM 3070 Biochemistry I (4)
- CHEM 4550 Geochemistry (3)

### 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 26 credit hours is required.

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

### Course Requirements for Teaching Minor

**Courses Required (23 credit hours)**
- CHEM PS/SI1210 Principles of Chemistry I (5)
- CHEM SI1220 Principles of Chemistry II (5)
- CHEM 2310 Organic Chemistry I (5)
- CHEM 2320 Organic Chemistry II (5)
- Approved chemistry elective, 3000 or above (3)

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

### GENERAL EDUCATION

- **Degree:** Associate of Applied Science (AAS)
- **Credit Hours Required:** A total of 63 credit hours is required for graduation – 35 of these are required within the program.

### 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 3090 Biochemical Techniques (1)
- 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 SI2503 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)
- PHYS PS/SI1010 Elementary Physics (3)
- PHYS PS/SI2010 College Physics I (5)
- or PHYS PS/SI2210 Physics for Scientists and Engineers I (5)
- or PHYS SI2020 College Physics II (5)
- or PHYS SI2220 Physics for Scientists & Engineers II (5)
- ZOOL 2200 Human Physiology (4)
- ZOOL 3200 Cell Biology (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.

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 quarter 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-quarter sequence designed primarily for students of nursing, engineering technology and some other fields of science and health professions who will take no more than one quarter of chemistry. Four hours of lecture and one 3-hour lab a week.

CHEM SI1115. 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 Chemistry Department Chair. Transfer students who have taken the CHEM 1050 lecture or equivalent without the lab should petition the Chemistry Department Chair for permission to take this course. Prerequisite: Must have completed or be currently enrolled in CHEM 1050 lecture or equivalent.

CHEM PS/SI1110. Elementary Chemistry (5) F, S
Fundamentals of inorganic chemistry and introduction to organic chemistry. The first course in a two-quarter sequence designed primarily for students of nursing, engineering technology and some other fields of science and health professions who will take no more than one quarter of chemistry. Four hours of lecture and one 3-hour lab a week.

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 1120 lecture without the lab should petition the Chair of the Chemistry Department for permission to take this course. Prerequisite: Must have completed or currently been 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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 2300</td>
<td>Laboratory Safety (1)</td>
<td>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.</td>
</tr>
<tr>
<td>CHEM 2305</td>
<td>Quantitative Analysis Lab (1)</td>
<td>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 with 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 1210.</td>
</tr>
<tr>
<td>CHEM 2500</td>
<td>Principles of Chemistry I (5) Su, F, S</td>
<td>The first course in a series designed primarily for science majors and others who will take more than one year of chemistry such as pre-medical 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.</td>
</tr>
<tr>
<td>CHEM 2515</td>
<td>Principles of Chemistry II Lab (1)</td>
<td>CHEM 2515 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 2515 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 2510 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.</td>
</tr>
<tr>
<td>CHEM 3000</td>
<td>Principles of Chemistry II Lab (1)</td>
<td>CHEM 3000 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 3000 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.</td>
</tr>
<tr>
<td>CHEM 3005</td>
<td>Principles of Chemistry I Lab (1)</td>
<td>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.</td>
</tr>
<tr>
<td>CHEM 3010</td>
<td>Organic Chemistry I (5) Su, F, S</td>
<td>CHEM 3010 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 3010 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 3010 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 3010 lecture.</td>
</tr>
<tr>
<td>CHEM 3020</td>
<td>Organic Chemistry II (5) Su, F, S</td>
<td>CHEM 3020 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 3020 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 3020 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 3020 lecture.</td>
</tr>
<tr>
<td>CHEM 3030</td>
<td>Organic Chemistry I Lab (1)</td>
<td>CHEM 3030 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 3030 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 3030 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 3030 lecture.</td>
</tr>
<tr>
<td>CHEM 3040</td>
<td>Organic Chemistry II Lab (1)</td>
<td>CHEM 3040 is a stand-alone lab course designed to accommodate transfer students from other Universities. CHEM 3040 registration will be allowed only by special permission from the Chair of Chemistry. Transfer students who have taken the CHEM 3040 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 3040 lecture.</td>
</tr>
<tr>
<td>CHEM 3050</td>
<td>Principles of Physical Science (3) F</td>
<td>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.</td>
</tr>
<tr>
<td>CHEM 3060</td>
<td>Applied Analysis (1)</td>
<td>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 3010.</td>
</tr>
<tr>
<td>CHEM 3070</td>
<td>Biochemistry I (4) F, S</td>
<td>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.</td>
</tr>
</tbody>
</table>
| 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 SI1220. Co-requisite: CHEM 3410.

CHEM 3410. Physical Chemistry I (4) F
The first semester course of Physical Chemistry covering chemical thermodynamics and kinetics. Three hours of lecture and one 3-hour lab a week. Prerequisites: CHEM 3000 and PHYS SI1220. Co-requisite: CHEM 3400.

CHEM 3420. Physical Chemistry II (4) S
The second semester course of Physical Chemistry covering quantum mechanics, statistical mechanics, and chemical reaction dynamics. Three hours of lecture and one 3-hour lab a week. Prerequisite: CHEM 3420 or permission of instructor.

CHEM 3570. Foundations of Science Education (3)
A thorough investigation of research in science learning and curricular standards at the state and national levels. Foundations of the philosophy of science and scientific inquiry as applicable to science teaching at the secondary level. This course serves as a foundation to a preservice science teacher's education coursework.

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)
Acquaintance and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: 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 variable title
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) S, 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)
A seminar course where students will share their research results with fellow students and faculty in written and oral formats. Prerequisite: CHEM 4800 or permission of instructor.

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

Geosciences

Chair: Dr. W. Adolph Younke
Location: Science Lab Building, Room SL 202M
Telephone Contact: Susan Swider, 801-626-7139
Professors: Jeffrey Eaton, Richard Ford, Marek Matyjasik, James R. Wilson, W. Adolph Younke; Assistant Professor: Michael Hernandez

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's 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 Geospatial Analysis is also available.

Geology Major

BACHELOR'S DEGREE (BS OR BA)

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 within the major for Option B.
- 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.

Weber State University 2008 – 2009 Catalog
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 17). 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 37-43 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.

Course Requirements for BS or BA Degree

Geosciences Courses Required (35 credit hours)

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS1060</td>
<td>Environmental Geosciences (3)</td>
<td></td>
</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>
<td></td>
</tr>
<tr>
<td>GEO 3080</td>
<td>Water Resources (3)</td>
<td></td>
</tr>
<tr>
<td>GEO 3180</td>
<td>Paleontology (4)</td>
<td></td>
</tr>
<tr>
<td>GEO 3210</td>
<td>Quaternary Environmental Change (3)</td>
<td></td>
</tr>
<tr>
<td>GEO 3250</td>
<td>Geology of Utah (3)</td>
<td></td>
</tr>
<tr>
<td>GEO 3400</td>
<td>Remote Sensing I (4)</td>
<td></td>
</tr>
<tr>
<td>GEO 3880</td>
<td>Groundwater (4)</td>
<td></td>
</tr>
<tr>
<td>GEO 4010</td>
<td>Ancient Environments &amp; Paleocology (3)</td>
<td></td>
</tr>
<tr>
<td>GEO 4100</td>
<td>Engineering Geology (3)</td>
<td></td>
</tr>
<tr>
<td>GEO 4150</td>
<td>Environmental Assessment (3)</td>
<td></td>
</tr>
<tr>
<td>GEO 4210</td>
<td>Intro to Computer Mapping and GIS (4)</td>
<td></td>
</tr>
<tr>
<td>GEO 4220</td>
<td>Technical and Application Issues in GIS (4)</td>
<td></td>
</tr>
<tr>
<td>GEO 4400</td>
<td>Remote Sensing II (4)</td>
<td></td>
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<tr>
<td>GEO 4530</td>
<td>Geochemistry (3)</td>
<td></td>
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<tr>
<td>GEO 4630</td>
<td>Global Tectonics (3)</td>
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<tr>
<td>GEO 4750</td>
<td>Special Topics in Geosciences (1-4)</td>
<td></td>
</tr>
<tr>
<td>GEO 4800</td>
<td>Independent Study (1-3)</td>
<td></td>
</tr>
<tr>
<td>GEO 4970</td>
<td>Senior Thesis (2)</td>
<td></td>
</tr>
</tbody>
</table>

or up to two of the following courses from related areas

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

MATH QL1050 College Algebra (4)
& MATH 1060 Trigonometry (3)

MATH QL1080 Precalculus (5) **

* 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'S DEGREE (BS)

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 course 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.

Advisement

All Geoscience 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 17). 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 37-43 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 BS Degree

Courses Required (38 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 1065</td>
<td>Environmental Geosciences</td>
<td>3</td>
</tr>
<tr>
<td>GEO 31110</td>
<td>Physical Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>GEO 2520</td>
<td>Historical Geology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3080</td>
<td>Earth Materials</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3150</td>
<td>Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3550</td>
<td>Sedimentology &amp; Stratigraphy</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4060</td>
<td>Geoscience Field Methods</td>
<td>3</td>
</tr>
<tr>
<td>GEO 4220</td>
<td>Technical &amp; Applicational</td>
<td>3</td>
</tr>
<tr>
<td>GEO 4210</td>
<td>Intro to Computer Mapping &amp; GIS</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4400</td>
<td>Remote Sensing II</td>
<td>4</td>
</tr>
<tr>
<td>GEO SI1130</td>
<td>Intro to Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>GEO SI3010</td>
<td>Oceanography and Earth Systems</td>
<td>3</td>
</tr>
<tr>
<td>GEO 3060</td>
<td>Structural Geology</td>
<td>4</td>
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<td>GEO 3180</td>
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<td>Geology of Utah</td>
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<td>GEO 3880</td>
<td>Groundwater</td>
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<td>GEO 4010</td>
<td>Ancient Environments &amp; Paleoecology</td>
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<td>GEO 4100</td>
<td>Engineering Geology</td>
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<td>GEO 4150</td>
<td>Environmental Assessment</td>
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<td>GEO 4300</td>
<td>Igneous and Metamorphic Petrology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4510</td>
<td>Geology Field Camp</td>
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</tr>
<tr>
<td>GEO 4550</td>
<td>Geochemistry</td>
<td>3</td>
</tr>
<tr>
<td>GEO 4630</td>
<td>Global Tectonics</td>
<td>3</td>
</tr>
<tr>
<td>GEO 4750</td>
<td>Special Topics in Geosciences (1-4)</td>
<td>3</td>
</tr>
<tr>
<td>GEO 4970</td>
<td>Senior Thesis (2)</td>
<td>2</td>
</tr>
<tr>
<td>BTNY 3214</td>
<td>Soils</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 2310</td>
<td>Organic Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 3000</td>
<td>Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>GEOG 4410</td>
<td>Land Use Planning Techniques</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 4420</td>
<td>Advanced Planning Techniques</td>
<td>3</td>
</tr>
<tr>
<td>MICR 3484</td>
<td>Environmental Microbiology</td>
<td>4</td>
</tr>
</tbody>
</table>

Electives Required (12 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO 3300</td>
<td>Remote Sensing I</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4210</td>
<td>Intro to Computer Mapping &amp; GIS</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4220</td>
<td>Technical &amp; Application</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4400</td>
<td>Remote Sensing II</td>
<td>4</td>
</tr>
<tr>
<td>BTNY 3214</td>
<td>Soils</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 2310</td>
<td>Organic Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 3000</td>
<td>Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>GEOG 4410</td>
<td>Land Use Planning Techniques</td>
<td>3</td>
</tr>
<tr>
<td>GEOG 4420</td>
<td>Advanced Planning Techniques</td>
<td>3</td>
</tr>
<tr>
<td>MICR 3484</td>
<td>Environmental Microbiology</td>
<td>4</td>
</tr>
</tbody>
</table>

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

Support Courses Required (34-37 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY LS1203</td>
<td>Plant Biology</td>
<td>3</td>
</tr>
<tr>
<td>BTNY SI2104</td>
<td>Plant Form and Function</td>
<td>4</td>
</tr>
<tr>
<td>BTNY SI2114</td>
<td>Evolutionary Survey of Plants</td>
<td>4</td>
</tr>
<tr>
<td>CHEM PS/SI1210/1220 Principles of Chemistry</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>ENGL 2100</td>
<td>Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>MATH QL1020 Intro to Statistics</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>PHYS PS/SI2100/1120 General Physics</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>or PHYS PS/SI2120/1120 Physics for Scientists &amp; Engineers</td>
<td>10</td>
<td></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.

EARTH SCIENCE TEACHING MAJOR

BACHELOR’S DEGREE (BS OR BA)

Advisor: Dr. Richard Ford, 801-626-6942

Program Prerequisite: Must satisfy Teacher Education admission and licensure requirements (see Teacher Education Department).

Minor: Not required.

Grade Requirements: A grade of "C-" or better in courses required for this major. An overall GPA of 3.00 is required for admission to the Teacher Education program.

Credit Hour Requirements: A total of 120-123 credit hours is required for graduation – 70 to 72 of these are required within the major. Teacher Education Licensure requires 6 credit hours of support courses and 24 credit hours of professional education courses (see Teacher Education Department). This major requires a total of 44 upper division credit hours (courses numbered 3000 and above) – 17 of these are required Geosciences courses and 24 are Teacher Education courses.

Advisement

All Earth Science Teaching 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. In addition, teaching majors are encouraged to consult with an advisor in the Jerry and Vickie Moyes College of Education and/or contact the department for a suggested course sequence.

Admission Requirements

Declare your program of study (see page 17). Earth Science Teaching majors must satisfy Teacher Education admission and licensure requirements. (See Teacher Education Department.)

General Education

Refer to pages 37-43 for either Bachelor of Science or Bachelor of Arts requirements. MATH QL1050 or MATH QL1080 is recommended for the Quantitative Literacy requirement. The following required courses for the Earth Science Teaching major will also satisfy general education requirements: BTNY LS1203, CHEM PS/SI1210, GEO PS/SI1060, GEO PS/SI1110, GEO PS/SI1130, PHYS PS/SI1040, PHYS PS/SI2100, and PHYS PS/SI2120. The following required education support courses will also satisfy general education requirements: CHEM SS1500 and COMM HU1020 or COMM HU2110.
## Course Requirements for BS Degree

### Earth Science Courses Required (42 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS1060</td>
<td>Environmental Geosciences</td>
<td>3</td>
</tr>
<tr>
<td>GEO PS/SI1110</td>
<td>Dynamic Earth: Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>GEO PS/SI1130</td>
<td>Meteorology</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1220</td>
<td>Historical Geology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 2050</td>
<td>Earth Materials</td>
<td>4</td>
</tr>
<tr>
<td>GEO 2600</td>
<td>Laboratory Safety</td>
<td>1</td>
</tr>
<tr>
<td>GEO SI3010</td>
<td>Oceanography &amp; Earth Systems</td>
<td>3</td>
</tr>
<tr>
<td>GEO 3150</td>
<td>Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4570</td>
<td>Secondary School Science Teaching Methods</td>
<td>3</td>
</tr>
<tr>
<td>GEO 4800</td>
<td>Independent Research</td>
<td>1</td>
</tr>
<tr>
<td>PHYS PS/SI1040</td>
<td>Elementary Astronomy</td>
<td>3</td>
</tr>
<tr>
<td>BTNY LS1203</td>
<td>Plant Biology</td>
<td>3</td>
</tr>
</tbody>
</table>

Select one or more of the following for a minimum of 3 credit hours:

- GEO 3060: Structural Geology (4)
- GEO 3080: Water Resources (3)
- GEO 3180: Paleontology (4)
- GEO 3210: Quaternary Environmental Change (3)
- GEO 3250: Geology of Utah (3)
- GEO 3550: Sedimentology & Stratigraphy (4)
- GEO 4210: Intro to Computer Mapping & GIS (4)
- GEO 4750: Special Topics in the Geosciences (2-4)
- GEO 4950: Advanced Geoscience Fieldtrips (1-3)

### Required Support Courses (28-30 credit hours)

- CHEM PS/SI1210/SI1220: Principles of Chemistry (10)
- PHYS PS/SI1040/SI2010: General Physics (10)
- HIST: History and Philosophy of Science (3)

#### Recommended Support Courses

- MATH QL1050: College Algebra (4)
- MATH 1060: Trigonometry (3)
- MATH QL1080: Precalculus (5)

Any additional upper division Geoscience course (numbered 3000 and above)

- BTNY 3214: Soils (4)
- BTNY 3303: Plant Genetics (3)
- BTNY 3473: Plant Geography (3)
- GEGO 3060: World Environmental Issues (3)
- ZOOL LS1010: Animal Biology (3)

* Completion of ZOOL 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).

### Physical Science Composite Teaching Major

- BACHELOR'S DEGREE

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

### Geosciences Departmental Honors

- Program Prerequisite: Enroll in the General Honors Program and complete 8 hours of General Honors courses (see the Honors Program on page 45).

- Grade Requirements: Maintain an overall GPA of 3.3.

### Geology

#### Minor

Advisor: Dr. Jeff Eaton 626-6225

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

- Credit Hour Requirements: Minimum of 19 credit hours in Geosciences courses.

### Course Requirements for Minor

#### Geology Courses Required (12 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS/SI1110</td>
<td>Dynamic Earth: Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>GEO 1220</td>
<td>Historical Geology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 2050</td>
<td>Earth Materials</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3210</td>
<td>Quaternary Environmental Change (3)</td>
<td>3</td>
</tr>
<tr>
<td>PHYS PS/SI1040</td>
<td>Elementary Astronomy</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Geosciences Electives (minimum 7 credit hours)

Select at least two classes from the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS1060</td>
<td>Environmental Geosciences</td>
<td>3</td>
</tr>
<tr>
<td>GEO 1065</td>
<td>Environmental Geosciences Lab</td>
<td>1</td>
</tr>
<tr>
<td>GEO 3060</td>
<td>Structural Geology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3080</td>
<td>Water Resources</td>
<td>3</td>
</tr>
<tr>
<td>GEO 3150</td>
<td>Geomorphology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3180</td>
<td>Paleontology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 3210</td>
<td>Quaternary Environmental Change (3)</td>
<td>3</td>
</tr>
<tr>
<td>GEO 3550</td>
<td>Sedimentology &amp; Stratigraphy</td>
<td>4</td>
</tr>
<tr>
<td>GEO 4010</td>
<td>Ancient Environments &amp; Paleocoeology</td>
<td>3</td>
</tr>
</tbody>
</table>

### Earth Science Teaching Minor

#### Minor

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 licensure requirements (see Teacher Education Department).

### Course Requirements for Minor

#### Geology Courses Required (20 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS1060</td>
<td>Environmental Geosciences</td>
<td>3</td>
</tr>
<tr>
<td>GEO PS/SI1110</td>
<td>Dynamic Earth: Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>GEO SI1115</td>
<td>Physical Geology Laboratory</td>
<td>1</td>
</tr>
<tr>
<td>GEO 1220</td>
<td>Historical Geology</td>
<td>4</td>
</tr>
<tr>
<td>GEO 2050</td>
<td>Earth Materials</td>
<td>4</td>
</tr>
<tr>
<td>GEO SI3010</td>
<td>Oceanography and Earth Systems</td>
<td>3</td>
</tr>
<tr>
<td>or GEO 3210</td>
<td>Quaternary Environmental Systems (3)</td>
<td>3</td>
</tr>
<tr>
<td>PHYS PS/SI1040</td>
<td>Elementary Astronomy</td>
<td>3</td>
</tr>
</tbody>
</table>
If not taken as part of a student's major requirements, then the following courses are also required (up to 29 credit hours):

- GEO 3570 Foundations of Science Education (3)
- GEO 4570 Teaching Methods (3)
- PHYS PS/SI2010/SI2020 College Physics (10) or PHYS PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
- CHEM PS/SI1210/SI1220 Principles of Chemistry (10)
- HIST 3350 History and Philosophy of Science (3)

Any deviation from the above requirements must be approved by the department in advance.

This minor is best for students majoring in another area of science or science teaching, as one year of chemistry and one year of physics are required to obtain Earth Science teaching certification in the state of Utah.

**Geospatial Analysis**

**MINOR**

**Advisor:** Dr. Michael Hernandez 626-8186

- **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 20 credit hours.

### Course Requirements for Minor

#### Geosciences Courses Required (20 credit hours)

- GEO 3400 Remote Sensing I (4)
- GEO 4210 Intro to Computer Mapping & Geographic Info Systems (4)
- GEO 4220 Technical & Application Issues in GIS (4)
- GEO 4210 Selected Programming Language (4)
- IST SI2110 Software Development I (3)
- IST 3210 Database Design and Implementation (4)
- IST 3720 Software Development II (3)

### 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 SI2110 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.

A selected sample of degree programs that will complement the Geomatics Certificate include Applied Environmental Geosciences, Geology, Computer Science, Information Systems & Technologies, Geography, Archaeology, or a combination of three emphasis areas for a Bachelor of Integrated Studies (BIS) Degree. The Geomatics Certificate provides students with the essential skills necessary for today's geospatial applications.

**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 SI2110 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.

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### 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 SI2110 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.

A selected sample of degree programs that will complement the Geomatics Certificate include Applied Environmental Geosciences, Geology, Computer Science, Information Systems & Technologies, Geography, Archaeology, or a combination of three emphasis areas for a Bachelor of Integrated Studies (BIS) Degree. The Geomatics Certificate provides students with the essential skills necessary for today's geospatial applications.

### 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 SI2110 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.

A selected sample of degree programs that will complement the Geomatics Certificate include Applied Environmental Geosciences, Geology, Computer Science, Information Systems & Technologies, Geography, Archaeology, or a combination of three emphasis areas for a Bachelor of Integrated Studies (BIS) Degree. The Geomatics Certificate provides students with the essential skills necessary for today's geospatial applications.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Department</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEO PS/SI1130. Introduction to Meteorology (3)</td>
<td>F, S</td>
<td>Survey of atmospheric processes that create weather. Topics include solar radiation, temperature, moisture, pressure, wind, storm systems, weather forecasting, and air pollution. Problem solving skills and use of satellite imagery included. Three lectures per week.</td>
<td></td>
</tr>
<tr>
<td>GEO 1220. Historical Geology (4)</td>
<td>S</td>
<td>The history of the Earth and the methods used to interpret this history. Short field trips required. Three lectures and one three-hour lab per week. Prerequisite: GEO PS/SI1110 and GEO SI1115.</td>
<td></td>
</tr>
<tr>
<td>GEO PS/SI1350. Principles of Earth Science (3)</td>
<td>F, S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 2050. Earth Materials (4)</td>
<td>F</td>
<td>An introduction to the origin, classification, and identification of minerals and rocks including topics related to crystallography, mineral chemistry, petrology, and the importance of mineral and rock resources to our society. Three lectures and one three-hour laboratory per week. Prerequisite: GEO SI1115 or permission of instructor.</td>
<td></td>
</tr>
<tr>
<td>GEO 2600. Laboratory Safety (1)</td>
<td>F, S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 2890. Cooperative Work Experience (1-6)</td>
<td>F, S</td>
<td>Open to all students in Geosciences 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.</td>
<td></td>
</tr>
<tr>
<td>GEO 2920. Short Courses, Workshops, Institutes and Special Programs (1-4) (offered as needed)</td>
<td>F, S</td>
<td>Consult the semester class schedule for the current offering under this number. The specific title and credit authorized will appear on the student transcript.</td>
<td></td>
</tr>
<tr>
<td>GEO 2950. Geoscience Fieldtrips (1-3)</td>
<td>F, S</td>
<td>Application of basic Geoscience field methods during fieldtrips. Readings, written and oral reports, and/or examinations may be required. Prerequisite: consent of instructor.</td>
<td></td>
</tr>
<tr>
<td>GEO SI3010. Oceanography and Earth Systems (3) (alternate years)</td>
<td>F, S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3060. Structural Geology (4) (alternate years)</td>
<td>F, S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3080. Water Resources (3)</td>
<td>F</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3150. Geomorphology (4)</td>
<td>S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3180. Paleontology (4) (alternate years)</td>
<td>F</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3210. Quaternary Environmental Change (3) (alternate years)</td>
<td>F, S</td>
<td>Overview of the geologic and paleoclimatic history of the Earth during the last 2 million years (the &quot;Ice Age&quot;), 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 220 or GEOG PS1010 or ANTH SS2030.</td>
<td></td>
</tr>
<tr>
<td>GEO 3250. Geology of Utah (3) (alternate years)</td>
<td>F, S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3400. Remote Sensing I (4)</td>
<td>F</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3550. Sedimentology and Stratigraphy (4)</td>
<td>S</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>GEO 3570. Foundations of Science Education (3)</td>
<td>F, S</td>
<td>A thorough investigation of research in science learning and curricular standards at the state and national levels. Foundations of the philosophy of science and scientific inquiry as applicable to science teaching at the secondary level. This course serves as a foundation to a preservice science teacher's education coursework.</td>
<td></td>
</tr>
</tbody>
</table>
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 Paleozoology (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) F
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 Applicational 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 spatial 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 metamorphic 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.

A laboratory intensive assessment of digital (raster) imagery using advanced computer-assisted digital processing procedures with an emphasis on quantitative statistical analysis through ERDAS Imagine image processing software. The focus is on feature classification of multi spectral imagery, principle components analysis, georectification, 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 geologic processes and history. Includes geologic mapping and analysis of bedrock, surficial deposits, and geologic 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. Applications 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 and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: Admission to the Teacher Education Program.

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)
Variable Title
An opportunity to examine in depth topics in the Geosciences not regularly offered as part of the standard course offerings. The specific 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. Prerequisite: 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 direction 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 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.

PROGRAM

DEVELOPMENTAL MATHEMATICS

Director: Dr. John S. Thaeler
Location: Building 4, Room 506A
Telephone Contact: Lisa Ostermiller 801-626-7478
Associate Professor: John S. Thaeler; Lecturers: Brenda Acor, Alice Alred, Loyal Baker, Mary Jo Hansen, David Imig, Darrell Poore, Carrie Quesnell, John Spence

The Developmental Mathematics Program prepares students to take the Quantitative Literacy courses offered by the Mathematics Department and the Philosophy Program. See the Core Requirements listed under the General Education Requirements of the WSU Degree and General Education Requirements of this catalog.

Placement in Mathematics Courses

Many students enrolling at Weber State are under prepared for college level mathematics. All students requiring developmental course work must enroll in and not withdraw from their initial developmental course(s) within the first two semesters. These students are then required to enroll in developmental course(s) and make progress each subsequent semester (excluding summer) until all relevant minimum developmental requirements (including MATH 1010 if applicable) have been met for the students’ declared degree program of study (AAS, AS, AA, or bachelor’s degree). Otherwise, a hold will be placed on their registration, which can only be removed by the Academic Advisement Center (see the Policy and Procedures Manual, PPM 6-02.III.D.1; weber.edu/ppm/6-02.htm).

Students are placed in the Mathematics developmental sequence of courses either by ACT, ACCUPLACER, or COMPASS scores. Note that the cut scores given below may be subject to change. (For the most recent cut scores, see the WSU Assessment and Placement Standards at weber.edu/wsuiimages/testplacement/assessmentplacement.pdf)

<table>
<thead>
<tr>
<th>ACT MATH Score1</th>
<th>ACCUPLACER Score2</th>
<th>COMPASS Score3</th>
<th>Course Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Applicable</td>
<td>CLM 90 and above</td>
<td>Trig 75 and above</td>
<td>MATH SI1210 (required for some majors)</td>
</tr>
<tr>
<td></td>
<td>CLM 50 and above</td>
<td>CA 50 - 100</td>
<td>MATH QL1030, QL1040, QL1050, QL10604 or QL1080 or PHIL QL22005</td>
</tr>
<tr>
<td>23 and above</td>
<td>Note: CLM 70 or higher satisfies QL and a MATH QL1050 prerequisite requirement for any course</td>
<td>Trig 45 - 74, AL 70 - 100</td>
<td>Note: CA 65 or higher satisfies QL and a MATH QL1050 prerequisite requirement for any course</td>
</tr>
<tr>
<td>22 and below, Must take ACCUPLACER placement exam</td>
<td>Note: CA 65 or higher satisfies QL and a MATH QL1050 prerequisite requirement for any course</td>
<td>AL 70 - 100</td>
<td>MATH QL1010 or PHIL QL22005</td>
</tr>
<tr>
<td>AR 39 and below</td>
<td>AR 40 - 74</td>
<td>AL 0 - 30</td>
<td>MATH ND0950, ND0955</td>
</tr>
<tr>
<td></td>
<td>AR 75 and above</td>
<td>PA 70 - 100</td>
<td>MATH ND0960</td>
</tr>
<tr>
<td></td>
<td>EA 0 - 54</td>
<td>AL 31 - 57</td>
<td>MATH ND0960</td>
</tr>
<tr>
<td></td>
<td>EA 55 - 64</td>
<td>CA 25 - 49</td>
<td>MATH 1010</td>
</tr>
<tr>
<td></td>
<td>CLM 0 - 49</td>
<td>AL 58 - 69</td>
<td>MATH 1010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CA 0 - 24</td>
<td>MATH ND0950</td>
</tr>
</tbody>
</table>

1 ACT MATH scores are only valid for two years from the date of the exam
2 ACCUPLACER scores are only valid for one year from the date of the exam
3 COMPASS scores are only valid for one year from the date of the exam
4 MATH QL1060 does not satisfy the QL requirement
5 PHIL QL2200 will satisfy the QL requirement

Test Score Legend:

<table>
<thead>
<tr>
<th>CLM - College Level Math</th>
<th>EA - Elementary Algebra</th>
<th>AR - Arithmetic</th>
<th>Trig - Trigonometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA - College Algebra</td>
<td>AL - Algebra</td>
<td>PA - Pre-Algebra</td>
<td>NA - Not Applicable</td>
</tr>
</tbody>
</table>

* Weber State University students earning an associate’s degree in General Studies or who anticipate transferring to another institution within the Utah State higher education system should fulfill quantitative literacy (QL) with one of the approved Math QL courses rather than PHIL 2200, “Deductive Logic.” PHIL 2200 will not be accepted in transfer as a QL course by another Utah public institution of higher education.

DEVELOPMENTAL MATHEMATICS COURSES - MATH

MATH ND0950. Pre-algebra (3) F, S
Fundamental concepts of arithmetic including pre-algebra. Does not count for graduation.

MATH ND0955. Integrated Arithmetic and Beginning Algebra (6) Su, F, S
Fundamental concepts of arithmetic including pre-algebra. Relations, functions, positive and negative numbers, rational expressions, linear equations and inequalities. Does not count toward graduation.

MATH ND0960. First Course in Algebra (3) Su, F, S
Relations, functions, positive and negative numbers, rational expressions, linear equations and inequalities. Does not count toward graduation. Prerequisite: MATH ND0950 or placement test.

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.

All Mathematics courses numbered 1020 or higher are found in the following Department of Mathematics portion of the catalog.
From data mining to forensics, mathematics is the language of choice for an ever increasing number of disciplines. The scientist, the engineer, the actuary, the financial planner—all use algebra, geometry, calculus and statistics. But also the voter needs to understand these concepts, albeit at a less advanced level, to reach informed decisions about a multitude of issues from utility rates and retirement saving to information security and global warming.

The Department of Mathematics offers a variety of courses (from developmental through general and into advanced levels of applicability), two minors, departmental honors, and three majors. The Mathematics major may be the best choice for someone planning to go directly to graduate school; the Applied Mathematics major prepares one for a job that uses mathematics; the Mathematics Teaching major prepares students to be teachers of mathematics in high school.

**Prerequisites**

Since each course in mathematics requires a working knowledge of principles from prerequisite courses, students are required to earn a “C” grade in each prerequisite course before registering for the next course.

**Placement**

Weber State University students will be placed into mathematics courses by the following procedure.

A. To enroll in mathematics courses numbered 1210 through 2210, or MATH QL1030, MATH QL1040, students by the following procedure.

B. To enroll in mathematics courses numbered 1210 through 2210, or MATH QL1030, MATH QL1040, students by the following procedure.

- Obtain the appropriate AP Calculus score described below:
  - Five on the BC test places the student in MATH SI1220
  - Four or five on the AB test places the student in MATH SI1220
  - Three on the AB test places the student in MATH SI1210
  - Two scored sufficiently high on a placement exam at the WSU testing center.

- Complete the prerequisite course(s) with a grade of “C” or
c. 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'S DEGREE (BS OR BA)**

- **Program Prerequisite:** Not required for Mathematics and Applied Mathematics majors. Mathematics Teaching majors must meet the Teacher Education admission and licensure 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—31-46 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**

Declarer your program of study (see page 17) 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 licensure requirements (see Teacher Education Department).

**General Education**

Refer to pages 37-43 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.

**Course Requirements for Mathematics**

**BS or BA Degree**

**Mathematics Courses Required (30 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH SI1210</td>
<td>Calculus I (4)</td>
</tr>
<tr>
<td>MATH SI1220</td>
<td>Calculus II (4)</td>
</tr>
<tr>
<td>MATH 2210</td>
<td>Calculus III (4)</td>
</tr>
<tr>
<td>MATH 2270</td>
<td>Elementary Linear Algebra (3)</td>
</tr>
<tr>
<td>MATH 2280</td>
<td>Ordinary Differential Equations (3)</td>
</tr>
</tbody>
</table>
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
BS or BA Degree
The Applied Mathematics Program provides an opportunity for WSU students to apply mathematics to different fields. The program requires 19 credit hours of core lower division mathematics courses, a minimum of 12 credit hours of upper division applied mathematics courses and additional upper division courses in specified fields, including mathematics, so the total upper division credit hours reaches at least 40. To design a specific program different from the tracks below, students must get approval from a Mathematics Department advisor.

Lower Division Mathematics Courses
Required for All Tracks (19 credit hours)
MATH 1200 Mathematics Computer Laboratory (1)
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)

1. REGULAR TRACK
A traditional diversified program in applied mathematics.

Required Upper Division Mathematics Courses
(12 credit hours)
MATH 3410 Probability and Statistics (3)
MATH 3550 Introduction to 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 at least an additional 12 credit hours of upper division Mathematics courses.

Support Courses Required (6-10 credit hours)
Complete 2 calculus based courses outside the Mathematics Department, for example PHYS PS/SI2210 Physics for Scientists and Engineers I (5), ECON 3030 Managerial Economics (3), CHEM 3400 Molecular Symmetry and Applied Math for Physical Chemistry (3), etc.

Graduate School Preparation
It is recommended that students planning on graduate work in Applied Mathematics take MATH 4210/4220 Introductory Real Analysis and all Mathematics courses in the future area of graduate study. See the Mathematics Department for counseling.

2. COMPUTING TRACK

Additional Required Lower Division Courses
(16 credit hours)
CS SI1400 Fundamentals of Programming (4)
CS SI1410 Object-Oriented Programming (4)
CS SI2420 Introduction to Data Structures and Algorithms (4)
MATH 1630 Discrete Mathematics Applied to Computing (4)

Required Upper Division Mathematics Courses
(15 credit hours)
MATH 3410 Probability and Statistics (3)
MATH 3550 Introduction to Mathematical Modeling (3)
MATH 3710 Boundary Value Problems (3)
MATH 3730 Partial Differential Equations (3)
MATH 3750 Dynamical Systems (3)
MATH 3810 Complex Variables (3)
MATH 4610 Numerical Analysis (3)
or MATH 4620 Enumeration (3)

Electives (at least 25 credit hours)
Complete at least an additional 25 credit hours of upper division courses in Computer Science or Mathematics. At least 6 of these credit hours must be in Computer Science.

3. PHYSICAL MATHEMATICS TRACK

Required Upper Division Mathematics Courses
(18 credit hours)
Complete 6 of the following courses
MATH 3410 Probability and Statistics (3)
MATH 3550 Introduction to Mathematical Modeling (3)
MATH 3710 Boundary Value Problems (3)
MATH 3730 Partial Differential Equations (3)
MATH 3750 Dynamical Systems (3)
MATH 3810 Complex Variables (3)
MATH 4610 Numerical Analysis (3)

Electives (at least 22 credit hours)
Complete at least an additional 22 credit hours of upper division courses in Chemistry, Geosciences, Mathematics, or Physics. At least 6 of these credit hours must be outside Mathematics.

4. ENGINEERING MATHEMATICS TRACK

Required Upper Division Mathematics Courses
(18 credit hours)
Complete 6 of the following courses
MATH 3410 Probability and Statistics (3)
MATH 3550 Introduction to Mathematical Modeling (3)
MATH 3710 Boundary Value Problems (3)
MATH 3730 Partial Differential Equations (3)
MATH 3750 Dynamical Systems (3)
MATH 3810 Complex Variables (3)
MATH 4610 Numerical Analysis (3)

Electives (at least 22 credit hours)
Complete at least an additional 22 credit hours of upper division courses from the Engineering Technology programs. At least 6 of these credit hours must be outside of Mathematics.

5. ACTUARIAL/FINANCIAL MATHEMATICS TRACK

Required Upper Division Mathematics Courses
(15 credit hours)
MATH 3410 Probability and Statistics (3)
MATH 3420 Probability and Statistics (3)
and three of the following courses
MATH 3550 Introduction to Mathematical Modeling (3)
MATH 3710 Boundary Value Problems (3)
MATH 3730  Partial Differential Equations (3)
MATH 4610  Numerical Analysis (3)

Electives (at least 25 credit hours)
Complete at least an additional 25 credit hours of upper division Mathematics courses or courses from the list below offered by the John B. Goddard School of Business and Economics:

- ACTG 3110 Intermediate Financial Accounting I (3)
- ACTG 3120 Intermediate Financial Accounting II (3)
- ECON 3030 Managerial Economics (3)
- ECON 4010 Intermediate Microeconomic Theory (3)
- ECON 4020 Intermediate Macroeconomic Theory (3)
- ECON 4550 Introduction to Econometrics (3)
- ECON 4560 Mathematical Economics (3)
- FIN 3200 Financial Management (3)
- FIN 3300 Investments (3)
- FIN 4400 Financial Problems - Corporate Finance (3)
- MGMT 3010 Organizational Behavior and Management (3)
- MKTG 3010 Marketing Concepts and Practices (3)
- QUAN SI3610 Business Statistics II (3)

6. NATURAL/LIFE SCIENCES TRACK

Required Upper Division Mathematics Courses (12 credit hours)
- MATH 3410 Probability and Statistics (3)
- MATH 3550 Introduction to Mathematical Modeling (3)
- MATH 3710 Boundary Value Problems (3)
- MATH 3750 Dynamical Systems (3)
- MATH 4610 Numerical Analysis (3)

Electives (at least 28 credit hours)
Complete at least an additional 28 credit hours of upper division courses in Botany, Mathematics, Microbiology or Zoology. At least 6 of these credit hours must be outside of Mathematics.

Course Requirements for Mathematics Teaching BS or BA Degree

Mathematics Courses Required (48 credit hours)
- MATH SI1210 Calculus I (4)
- MATH SI1220 Calculus II (4)
- MATH 2110 Foundations of Algebra (3)
- MATH 2120 Euclidean Geometry (3)
- MATH 2210 Calculus III (4)
- MATH 2220 Ordinary Differential Equations (3)
- MATH 2410 Foundations of Probability and Statistics (3)
- MATH 3050 History of Mathematics (3)
- MATH 3120 Foundations of 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 (5)
- or
- CHEM PS/SI1210 Principles of Chemistry (5)

and
- CHEM SI1220 Principles of Chemistry (5)

A minor is required. A student must also complete requirements for a secondary education licensure as determined by the Jerry and Vickie Moges College of Education.

Mathematics

DEPARTMENTAL HONORS

- Program Prerequisite: Enroll in General Honors Program and complete at least 6 hours of General Honors courses (see the Honors Program on page 45).

- Grade Requirements: Maintain an overall GPA of 3.3 and a mathematics GPA of 3.3.

- Credit Hour Requirements: Fulfill the requirements for the departmental Mathematics major (regular emphasis) and some extras, including MATH 4910 and 9 hours of upper division Mathematics courses taken for Honors credit, i.e.: Complete MATH SI1210, 1220, 2210, 2270, 2280, 4110, 4120, 4210, 4220 plus 15 more hours of upper division mathematics courses (grades of "C" or better required). Nine of the upper division hours must be for Honors credit.*

and
- Complete MATH 4910 Senior Research Project
- Complete Physics PS/SI2210 and SI2220
- Complete a minor

and
- Complete general education requirements

*To take a mathematics course for Honors credit, do the following: Enroll in the course, fill out an Agreement for Departmental Honors Component Credit form with the instructor which both the instructor and student should sign, and turn in the Program by the second week of the semester. Then abide by the contract. The requirements will be the regular course assignments plus some extra work which will vary with the course and the instructor, but it could include writing a paper, doing an extra project, doing extra readings and reporting on them, and/or giving a talk to the class (or in some other forum). The extra part of the course will be a significant assignment.

Mathematics

MINOR AND TEACHING 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 20 credit hours for 24 credit hours for Mathematics Teaching minor At least one upper-division mathematics course for three credit hours must be completed at Weber State University.

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

Course Requirements for Mathematics Minor (Regular Emphasis)

Mathematics Courses Required (11 credit hours)
- MATH SI1210 Calculus I (4)
- MATH SI1220 Calculus II (4)
- MATH 2270 Elementary Linear Algebra (3)

Electives (9-10 credit hours)
Take three courses chosen from the following:
- MATH 2210 Calculus III (4)
- MATH 2280 Ordinary Differential Equations (3)

any upper division mathematics courses (courses numbered 3000 and higher)
Course Requirements for Mathematics Teaching Minor

Mathematics Courses Required (26 credit hours)

- MATH SI1210 Calculus I (4)
- MATH SI1220 Calculus II (4)
- MATH 2110 Foundations of Algebra (3) or MATH 4110 Modern Algebra I (3)
- MATH 2120 Euclidean Geometry (3)
- MATH 2270 Elementary Linear Algebra (3)
- MATH 2410 Foundations of Probability and Statistics (3) or MATH 3410 Probability and Statistics (3)
- MATH 3120 Foundations of Euclidean & non-Euclidean Geometry (3)
- MTH 3010 Methods & Technology for Teaching Secondary Mathematics (3)

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 2100. Mathematics for Elementary Teachers I (3) Su, F, S
Prospective elementary school teachers revisit mathematics topics from the elementary school curriculum and examine them from an advanced perspective including arithmetic, number theory, set theory and problem solving. Prerequisite: MATH QL1050.

MATH 2120. Euclidean Geometry (3)
Exploration of Euclidean geometry, from basic concepts to advanced theorems. Prerequisite: MATH SI1210 or consent of instructor.

MATH 2210. Calculus III (4) Su, F, S
Vector algebra, vector valued functions, multivariable functions, partial derivatives, multiple integrals, line integrals, integration in vector fields. Prerequisite: MATH SI1220.

MATH 2250. Linear Algebra and Differential Equations (4)
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: MATH SI1220.

MATH 2270. Elementary Linear Algebra (3) F, S
Systems of linear equations, matrices, vector spaces, eigenvalues, linear transformations, orthogonality. Prerequisite: MATH SI1220.

MATH 2280. Ordinary Differential Equations (3) F, S
Methods of solution for ordinary differential equations. Exact equations, linear equations Laplace Transforms, series solutions. Prerequisite: MATH SI1220.

MATH 2410. Foundations of Probability and Statistics (3)
An introduction to probability and statistics with special emphasis on concepts in the K-12 school curriculum. Prerequisite: MATH SI1210 or MATH QL1050 and consent of instructor.

MATH 2920. 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.

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 320. Foundations of Euclidean and Non-Euclidean Geometry (3) F
Axiomatic development of geometry; Euclidean and non-Euclidean. MATH SII220, and either MATH 2120 or consent of instructor.

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 SII120.

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 SII220. 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 SII120.

MATH 3620. Enumeration (3) S
Principles of Enumeration including counting principles, generating functions, recurrence relations, inclusion-exclusion, and applications. Prerequisite: MATH SII120.

MATH 3710. Boundary Value Problems (3) F
Fourier series and the method of separation of variables. Heat, wave, and potential equations, Sturm-Liouville problems, orthogonal functions, special functions. Prerequisites: MATH 2210 and 2270 or 2280.

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. Prerequisites: 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 2270.

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 an ability to use a 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.

MATH 325. Mathematical Reasoning (3)
An advanced course in formal reasoning and proof writing. The course develops the ability to think logically and construct formal proofs. Prerequisite: MATH 2210 or consent of instructor.

MATH 330. Advanced Calculus (3)
A rigorous treatment of the topics covered in MATH 2210 and 2270. Prerequisites: MATH 2210 and 2270.
MTHE SI3080. Number Theory for Elementary Teachers (3) S
Survey of elementary number theory concepts with applications to topics of interest plus teaching suggestions. Prerequisite: MATH 2010 and MATH 2020.

MTHE 4010. Capstone Mathematics for High School Teachers I (3) S
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.

MTHE 4020. Capstone Mathematics for High School Teachers II (3) S
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.

MTHE SI4040. Mathematical Problem Solving for Elementary Teachers (3) S
Mathematical problem solving, discussion of process, writing solutions, and writing extensions. Prerequisite: MATH 2010 and MATH 2020.

MTHE SI4100. Intuitive Calculus for Elementary Teachers (3) F
Prerequisite: MATH 2010 and MATH 2020.

MTHE 4700. Senior Project in Elementary Mathematics Teaching (3) F, S
Projects in preparing, teaching and revising sequential mathematics lessons for elementary students. Prerequisite: MATH 2010 and MATH 2020.

MTHE 5010. Methods and Technology for Teaching Secondary Mathematics (3)
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.

MTHE 5210. Calculus with Analytic Geometry (4)
Analytic geometry, differentiation, integration, and applications. Prerequisite: MATH QL1050 and 1060 or MATH QL1080 or placement test.

MTHE 5220. Calculus with Analytic Geometry (4)
Transcendental functions, techniques of integration, conic sections, polar coordinates, infinite series, introduction to partial derivatives. Prerequisite: MTHE 5210.

MTHE 5230. Mathematics Computer Laboratory (1)
Computer solution of mathematics problems. May be taken concurrently with any lower division mathematics course. Prerequisite: Approval of instructor.

MTHE 5310. Multivariable and Vector Calculus (4)
Vectors, vector valued functions, motion in space, multivariable functions, partial derivatives, multiple integrals, integration in vector fields. Prerequisite: MTHE 5220.

MTHE 5350. Linear Algebra and Differential Equations (4)
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.

MTHE 6120. Euclidean and Non-Euclidean Geometry (3)
Axiomatic development of geometry; Euclidean and non-Euclidean. Prerequisite: MTHE 5220.

MTHE 6160. Number Theory (3)
An overview of beginning number theory including the integers, modulo arithmetic, congruencies, Fermat's theorem and Euler's theorem. Prerequisite: MTHE 5210.

MTHE 6350. Linear Algebra (3)
Theoretical and applications of linear algebra including abstract vector spaces and canonical forms of matrices. Prerequisite: MTHE 5350.

MTHE 6410, 6420. Probability and Statistics (3-3)
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.

MTHE 6550. Introduction to Mathematical Modeling (3)
Formulation, solution and interpretation of mathematical models for problems occurring in areas of physical, biological and social science. Prerequisite: MTHE 5310 and 5350.

MTHE 6610. Graph Theory (3)
Principles of Graph Theory including methods and models, special types of graphs, paths and circuits, coloring, networks, and other applications. Prerequisite: MTHE 5210.

MTHE 6620. Enumeration (3)
Principles of Enumeration including counting principles, generating functions, recurrence relations, inclusion-exclusion, and applications. Prerequisite: MTHE 5210.

MTHE 6630. Boundary Value Problems (3)
Series solutions, Fourier series, separation of variables, orthogonal functions. Prerequisite: MTHE 5350.

MTHE 6640. Differential Equations II (3)
Matrix approach to linear systems, nonlinear systems, Laplace transforms. Prerequisite: MTHE 5350.

MTHE 6650. Complex Variables (3)
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.

MTHE 6660. Modern Algebra I (3)
Logic, sets, and the study of algebraic systems including groups, rings, and fields. Prerequisite: MTHE 5350.

MTHE 6670. Modern Algebra II (3)
Continuation of MATH 4110: advanced topics from groups, rings, and fields including the Sylow theorems and Galois theory. Prerequisite: MTHE SI3080.

MTHE 6680, 6690. Introductory Real Analysis (3-3)
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.

MTHE 6700. Topology (3)
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.
MTHE 6710, 6720. Numerical Analysis (3-3)
Introduction to numerical methods. Use of the digital computer in solving otherwise intractable problems. Prerequisite: MTHE 5350 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:
Karen G. Nakaoka, Craig J. Oberg, Mohammad Sondossi;
Associate Professor: William Lorowitz; 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’s Degree (BS)

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 the 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 17). There are no special admission or application requirements for this program.

General Education
Refer to pages 37-43 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, PHYS PS/SI1010 or PHYS PS/SI2010, BTNY LS1203, and ZOOL LS1010.

Course Requirements for BS Degree

Microbiology Courses Required (19 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MICR LS/SI2054</td>
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<tr>
<td>MICR 3053</td>
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</tr>
<tr>
<td>MICR 3154</td>
<td>4</td>
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<tr>
<td>MICR 4054</td>
<td>4</td>
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<tr>
<td>MICR 4154</td>
<td>4</td>
</tr>
<tr>
<td>ZOOL 3300</td>
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Microbiology Elective Courses (20 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>MICR 3505</td>
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</tr>
<tr>
<td>MICR 4252</td>
<td>2</td>
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<tr>
<td>MICR 4354</td>
<td>4</td>
</tr>
<tr>
<td>MICR 4554</td>
<td>4</td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>4</td>
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</table>

Required Support Classes (32-42 credit hours)

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CHEM PS/SI1210/SI1220</td>
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<tr>
<td>CHEM 2310</td>
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<tr>
<td>CHEM 3070</td>
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<td>MATH QL1050</td>
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<td>MATH QL1080</td>
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<tr>
<td>BTNY SI2104</td>
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<td>3</td>
</tr>
<tr>
<td>ZOOL SI1120</td>
<td>3</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.

Special Emphases

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:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICR 3484</td>
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</tr>
<tr>
<td>MICR 3853</td>
<td>3</td>
</tr>
<tr>
<td>MICR 4252</td>
<td>2</td>
</tr>
<tr>
<td>MICR 4354</td>
<td>4</td>
</tr>
<tr>
<td>ZOOL 3300</td>
<td>4</td>
</tr>
</tbody>
</table>
and consider the following

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTNY 3504</td>
<td>Mycology (4)</td>
<td></td>
</tr>
<tr>
<td>BTNY 3514</td>
<td>Algology (4)</td>
<td></td>
</tr>
<tr>
<td>BTNY 3523</td>
<td>Marine Biology (3)</td>
<td></td>
</tr>
<tr>
<td>CHEM 3050</td>
<td>Instrumental Analysis (3)</td>
<td></td>
</tr>
</tbody>
</table>

**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 QL1050*: College Algebra (4)

*or equivalent of a full year of college math

**Microbiology**

Students planning to attend graduate school should include the following

- PHYS PS/SI2100/SI2200: General Physics w/lab (10)
- or PHYS PS/SI2210/SI2220: Physics for Sci & Eng w/lab (10)
- ZOOL 2200: Human Physiology (4)
- ZOOL 3200: Cell Biology (4)
- ZOOL 3300: Genetics (4)

and consider the following

- MICR 3254: Immunology (4)
- MICR 3305: Medical Microbiology (5)
- MICR 4554: Virology (4)
- PSY SS1010: Introductory Psychology (3)
- ZOOL SI1110/SI1120: Principles of Zoology I & II (8)

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

**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) S
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 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, 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 3570. Foundations of Science Education (3)
A thorough investigation of research in science learning and curricular standards at the state and national levels. Foundations of the philosophy of science and scientific inquiry as applicable to science teaching at the secondary level. This course serves as a foundation to a preservice science teacher’s education coursework.

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; CHEM 3070 recommended.

MICR 4154. Microbial Genetics (4) S
Genetics of microorganisms and its applications, including mutation, 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 three-hour lab and lecture sessions per week. Prerequisite: MICR LS/SI2054, or BTNY LS/SI1105 (if previously taken - no longer offered), or BTNY LS/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 4570. Secondary School Science Teaching Methods (3)
Acquaintance and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: Admission to the Teacher Education Program.

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 MEd Science Emphasis Program.

DEPARTMENT

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, Walthter N. Spijeldvik; Associate Professors: Colin Inglefield, Adam Johnston; 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'S DEGREE (BS OR BA)

Program Prerequisite: Not required for Physics or Applied Physics. Physics Teaching majors must meet the Teacher Education admission and licensure 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 37.

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 45 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 and 26 to 31 within the Applied Physics major.

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 17). There are no special admission or application requirements for the Physics and Applied Physics majors. Teaching majors must meet the Teacher Education admission and licensure requirements (see Teacher Education Department).

General Education
Refer to pages 37-43 for specific requirements. The following courses required for the Physics and Applied Physics majors will satisfy general education requirements: PHYS PS/SI2210, CHEM PS/S/12210 and MATH SI1210. The following courses required for the Physics Teaching Major will satisfy general education requirements: PHYS PS/SI1010, PS/SI2210, and Math1210.

Course Requirements for BS or BA Degree

Physics Major

Physics Courses Required (41 credit hours)

<table>
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<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS PS/SI2210/SI2220</td>
<td>Physics for Scientists &amp; Engineers (10)</td>
<td></td>
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<tr>
<td>PHYS 2300</td>
<td>Scientific Computing</td>
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<tr>
<td>PHYS 2710</td>
<td>Introductory Modern Physics (3)</td>
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<tr>
<td>PHYS 3180</td>
<td>Thermal Physics (3)</td>
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<tr>
<td>PHYS 3410</td>
<td>Electronics for Scientists (4)</td>
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<tr>
<td>PHYS 3500</td>
<td>Analytical Mechanics (3)</td>
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<tr>
<td>PHYS 3510</td>
<td>Electromagnetic Theory (3)</td>
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<tr>
<td>PHYS 3540</td>
<td>Mech. &amp; Electromagnetic Waves (3)</td>
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<tr>
<td>PHYS 3640</td>
<td>Advanced Physics Lab (2)</td>
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<tr>
<td>PHYS 4610</td>
<td>Quantum Mechanics (3)</td>
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<tr>
<td>PHYS 4620</td>
<td>Atomic, Nuclear, &amp; Particle Physics (3)</td>
<td></td>
</tr>
<tr>
<td>PHYS 4990</td>
<td>Seminar in Physics (1)</td>
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</tbody>
</table>

Physics Electives (3 credit hours)
Select 3 credit hours from the following:

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<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 3160</td>
<td>Astrophysics (3)</td>
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<tr>
<td>PHYS 3190</td>
<td>Applied Optics (3)</td>
<td></td>
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<tr>
<td>PHYS 3200</td>
<td>Solid State Physics (3)</td>
<td></td>
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<tr>
<td>PHYS 3300</td>
<td>Advanced Computational Physics (3)</td>
<td></td>
</tr>
<tr>
<td>PHYS 3420</td>
<td>Data Acquisition and Analysis (3)</td>
<td></td>
</tr>
</tbody>
</table>
Course Requirements for BS or BA Degree

Applied Physics Major

Physics Courses Required (25 credit hours)
- PHYS 4800: Individual Research Problems (1-3)
- PHYS 4830*: Readings in Physics (1-3)
- PHYS 4970: Senior Thesis (2)

Support Courses Required (31 credit hours)
- CHEM PS/SI2120/SI2220: Principles of Chemistry (10)
- MATH SI2120: Calculus I (4)
- MATH SI2220: 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)

Physics Courses Required (38 credit hours)
- PHYS PS/SI2210/SI2220: Physics for Scientists & Engineers (10)
- PHYS 2300: Scientific Computing for Physical Systems (3)
- PHYS 2710: Introductory Modern Physics (3)
- PHYS 3190: Applied Optics (3)
- PHYS 3410: Electromagnetics 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 nine credits in approved Physics classes (courses numbered 2300 and above, excluding other explicit course requirements).

Support Courses Required (11 credit hours)
- HIST 3550: History and Philosophy of Science (3)
- MATH SI2120/SI2220: Calculus I, II (8)

Students must also complete the Teacher Education Licensure Program.

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’S DEGREE (BS OR BA)

- Program Prerequisite: Composite Teaching majors must meet the Teacher Education admission and licensure 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 37. 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 68 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 13 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 801-626-6269). Students in this program should work closely with their advisor to ensure their teaching endorsements in multiple subject areas within physical science.

Admission Requirements
Declare your program of study (see page 17). Physical Science Composite Teaching majors must satisfy Teacher Education admission and licensure requirements (see Teacher Education Department).

General Education
Refer to pages 37-43 for specific requirements. The following courses required for this major will satisfy physical science general education requirements: CHEM PS/SI2120, GEO PS/SI1110 and PHYS PS/SI2210.

Course Requirements for BS or BA Degree

Required Courses (minimum of 68 credit hours)
- Physics Courses (19 credit hours)
  - PHYS 1040: Elementary Astronomy (3)
  - PHYS PS2210 & PS2220: Physics for Scientists & Engineers I & II (w/ lab) (10)
- Physics electives
  - PHYS 2300 and above (6)
- Geology Courses (17 credit hours)
  - GEO 1060: Environmental Geosciences (3)
  - GEO 1110: Physical Geology (3)
  - GEO 1115: Physical Geology Lab (1)
  - GEO 1130: Intro to Meteorology (3)
  - GEO 1220: Historical Geology (4)
  - GEO 3010: Oceanography/Earth Systems (3)
  - or GEO 3210: Quaternary Environmental Change (3)
**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 2300 and above)

**Support Courses Required (11 credit hours)**
- MATH SI1210/SI1220  Calculus I & II (8)
- HIST 3350  History and Philosophy of Science (3)

Students must also complete the Teacher Education Licensure Program.

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**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, sound, electricity, magnetism, atomic and nuclear physics, radioactivity, and relativity. Three hours of lecture per week.

- **PHYS PS/SI11040. 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 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 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. Co-requisite: 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 for Physical Systems (3) F
An introduction to computer programming and fundamental numerical algorithms as used for problem solving and visualization in the natural sciences. Applications may include nonlinear dynamics, chaos, many-particle systems, and Monte Carlo techniques. Prerequisites: PHYS 2210, MATH 1200, and MATH 1210.

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 1200, and 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 reading project which includes physics at the lower division level for one or more semesters. Prerequisite: Consent of instructor.

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 authorization 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 and MATH 1200.

PHYS 3180. Thermal Physics (3) S
An introduction to thermodynamics and statistical mechanics. Topics include heat and work; ideal gases; 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, MATH 1200 and MATH SI1220.

PHYS 3190. Applied Optics (3) F
Geometrical and physical optics, lasers, lenses, optical instruments, interference, thin films, interferometry, holoigraphy, diffraction, gratings, crystal diffraction, polarization. Prerequisites: PHYS SI2220, MATH 1200 and 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. Advanced Computational Physics (3) S (alternate years - even)
This course extends the computational skills developed in PHYS 2300 to address a wider range of problems in modern physics. Students will explore the limits of computational methods and develop techniques suited to high-performance computing. Applications may be chosen from nonlinear dynamics, astrophysics, condensed matter physics, and quantum mechanics. Prerequisites: PHYS 2220 and 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, and MATH 1200. 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, MATH 1200 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 1200, 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 3570. Foundations of Science Education (3)**
A thorough investigation of research in science learning and curricular standards at the state and national levels. Foundations of the philosophy of science and scientific inquiry as applicable to science teaching at the secondary level. This course serves as a foundation to a preservice science teacher's education coursework.

**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 and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: 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 MEd 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**

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 pre-medical 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.

**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.

- **ZOOL 3340** Information Resources in the Life Sciences (2)
- **ZOOL 3470** Zoogeography (3)
- **ZOOL 3500** Conservation Biology (3)
- **ZOOL 3730** Population Biology (3)
- **ZOOL 4050** Comparative Vertebrate Anatomy (4)
- **ZOOL 4100** Vertebrate Embryology (4)
- **ZOOL 4120** Histology (4)
- **ZOOL 4060** Comparative Physiology (4)
- **ZOOL 4210** Advanced Human Physiology (4)
- **ZOOL 4220** Endocrinology (4)

*If not taken as a required course*

- **ZOOL 4250** Radiation Biology (4)
- **ZOOL 4300** Molecular Genetics (4)
- **ZOOL 4330** Animal Behavior (4)
- **ZOOL 4470** Wildlife Ecology and Management (4)
- **ZOOL 4480** Aquatic Ecology (4)
- **ZOOL 4500** Parasitology (4)
- **ZOOL 4600** Prototaxology (4)
- **ZOOL 4640** Entomology (4)
- **ZOOL 4650** Ichthyology (4)
- **ZOOL 4660** Herpetology (4)
- **ZOOL 4670** Ornithology (4)
- **ZOOL 4680** Mammmalogy (4)
- **ZOOL 4800** Problems in Zoology (1-4)
- **ZOOL 4830** Readings in Zoology (1-4)
- **ZOOL 4890** Cooperative Work Experience (1-4)

*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)
- **ZOOL 4920** Short Courses, Workshops, etc. (1-4)
- **ZOOL 4950** Field Zoology (1-3)
- **ZOOL 4970** Thesis (2)
- **ZOOL 4980** Research Design (2)
- **ZOOL 4990** Seminar (1)

*ZOOL 4990 may count toward fulfilling the elective hours requirement only if it is additional to the 1 credit required for the major.*

**Other Zoology Courses**

These do not qualify as Zoology electives.

- **ZOOL 2100** Human Anatomy (4)
- **ZOOL 2200** Human Physiology (4)
- **ZOOL 2800** History of Life Sciences (3)
- **ZOOL 2900** Topics in Zoology (1-4)
- **ZOOL 2920** Short Courses, Workshops . . . (1-4)

**Support Courses Required**

- **CHEM PS/SI1130** Elementary Chemistry (5)
- **& CHEM SI1120** Elementary Organic Bio-Chemistry (5)

or

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

**CHEM 3070 may be taken instead of CHEM 2320.**

Pre-medical professional students should take **CHEM 1210/1220 and CHEM 2310/2320.**

- **MATH QL1050** College Algebra (4)
- **or MATH QL1080** Pre-Calculus (5)
- **or MATH QL1210** Calculus (4)
Students planning to attend graduate or professional schools are encouraged to take a class in the Calculus series (MATH SI1210/ SI1220). Pre-medical professional students are required to take one year of mathematics.

PHYS PS/SI1010 Elementary Physics (3)
or
PHYS PS/SI2010/SI2020 General Physics (10)
or
PHYS PS/SI2210/SI2220 Calculus Physics (10)

Pre-medical professional students should take PHYS PS/SI2010/SI2020 with labs.

Choose any two (2) Botany or Microbiology courses from the list below. Approval must be obtained from the Botany and Microbiology Department Chair before taking Botany and Microbiology courses numbered 3000 and above. Ecology-oriented students should take at least one Botany class, and Pre-medical professional students should take at least one Microbiology class.

BTNY LS1203 Plant Biology (3)
BTNY SI2104 Plant Form and Function (4)
BTNY SI2114 Evolutionary Survey of Plants (4)
BTNY DV2303 Ethnobotany (3)
BTNY 3105 Anatomy & Morphology of Vascular Plants (5)
BTNY 3204 Plant Physiology (4)
BTNY 3214 Soils (4)
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 4113 Plant Evolution (3)
MICR LS/SI2054 Principles of Microbiology (4)
MICR 3053 Microbiological Procedures (3)
MICR 3254 Immunology (4)
MICR 3305 Medical Microbiology (5)
MICR 3484 Environmental Microbiology (4)
MICR 3502 Environmental Health (2)
MICR 3853 Food Microbiology (3)
MICR 4054 Microbial Physiology (4)
MICR 4252 Cell Culture (2)
MICR 4554 Virology (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.

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

ZOOL 3200, 3300, 3450, 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.

Pre-professional 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 EMPHASIS

Pre-medical 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. 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 Mammalogy (4)

Support Course Electives in Botany

BTNY 3624 Taxonomy of Vascular Plants (4)
BTNY 3473 Plant Geography (3)

SPECIAL EMPHASIS

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 (MS or PhD degree), should minor in Botany. (Consult with the department secretary at 801-626-6165 for information about the advisor of this program.)

BIOLGY COMPOSITE TEACHING MAJOR

BACHELOR’S DEGREE (BS OR BA)

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

Program Prerequisite: Must meet the Teacher Education admission and licensure 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: This major requires 120-124 credit hours. The student must also complete requirements for a secondary education license as determined by the Jerry and Vicki Moyes College of Education.

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

 Declare your program of study (see page 17). Biology Composite Teaching majors must satisfy Teacher Education admission and licensure requirements (see Teacher Education Department in this catalog).

General Education

Refer to pages 37-43 or either Bachelor of Science or Bachelor of Arts requirements. The following courses required for the Biology Composite Teaching major also will satisfy general education requirements: MICR LS/SI2054, GEO PS/SI1110, CHEM PS/SI1110 or CHEM PS/SI1210, PHYS PS/SI1010, CHF SS1500, COMM HU1020, and MATH QL1050.
Course Requirements for BS Degree

**Biological Science Courses Required (46 credit hours)**

- BTNY SI2104 Plant Form and Function (4)
- BTNY SI2114 Evolutionary Survey of Plants (4)
- MICR LS/SI2054 Principles of Microbiology (4)
- ZOOL SI1110/1120 Principles of Zoology I & II (8)
- ZOOL 2200 Human Physiology (4)
- or ZOOL 4060 Comparative Physiology (4)
- ZOOL 3300 Genetics (4)
- ZOOL 3720 Evolution (3)
- or BTNY 4113 Plant Evolution (3)
- BTNY 3454 Plant Ecology (4)
- or ZOOL 3450 Ecology (4)
- or MICR 3154 Microbial Ecology (4)
- BTNY 2600 Laboratory Safety (1)
- or MICR 2600 Laboratory Safety (1)
- or ZOOL 2600 Laboratory Safety (1)
- BTNY/ZOOL/MICR 3000+ Electives (3)
- BTNY 3570 Foundations of Science Education (3)
- or MICR 3570 Foundations of Science Education (3)
- or ZOOL 3570 Foundations of Science Education (3)
- ZOOL 4570 Science Teaching Methods (3)
- or BTNY 4570 Science Teaching Methods (3)
- or MICR 4570 Science Teaching Methods (3)
- BTNY 4800 Independent Research (1)
- or MICR 4800 Independent Research (1)
- or ZOOL 4800 Independent Research (1)

**Support Courses Required (23-25 credit hours)**

- CHEM PS/Si1110 Elementary Chemistry (5)
- CHEM Si1120 Elementary Organic Bio-Chemistry (5)
- or CHEM PS/Si1210/1220 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)

It is recommended that more advanced courses in Mathematics, Physics and Chemistry be taken, especially if graduate studies are planned. These should be discussed in advance with the advisor.

**Zoology**

**DEPARTMENTAL HONORS**

- **Program Prerequisite:** Enroll in the General Honors Program and complete 10 hours of General Honors courses (see the Honors Program on page 45).

- **Grade Requirements:** Maintain an overall GPA of 3.5.

- **Credit Hour Requirements:** Fulfill the requirements for the Zoology major, of which at least 12 hours must be completed on an Honors basis. A student may receive Honors credit for any Zoology course numbered above 3000.* In addition, complete the senior seminar with Zoology department Honors credit and the thesis.

- *Permission from the course professor should be sought before registering in a course for Honors credit. A written agreement should be reached with the professor regarding the work expected for Honors credit. (See the Honors Program on page 45.)*

**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)

**Elective Zoology Courses (8 credit hours)**

Select 8 credit hours of Zoology courses at or above the 2000 level.

**Biological Teaching Minor**

This minor replaces and is a consolidation of the Botany and Zoology Teaching Minors.

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

- **Credit Hour Requirements:** A minimum of 47 credit hours.

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

Course Requirements for Biology Teaching Minor

**Science Courses Required (39 credit hours)**

- ZOOL SI1110 Principles of Zoology I (4)
- ZOOL SI1120 Principles of Zoology II (4)
- BTNY SI2014 Plant Form and Function (4)
- BTNY SI2114 Evolutionary Survey of Plants (4)
- MICR LS/SI2054 Principles of Microbiology (4)
- ZOOL 3300 Genetics (4)
- or ZOOL 4570 Comparative Physiology (4)
- MICR 3154 Microbial Ecology (4)
- or MICR 2600 Laboratory Safety (1)
- or ZOOL 2600 Laboratory Safety (1)
- BTNY/ZOOL/MICR 3000+ Electives (3)
- BTNY 3570 Foundations of Science Education (3)
- or MICR 3570 Foundations of Science Education (3)
- or ZOOL 3570 Foundations of Science Education (3)
- ZOOL 4570 Science Teaching Methods (3)
- or BTNY 4570 Science Teaching Methods (3)
- or MICR 4570 Science Teaching Methods (3)
- BTNY 4800 Independent Research (1)
- or MICR 4800 Independent Research (1)
- or ZOOL 4800 Independent Research (1)

**Required Support Courses (8 credit hours)**

- HIST 3350 History & Philosophy of Science (3)
- CHEM PS/Si1110 Elementary Chemistry
- or CHEM PS/Si1210 Principles of Chemistry I (5)

**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 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. Prerequisite: ZOOL SI1110 or permission of instructor.

**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 3000. 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 CHEM PS/SI1210 and CHEM SI1220, or approval of instructor.

**ZOOL 3300. Genetics (4)**
Principles and concepts of genetics with an emphasis on animals, including humans. Includes classical genetics, molecular genetics, cytogenetics, and population genetics. Three lecture hours and one 3-hour lab a week. Prerequisites: ZOOL SI1110 and MATH QL1050 (or equivalent), or approval of instructor.

**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. Writing intensive course.

**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 3570. Foundations of Science Education (3)**
A thorough investigation of research in science learning and curricular standards at the state and national levels. Foundations of the philosophy of science and scientific inquiry as applicable to science teaching at the secondary level. This course serves as a foundation to a preservice science teacher's education coursework.

**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 and SI1120, 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, ZOOL SI1120, and ZOOL 2200, 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 laboratory-based investigation of the molecular properties of the genetic material, including its structure, expression and evolution. Emphasis on applications and the genetics of humans. Three lecture/ lab hours and one 3-hour lab per week. Prerequisites: ZOOL 3300, CHEM PS/SI1210 and CHEM SI1220, 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 and practice with various teaching and assessment methods. Development of science curricula including lesson and unit plans. It is recommended that this course be completed immediately before student teaching. Prerequisite: 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. Prerequisites: 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 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 4670. Ornithology (4)  
The biology of birds including form, function, behavior and ecology. Lab emphasizes identification of Utah species. Three lecture hours and one 3-hour lab or a field trip each week. Prerequisite: ZOOL SI1110 and ZOOL 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 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, and 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 MEd 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.