The College of Science offers a comprehensive array of courses, programs and undergraduate degrees encompassing the biological sciences, earth sciences, physical sciences, and mathematics. Courses are offered through three life science departments: Botany, Microbiology, and Zoology; three physical science departments: Chemistry, Geosciences, and Physics; and the Department of Mathematics. Programs are available in four undergraduate curricular offering categories: Preprofessional, Professional, Science & Mathematics Education, and General Education. Educational work experience is available in projects conducted by the centers and departments listed below.

**Location:** Science Lab, Room 611  **Telephone Contact:** Maxine Westmoreland 801-626-6159

### Department / Area Listing

<table>
<thead>
<tr>
<th>Department/Area Listing</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center for Science &amp; Mathematics Education</td>
<td>267</td>
</tr>
<tr>
<td>Center for Bioremediation</td>
<td>268</td>
</tr>
<tr>
<td>Environmental Services Center</td>
<td>268</td>
</tr>
<tr>
<td>Chemical Technology Center</td>
<td>268</td>
</tr>
<tr>
<td>Museum</td>
<td>268</td>
</tr>
<tr>
<td>Planetarium</td>
<td>269</td>
</tr>
<tr>
<td>Pre-Medical and Professional Programs</td>
<td>269</td>
</tr>
<tr>
<td>Biotechnician</td>
<td>270</td>
</tr>
<tr>
<td>Botany</td>
<td>271</td>
</tr>
<tr>
<td>Chemistry</td>
<td>278</td>
</tr>
<tr>
<td>Geosciences</td>
<td>282</td>
</tr>
<tr>
<td>Mathematics</td>
<td>288</td>
</tr>
<tr>
<td>Microbiology</td>
<td>293</td>
</tr>
<tr>
<td>Physics</td>
<td>296</td>
</tr>
<tr>
<td>Zoology</td>
<td>301</td>
</tr>
</tbody>
</table>

### Department Chairs

- **Botany:** Dr. Eugene Bozniak 626-6174
- **Chemistry:** Dr. Todd Johnson 626-6952
- **Geosciences:** Dr. Adolph Yongke 626-7139
- **Mathematics:** Dr. Kent Kidman 626-6095
- **Microbiology:** Dr. Craig Oberg 626-6949
- **Physics:** Dr. Dale Ostlie 626-6163
- **Zoology:** Dr. Samuel Zeveloff 626-6165

### Degrees Offered

**Bachelor of Arts and Bachelor of Science Degree Programs** in the following areas:
- Geology
- Microbiology
- Mathematics
- Zoology
- Physics & Applied Physics

*Teaching majors are also available

### A Bachelor of Science Degree Program is offered in:
- Applied Environmental Geoscience
- Botany and Botany Teaching
- Chemistry and Chemistry Teaching

### Bachelor of Arts and Bachelor of Science Composite Degrees are offered in:
- Biology Teaching
- Earth Science Teaching
- Physical Science Teaching

### Associate of Science Degree (two-year course of study) and a Certificate (third year course of study) are offered in:
- Biotechnician Training

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

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

*Teaching minors are also available

### Certificates are offered in:
- Biotechnician
- Chemical Technician
- Geomatics (Applied Computer Mapping)

### Pre-Professional Programs
- Pre-Agriculture, Pre-Forestry
- Pre-Horticulture, Pre-Range Management
- Pre-Chiropractic, Pre-Dentistry, Pre-Medicine
- Pre-Occupational Therapy, Pre-Optometry
- Pre-Pharmacy, Pre-Physical Therapy
- Pre-Physician's Assistant, Pre-Veterinary
Professional Programs (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. Liberal arts graduates in the professional fields 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. Liberal arts graduates have the education for significant career ladder movement in their discipline fields. They also have the background to exercise unique job mobility to become entrepreneurs and pioneer new career directions.

Preprofessional Programs are designed for students interested in specific professional careers requiring additional education at professional schools elsewhere. Weber State has an excellent record of graduates being admitted into 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. Career opportunities for teachers with majors or minors in natural science disciplines and in mathematics are excellent.

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 two associate of applied science degrees and an associate of science degree are offered. A Certificate of Skill Proficiency in Chemistry is also offered.

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 Education and the Jerry and Vickie Moyes College of Education.

---

**CENTER FOR SCIENCE & MATHEMATICS EDUCATION**

Director: Dr. Sharon Ohlhorst  
Location: Lind Lecture 231  
Telephone Contact: Rebecca Shaw 801-626-6160

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 with the surrounding schools and community. In addition, the Center offers Science Education electives for the Master of Education program (Jerry and Vickie Moyes College of Education). MEduc 6100S through MEduc 6500S are especially appropriate for enhancing content understanding, and pedagogy for teachers of grades K-8. MEduc 6500S through MEduc 6900S are designed for teachers of grades 7-12. Master’s students may also obtain elective credit by registering for 5000 level courses through science department chairs.

Representative activities of the Center include:

- Supporting the Ott Planetarium and Weber State Museum of Natural Sciences
- Informing students of the opportunities available in science and mathematics education
- Coordinating formal and informal workshops for area teachers

---

**SCIENCE EDUCATION COURSES**

(Master of Education Courses)

**MEDuc 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.

**MEDuc 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.

**MEDuc 6630. Earth Science for Elementary Teachers (3)**  
A background in basic concepts relating to the formation, evolution will be 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.

**MEDuc 6640. The World As A Classroom (1-3)**  
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.

**MEDuc 6650. Understanding Science (2)**  
This course examines the development of science, the process of science, and the role of science in society.

**MEDuc 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.

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

**MEd 6680. Chemistry for Secondary Teachers (3)**
A background in basic concepts related to matter, its properties, and its reactions is provided. 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.

**CENTER FOR BIOREMEDIATION**

**Director:** Dr. D. Jack Adams  
**Location:** Science Lab Building, Room 124  
**Telephone:** 801-626-6058

The Center for Bioremediation is a State of Utah Center of Excellence that facilitates development, enhancement, and marketing of biotechnologies for remediation and environmental restoration. Center remediation processes use biological methods alone, or in conjunction with chemical and physical treatment methods. Research goals are to understand microbial/contaminant interactions to enhance and develop applied remediation processes. Bioremediation research draws on diverse disciplines, including microbiology, biotechnology, biochemistry, geology, and environmental engineering.

**Center programs provide:**
1. Assistance and collaboration with local, national, and international industry, universities, and federal agencies for environmental remediation and restoration
2. Multidisciplinary research and training opportunities for students, through employment and internships
3. Opportunities for students to learn and utilize new skills in undergraduate research projects
4. Collaborative environmental research opportunities for WSU and visiting professionals

Providing hands-on undergraduate research experiences and environmental research opportunities for faculty are two of the main Center goals. Furthermore, the Center’s affiliation with other universities provides a mechanism for student researchers to continue education and training through graduate research programs.

**ENVIRONMENTAL SERVICES CENTER**

**Director:** Dr. Barbara Wachocki  
**Location:** Science Lab Building, Room 303M  
**Telephone:** 801-626-7559

The Center for Environmental Services cooperates with other WSU offices, departments and colleges by providing assistance and training in current trends of corporate environmental responsibility and methods to cope with hazardous materials, wastewater and air quality.

**CHEMICAL TECHNOLOGY CENTER**

**Director:** Dr. Edward B. Walker  
**Location:** Science Lab Building, Room 503M  
**Telephone:** 801-626-6162

The Center for Chemical Technology is a State of Utah Center of Excellence. The mission of the Center is to conduct applied research on chemical problems leading directly to new and/or enhanced product innovations. Faculty and students of various science departments participate in research projects of the Center as appropriate. Students in the College of Science are employed in Center projects where they gain valuable work experience as well as earn money to assist in their educational expenses.

Over forty Utah companies have benefited from various types of assistance from the Center. Furthermore, the Center attempts to bring Utah companies with diversified chemical interests together to form alliances that are mutually beneficial to them and to the State of Utah.

**MUSEUM**

**Director:** Dr. Keith Harrison  
**Location:** Lind Lecture Hall 104  
**Telephone:** 801-626-6653

The Museum of Natural Science is an educational facility available to students in elementary and secondary schools, college students, and members of the community. Exhibits of interest include Plate Tectonics, Valley Glaciation, Continental Glaciation, The World of Neanderthal Man, the Grand Canyon District, Edward S. Curtis Indian Photographs, the Ichthyosaur, Dimetrodon, Allosaurus, Sabertooth Tiger, Petroglyphs, sedimentary, igneous and metamorphic rocks, minerals, fossils, and geological models. 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.
The Planetarium, or the Director of the Center for Science & Technology, or Zool 2100 Human Anatomy (4) or Zool LS1010 Animal Biology (non-major) (3) or Zool SI1110/SI1120 Principles of Zoology I & II (8) or Zool LS1110/SI1120 Principles of Zoology (Zoology majors) (8) or Zool LS1010 Animal Biology (non-major) (3) Zool 2100 Human Anatomy (4) or Zool LS1010 Animal Biology (non-major) (3) or Zool 3200 Cell Biology (4) or Zool 3200 Cell Biology (4) Math 1060 Trigonometry (3) or Math 1060 Trigonometry (3) Math 1010 Intermediate Algebra (4) or Math QL1050 College Algebra (4) AP or CLEP credits in English or science courses are not acceptable to medical schools.

Recommended Course Electives (none required)

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

Zool 4050 Comparative Vertebrate Anatomy (4) or Zool 4050 Comparative Vertebrate Anatomy (4) Zool 4100 Embryology (4) or Math QL1050 College Algebra (4) Zool 4120 Histology (4) or Zool 4120 Histology (4) Zool 4210 Advanced Human Physiology (4) or Zool 4210 Advanced Human Physiology (4) Micro 3254 Immunology (4) or Micro 3254 Immunology (4) Micro 3305 Medical Microbiology (5) or Micro 3305 Medical Microbiology (5) Micro 4252 Cell Culture (2) or Micro 4252 Cell Culture (2) Micro 4554 Virology (4) or Micro 4554 Virology (4) Chem 3070 Biochemistry I (4) or Chem 3070 Biochemistry I (4)

Course Requirements for Pre-Dentistry

Courses Required (50-61 credit hours)

Zool SI1110/SI1120 Principles of Zoology (Zoology majors) (8) or Zool LS1010 Animal Biology (non-major) (3) Zool 2100 Human Anatomy (4) or Zool LS1010 Animal Biology (non-major) (3) Zool 2200 Human Physiology (4) or Zool 3200 Cell Biology (4) Math QL1050 College Algebra (4) or Math QL1050 College Algebra (4) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) Math 1210/SI1220 Calculus I & II (8) or Math 1210/SI1220 Calculus I & II (8) Chem SI1110/SI1120 Principles of Chemistry I & II (10) or Chem SI1110/SI1120 Principles of Chemistry I & II (10) Chem 2310/2320 Organic Chemistry I & II (10) or Chem 2310/2320 Organic Chemistry I & II (10) Phsx PS/SI1210/SI1220 General Physics (10) or Phsx PS/SI1210/SI1220 General Physics (10) Engl EN1010 Intro to Writing (3) or Engl EN1010 Intro to Writing (3) Engl 2250 Power Reading (1-3) or Engl EN2010 Intermediate Writing (3) Engl 2250 Power Reading (1-3) or Engl EN2010 Intermediate Writing (3) Engl 2270 Creative Writing (3) or Engl EN2010 Intermediate Writing (3) Engl 2270 Creative Writing (3) or Engl EN2010 Intermediate Writing (3) Engl 2290 Advanced College Writing (3) or Engl EN2010 Intermediate Writing (3) Engl 2290 Advanced College Writing (3) or Engl EN2010 Intermediate Writing (3) Comm HU1020 Principles of Public Speaking (3) or Comm HU1020 Principles of Public Speaking (3) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) Math 1060 Trigonometry (3) or Math QL1050 College Algebra (4) AP or CLEP credits in English or science courses are not acceptable to medical schools.

Recommended Course Electives (none required)

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

Zool 4050 Comparative Vertebrate Anatomy (4) or Zool 4050 Comparative Vertebrate Anatomy (4) Zool 4100 Embryology (4) or Math QL1050 College Algebra (4) Zool 4120 Histology (4) or Zool 4120 Histology (4) Zool 4210 Advanced Human Physiology (4) or Zool 4210 Advanced Human Physiology (4) Micro 3254 Immunology (4) or Micro 3254 Immunology (4) Micro 3305 Medical Microbiology (5) or Micro 3305 Medical Microbiology (5) Micro 4252 Cell Culture (2) or Micro 4252 Cell Culture (2) Micro 4554 Virology (4) or Micro 4554 Virology (4) Chem 3070 Biochemistry I (4) or Chem 3070 Biochemistry I (4)
Specific requirements vary from one program to another. Please check pre-medical requirements and follow the catalog from the chiropractic school of your choosing.

### BIOTECHNICIAN

**ASSOCIATE OF SCIENCE DEGREE**

**INSTITUTIONAL CERTIFICATE**

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

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

#### Grade Requirements:
Cumulative GPA of 2.00 or higher.

#### Credit Hour Requirements:
Total of 62 credit hours is required - 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; call Julie Baker, Department of Zoology secretary (801-626-6165) for information.

#### General Education:
Refer to pages 36-41 for Associate of Science requirements. These should include either Econ AI2740, Hist AI1700, or PolSc AI1100. 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, Phsx PS/SI1010, and Micro LS/SI2054.

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

### Course Requirements for A.S. Degree

#### Courses Required (37 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>Micro 3053</td>
<td>Microbiological Procedures (3)</td>
</tr>
<tr>
<td>Botany SI2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>or Botany 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/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
</tbody>
</table>

### Course Requirements for Pre-Chiropractic

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

### Course Requirements for Pre-Physical Therapy

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zool SI1110/SI1120</td>
<td>Principles of Zoology (Zoology majors) (8)</td>
</tr>
<tr>
<td>or Zool LS1010</td>
<td>Animal Biology (non-major) (3)</td>
</tr>
<tr>
<td>Zool 2100</td>
<td>Human Anatomy (4)</td>
</tr>
<tr>
<td>Zool 2200</td>
<td>Human Physiology (4)</td>
</tr>
<tr>
<td>Phsx PS/SI1010/SI2020</td>
<td>General Physics (10)</td>
</tr>
<tr>
<td>Math QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>Math 1060</td>
<td>Trigonometry (3)</td>
</tr>
<tr>
<td>Math SI1210/SI1220</td>
<td>Calculus I &amp; II (8)</td>
</tr>
<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>Engl EN1010</td>
<td>Intro to Writing (3)</td>
</tr>
<tr>
<td>&amp; Engl EN2010</td>
<td>Intermediate Writing (3)</td>
</tr>
<tr>
<td>Engl 2100</td>
<td>Technical Writing (3)</td>
</tr>
</tbody>
</table>

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

#### Specific requirements vary from one program to another. Please check specific prerequisite course requirements for particular physical therapy degree programs.

### Course Requirements for Pre-Veterinary Medicine

#### Courses Required (68 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comm HU1020</td>
<td>Principles of Public Speaking (3)</td>
</tr>
<tr>
<td>Comm HU1050</td>
<td>Intro to Interpersonal &amp; Small Group Communication (3)</td>
</tr>
<tr>
<td>Zool SI1110/SI1120</td>
<td>Principles of Zoology I &amp; II (8)</td>
</tr>
<tr>
<td>Zool 3300</td>
<td>Genetics (4)</td>
</tr>
<tr>
<td>Math 1010</td>
<td>Intermediate Algebra (4)</td>
</tr>
<tr>
<td>Math QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>Micro LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>Phsx PS/SI2010/SI2020</td>
<td>General Physics (10)</td>
</tr>
<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 3070</td>
<td>Biochemistry I (4)</td>
</tr>
<tr>
<td>Botany SI2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>or Botany 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/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
<tr>
<td>Phsx PS/SI1010</td>
<td>Intro to Physics (3)</td>
</tr>
</tbody>
</table>

#### Electives
Electives should include general education graduation requirements. More advanced classes in the sciences may be taken at the option of the student.

### Course Requirements for Pre-Pharmacy

#### Courses Required (62 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zool 2100</td>
<td>Human Anatomy (4)</td>
</tr>
<tr>
<td>Zool 2200</td>
<td>Human Physiology (4)</td>
</tr>
<tr>
<td>Phsx PS/SI2010/SI2020</td>
<td>General Physics (10)</td>
</tr>
<tr>
<td>Math QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>Math 1060</td>
<td>Trigonometry (3)</td>
</tr>
<tr>
<td>Math SI1210/SI1220</td>
<td>Calculus I &amp; II (8)</td>
</tr>
<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>Engl EN1010</td>
<td>Intro to Writing (3)</td>
</tr>
<tr>
<td>&amp; Engl EN2010</td>
<td>Intermediate Writing (3)</td>
</tr>
<tr>
<td>Engl 2100</td>
<td>Technical Writing (3)</td>
</tr>
</tbody>
</table>

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

Specific requirements vary from one program to another. Please check specific prerequisite course requirements for particular physical therapy degree programs.

### Course Requirements for Pre-Veterinary Medicine

#### Courses Required (68 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comm HU1020</td>
<td>Principles of Public Speaking (3)</td>
</tr>
<tr>
<td>Comm HU1050</td>
<td>Intro to Interpersonal &amp; Small Group Communication (3)</td>
</tr>
<tr>
<td>Zool SI1110/SI1120</td>
<td>Principles of Zoology I &amp; II (8)</td>
</tr>
<tr>
<td>Zool 3300</td>
<td>Genetics (4)</td>
</tr>
<tr>
<td>Math 1010</td>
<td>Intermediate Algebra (4)</td>
</tr>
<tr>
<td>Math QL1050</td>
<td>College Algebra (4)</td>
</tr>
<tr>
<td>Micro LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>Phsx PS/SI2010/SI2020</td>
<td>General Physics (10)</td>
</tr>
<tr>
<td>Chem PS/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
</tbody>
</table>

#### Electives
Electives should include general education graduation requirements. More advanced classes in the sciences may be taken at the option of the student.

### Course Requirements for Pre-Physical Therapy

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zool SI1110/SI1120</td>
<td>Principles of Zoology (Zoology majors) (8)</td>
</tr>
<tr>
<td>or Zool LS1010</td>
<td>Animal Biology (non-major) (3)</td>
</tr>
<tr>
<td>Zool 2100</td>
<td>Human Anatomy (4)</td>
</tr>
<tr>
<td>Zool 2200</td>
<td>Human Physiology (4)</td>
</tr>
<tr>
<td>Phsx PS/SI1010/SI2020</td>
<td>General Physics (10)</td>
</tr>
<tr>
<td>Micro LS/SI2054</td>
<td>Principles of Microbiology (4)</td>
</tr>
<tr>
<td>Chem PS/SI1110/SI1120 Elementary Chemistry</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
<tr>
<td>or Chem PS/SI1210/SI1220 Principles of Chemistry I &amp; II (10)</td>
<td></td>
</tr>
<tr>
<td>Math 1060</td>
<td>Trigonometry (3)</td>
</tr>
<tr>
<td>Math 1210</td>
<td>Calculus</td>
</tr>
<tr>
<td>Math 1040</td>
<td>Statistics</td>
</tr>
<tr>
<td>or Psych SI3600</td>
<td>Statistics in Psychology</td>
</tr>
<tr>
<td>or SocIy SI3600</td>
<td>Social Statistics</td>
</tr>
<tr>
<td>Psych SS1010</td>
<td>Intro Psychology (3)</td>
</tr>
<tr>
<td>Psych 3010</td>
<td>Abnormal Psychology (3)</td>
</tr>
<tr>
<td>Engl EN1010</td>
<td>Intro to Writing (3)</td>
</tr>
<tr>
<td>Engl 3100</td>
<td>Technical Writing (3)</td>
</tr>
<tr>
<td>Health 1300</td>
<td>First Aid: Responding</td>
</tr>
<tr>
<td>or Zool SI1110/SI1120</td>
<td>Principles of Zoology I &amp; II (8)</td>
</tr>
<tr>
<td>or Botany SI2104</td>
<td>Plant Form and Function (4)</td>
</tr>
<tr>
<td>or Botany 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/SI1210/SI1220</td>
<td>Principles of Chemistry I &amp; II (10)</td>
</tr>
<tr>
<td>Phsx PS/SI1010</td>
<td>Intro to Physics (3)</td>
</tr>
</tbody>
</table>
course requires students to understand the past, present, and future uses of plants. The study of Botany can lead to a variety of professional careers, including soil science, forestry, range management, biotechnology, plant breeding, horticulture, marine biology, environmental science, and teaching.

The Botany Department at Weber State University offers undergraduate training in all areas of botany. The required upper division courses provide a core knowledge of the field of botany: anatomy, physiology, genetics, ecology, taxonomy, and plant diversity. The department also requires Botany majors to develop a portfolio. The portfolio is a multidimensional collection of both student and faculty selected materials that are both developmental and representational in nature. Within the portfolio, students can document their acquisition of a variety of skills, including critical thinking, scientific reasoning, writing, 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 personal 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.

Growth and access to plants and plant products are becoming much more intense. During the last few decades we have seen an unprecedented increase in the variety of plants available in our markets. As transfer students entering with an Associate's Degree, where 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 a quantitative scientific and intensive laboratory-based hands-on experiences, is designed to best prepare students for graduate school and careers in laboratory research in Plant Biology. Track B, enriched with field-oriented course opportunities, is designed to best prepare students for field-related careers such as ecology, environmental science, and natural resource management. Track C, with greater flexibility through more elective courses, is designed to meet the needs of students who wish to be more broadly trained because of general interests in Plant Biology or of those students who enter the program with an Associate of Science Degree.

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

The Botany Department also serves students who are interested in pre-professional programs: Pre-Agriculture, Pre-Horticulture, Pre-Forestry, and Pre-Range Management. After completing these programs at Weber State, students must continue their education at another institution in order to obtain baccalaureate degrees in these fields. The catalog of the school to which the student plans to transfer should be consulted as a guide in registering for courses at Weber State.

The Botany Minor and the Botany Teaching Minor provide valuable support for students majoring in a variety of other fields, including geosciences and zoology.

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 resource for students, faculty, biologists, and all others who need to know the identity of plants, or learn something about their geographic distributions and ecological associations. It also serves as the repository of the plants collected for the Institute of American Indian Botany.
Institute of American Indian Botany

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

PRE-AGRICULTURE AND PRE-HORTICULTURE

TWO YEARS (NO DEGREE)

Advisor: Dr. Eugene G. Bozniak
Location: Sciences Bldg. 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)

Botany 2104 Plant Form and Function (4)
Botany 2114 Evolutionary Survey of Plants (4)
Botany 2121 Career Planning for Botanists (1)
Botany DV2303 Ethnobotany (3)
Botany 2413 Introduction to Natural Resource Management (3)
Botany 2600 Laboratory Safety (1)

Select two of the following:

Botany 3204 Plant Physiology (4)
Botany 3214 Soils (4)
Botany 3454 Plant Ecology (4)
Botany 3624 Taxonomy of Vascular Plants (4)

Required Support Courses (24-26 credit hours)

Chem PS/SI1210,1220 Principles of Chemistry (10)
Geosci PS/SI1110 Physical Geology (3)
Math QL1050 College Algebra (4)
or Math QL1080 Pre-Calculus (5)
or Math SI1210 Calculus (4)
or Math QL1040 Introduction to Statistics (3)
Phsx PS/SI2010 General Physics (10)

Suggested Course Sequence

Please refer to this program in the on-line 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 Bldg 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)

Botany 2104 Plant Form and Function (4)
Botany 2114 Evolutionary Survey of Plants (4)
Botany 2121 Career Planning for Botanists (1)
Botany DV2303 Ethnobotany (3)

Required Support Courses (24-26 credit hours)

Chem PS/SI1210,1220 Principles of Chemistry (10)
Geosci PS/SI1110 Physical Geology (3)
Geosci SI1220 Physical Geology Laboratory (1)
Geosci SI1130 Introduction to Meteorology (3)
Geosci 2050 Earth Materials (4)
Math QL1050 College Algebra (4)
or Math QL1080 Pre-Calculus (5)
or Math SI1210 Calculus (4)
or Math QL1040 Introduction to Statistics (3)
Phsx PS/SI2010 General Physics (10)

Suggested Course Sequence

Please refer to this program in the on-line 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 DEGREE (B.S.)

> Program Prerequisite: Not required.

> Minor: A minor is required. Botany majors getting a B.S. (Track A) will meet the requirements for a minor in Chemistry.

> Grade Requirements: An overall GPA of 2.00 in all courses required for this major. Also refer to the general grade requirements for graduation on page 36.

> Credit Hour Requirements: A total of 120 credit hours is required for graduation – required within the major are 91-97 credit hours for Track A (minor included), 76-87 credit hours for Track B (minor not included) and 67-76 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 29-33 upper division credit hours for Track A, 22-32 upper division credit hours for Track B and 28-32 upper division credit hours for Track C.

Advisement

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

Admission Requirements

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

General Education

Refer to pages 36-41 for Bachelor of Science requirements. The following courses required for the Botany major will also satisfy general education requirements: Botany LS1403, Chem PS/SI1110 or PS1210, and Phsx PS/SI1010 or PS2010.
All Botany majors are required to develop a portfolio. The portfolio requirements are explained in detail when a student takes Botany 2121.

Course Requirements for B.S. Degree

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

Botany LS1403 Environment Appreciation (3)
Botany or Botany 3403 Environment Appreciation (3)
Botany SI2104 Plant Form and Function (4)
Botany SI2114 Evolutionary Survey of Plants (4)
Botany 2121 Career Planning for Botanists (1)
Botany DV2303 Ethnobotany (3)
Botany 2600 Laboratory Safety (1)

• Track A

Botany Courses Required (17-18 credit hours)

Botany 3105 Anatomy and Morphology of Vascular Plants (5)
Botany 3204 Plant Physiology (4)
Botany 3303 Plant Genetics (3)
Botany 4840 Thesis Reading (2)
Botany 4830 Readings in Botany (2)
Botany 4850 Thesis Research (2)
Botany 4970 Botany Thesis (2)
Botany 4990 Seminar in Botany (1)

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

Botany 2203 Home and Garden Plants (3)
Botany 2413 Introduction to Natural Resource Management (3)
Botany 2503 Biology of the Plant Cell (3)
Botany 3214 Soils (4)
Botany 3454 Plant Ecology (4)
Botany 3473 Plant Geography (3)
Botany 3504 Mycology (4)
Botany 3514 Algology (4)
Botany 3523 Marine Biology (3)
Botany 3541 Intermountain Flora (1-4)
Botany 4113 Plant Evolution (3)
Botany 4252 Cell Culture (2)
Botany 4750 Topics in Botany (2)
Botany 4890 Cooperative Work Experience (5)
Botany 4950 Advanced Field Botany (2)

Required Support Courses (29-39 credit hours)

Chem PS/SI1210/ SI1220 Principles of Chemistry I & II (10)
Chem 2310/2320 Organic Chemistry I & II (10)
Chem 3030 Quantitative Analysis (4)
or Chem 3070 Biochemistry I (4)
Math QL1050/1060 College Algebra & Trigonometry (7)
or Math QL1080 Pre-Calculus (5)
or Math QL1210 Calculus I (4)
or Math QL1040 Introduction to Statistics (3)
Phsx PS/SI1210/1220 General Physics I & II (10)
or Phsx PS/SI2210/2220 Physics for Scientists & Engineers (10)

Select one Group:
Micro LS/SI2054 & Micro 3484 Principles of Microbiology (4)

or
Geosci SI1120 Physical Geology Laboratory (1)
& Geosci SI1130 Introduction to Meteorology (3)
& Geosci 2220 Historical Geography (4)
or
Geogr 3450 Cartography (3)
& Geogr 3460 Advanced Cartography (3)

• Track B

Botany Courses Required (20-21 credit hours)

Botany 2413 Introduction to Natural Resource Management (3)
Botany 3214 Soils (4)
Botany 3454 Plant Ecology (4)
Botany 3624 Taxonomy of Vascular Plants (4)
Botany 4950 Advanced Field Botany (4)
or Botany 4990 Seminar in Botany (1)

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

Botany 2203 Home and Garden Plants (3)
Botany 3105 Anatomy and Morphology of Vascular Plants (5)
Botany 3204 Plant Physiology (4)
Botany 3303 Plant Genetics (3)
Botany 3473 Plant Geography (3)
Botany 3504 Mycology (4)
Botany 3514 Algology (4)
Botany 3523 Marine Biology (3)
Botany 3541 Intermountain Flora (1-4)
Botany 4113 Plant Evolution (3)
Botany 4252 Cell Culture (2)
or Botany 4850 Thesis Research (2)
or Botany 4970 Botany Thesis (2)
or Botany 4980 Individual Research (2)
or Botany 4980 Cooperative Work Experience (5)
or Botany 4980 Readings in Botany (2)
or Botany 4980 Thesis Readings (2)

• Track C

Botany Core Courses Required (13 credit hours)

Botany LS1403 Environment Appreciation (3)
Botany or Botany 3403 Environment Appreciation (3)
Botany SI2104 Plant Form and Function (4)
Botany SI2114 Evolutionary Survey of Plants (4)
Botany 2121 Career Planning for Botanists (1)
Botany 2600 Laboratory Safety (1)
### Botany Courses Required (12-13 credit hours)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany 3303</td>
<td>Plant Genetics</td>
<td>3</td>
</tr>
<tr>
<td>Botany 3454</td>
<td>Plant Ecology</td>
<td>4</td>
</tr>
<tr>
<td>Botany 3624</td>
<td>Taxonomy of Vascular Plants</td>
<td>4</td>
</tr>
<tr>
<td>Botany 4970</td>
<td>Botany Thesis</td>
<td>2</td>
</tr>
<tr>
<td>or Botany 4990</td>
<td>Seminar in Botany</td>
<td>1</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany 2203</td>
<td>Home and Garden Plants</td>
<td>3</td>
</tr>
<tr>
<td>Botany DV2303</td>
<td>Ethnobotany</td>
<td>3</td>
</tr>
<tr>
<td>Botany 2413</td>
<td>Introduction to Natural Resource Management</td>
<td>3</td>
</tr>
<tr>
<td>Botany 2503</td>
<td>Biology of the Plant Cell</td>
<td>3</td>
</tr>
<tr>
<td>Botany 3105</td>
<td>Anatomy and Morphology of Vascular Plants</td>
<td>5</td>
</tr>
<tr>
<td>Botany 3204</td>
<td>Plant Physiology</td>
<td>4</td>
</tr>
<tr>
<td>Botany 3214</td>
<td>Soils</td>
<td>4</td>
</tr>
<tr>
<td>Botany 3473</td>
<td>Plant Geography</td>
<td>3</td>
</tr>
<tr>
<td>Botany 3504</td>
<td>Mycology</td>
<td>4</td>
</tr>
<tr>
<td>Botany 3514</td>
<td>Algology</td>
<td>4</td>
</tr>
<tr>
<td>Botany 3523</td>
<td>Marine Biology</td>
<td>3</td>
</tr>
<tr>
<td>Botany 3641</td>
<td>Intermountain Flora</td>
<td>1-4</td>
</tr>
<tr>
<td>Botany 4113</td>
<td>Plant Evolution</td>
<td>3</td>
</tr>
<tr>
<td>Botany 4252</td>
<td>Cell Culture</td>
<td>2</td>
</tr>
<tr>
<td>Botany 4750</td>
<td>Topics in Botany</td>
<td>2</td>
</tr>
<tr>
<td>Botany 4800</td>
<td>Individual Research</td>
<td>2</td>
</tr>
<tr>
<td>or Botany 4850</td>
<td>Thesis Research</td>
<td>2</td>
</tr>
<tr>
<td>or Botany 4830</td>
<td>Readings in Botany</td>
<td>2</td>
</tr>
<tr>
<td>or Botany 4840</td>
<td>Thesis Readings</td>
<td>2</td>
</tr>
<tr>
<td>Botany 4890</td>
<td>Cooperative Work Experience</td>
<td>5</td>
</tr>
<tr>
<td>Botany 4950</td>
<td>Advanced Field Botany</td>
<td>1-5</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem PS/SI1110</td>
<td>Elementary Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>or Chem PS/SI1210</td>
<td>Principles of Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>Chem SI1220</td>
<td>Elementary Organic/Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td>or Chem SI1220</td>
<td>Principles of Chemistry II</td>
<td>5</td>
</tr>
<tr>
<td>Phsx PS/SI1010</td>
<td>Introduction to Physics</td>
<td>3</td>
</tr>
<tr>
<td>or Phsx PS/SI2010/SI2020 General Physics I &amp; II</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>or Phsx PS/SI2210/SI2220 Physics for Scientists &amp; Engineers</td>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

Select two of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci PS/SI1210</td>
<td>Physical Geology</td>
<td>3</td>
</tr>
<tr>
<td>or Geogr PS/SI1010</td>
<td>Natural Environments of the Earth</td>
<td>3</td>
</tr>
<tr>
<td>Micro LS/SI2054</td>
<td>Principles of Microbiology</td>
<td>4</td>
</tr>
<tr>
<td>Zool SI1110</td>
<td>Principles of Zoology I</td>
<td>4</td>
</tr>
<tr>
<td>Zool SI1120</td>
<td>Principles of Zoology II</td>
<td>4</td>
</tr>
</tbody>
</table>

### Suggested Course Sequence

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

---

### BOTANY TEACHING MAJOR

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

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

---

### Advisement

Teaching majors are encouraged to consult with advisors in both the College of Science (call 801-626-6174) and the College of Education (call 626-6269).

### Admission Requirements

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

### General Education

Refer to pages 36-41 for either Bachelor of Science requirements. The following courses required for the Botany Teaching major also will satisfy general education requirements: Botany LS1403, Comm HU1020, Chem SI1110 or SI210, Phsx PS/SI1010.

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

### Course Requirements for B.S. Degree

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

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

### Support Courses Required (27 credit hours)

- **Chem PS/SI1110/SI120 Elementary Chemistry/Elementary Organic/BioChemistry (10)
  - or Chem PS/SI1210/SI1220 Principles of Chemistry I (5)

- **Math QL1050 College Algebra (4)
  - or Chem 4570 Science Teaching Methods (3)
  - or Geosci 4570 Science Teaching Methods (3)
  - or Phsx 4570 Science Teaching Methods (3)
  - or Zool 4570 Science Teaching Methods (3)

- **Hist 3550 History & Philosophy of Science (3)
  - or Zool 2800 History of the Life Sciences (3)
  - or Comm HU1020 Principles of Public Speaking (3)

- **Micro LS/SI2054 Principles of Microbiology (4)**

### Suggested Course Sequence

Please refer to this program in the on-line 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:

- Botany 3105 Anatomy & Morphology of Vascular Plants (5)
- Botany 3204 Plant Physiology (4)
- Botany 3214 Soils (4)
- Botany 3303 Plant Genetics (3)
- Botany 3454 Plant Ecology (4)
- Botany 3504 Mycology (4)
- Botany 3514 Algology (4)
- Botany 3523 Marine Biology (3)
- Botany 3624 Taxonomy of Vascular Plants (4)
- Botany 3644 Intermountain Flora (4)
- Botany 4113 Plant Evolution (3)
- Botany 4252 Cell Culture (2)

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

* In order to obtain "Honors" credit in selected upper division courses in Botany, an Honors Student must meet the following criteria:

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

Examples of such projects appear below:

- Ethnobotany of a specific native group of peoples is to be carried out 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-).
- 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 43.)

**BOTANY COURSES - BOTANY**

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

**Course Requirements for Minor/BIS**

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

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

**BOTANY MINOR/BIS**

**Course Requirements for Minor/BIS**

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

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

**BOTANY TEACHING MINOR**

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

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

**Course Requirements for Minor**

- **Botany Courses Required (22 credit hours)**
  - Botany SI2104 Plant Form and Function (4)
  - Botany SI2114 Evolutionary Survey of Plants (4)
  - Botany DV2303 Ethnobotany (3)
  - Botany 2600 Laboratory Safety (1)
  - Botany 3624 Taxonomy of Vascular Plants (4)
  - Chem 4570 Science Teaching Methods (3)
  - or Geosci 4570 Science Teaching Methods (3)
  - or Phx 4570 Science Teaching Methods (3)
  - or Zool 4570 Science Teaching Methods (3)

**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.)

**Course Requirements**

- **Botany Courses - Botany**
  - **Botany LS1203. Plant Biology (3)** Su. F.
    - 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.
  - **Botany LS1303. Plants in Human Affairs (3)** Su. F.
    - This class provides a general introduction to the importance and function of plants in human affairs. It includes an overview of 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.
  - **Botany LS1370. Principles of Life Science (3)**
    - 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 education and planning.

**Additional Information**

- **Course Offerings**
  - Botany 2600 Laboratory Safety
  - Botany DV2303 Ethnobotany
  - Botany 4252 Cell Culture
  - Botany 4113 Plant Evolution
  - Botany SI2114 Evolutionary Survey of Plants

**Advising Information**

- Consult the Botany Department or the Education Department for specific course requirements and additional information.
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.

**Botany 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 (Botany 3403).

**Botany 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 Botany 2121 prior to or concurrently with this course.

**Botany 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 Botany 2121 prior to or concurrently with this course.

**Botany 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 Botany S2104 or Botany S2114.

**Botany 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.

**Botany DV2303. Ethnobotany (3) F. S**

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.

**Botany 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.

**Botany 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: Botany LS/SI1105 (if previously taken - no longer offered) or Botany SI2104.

**Botany 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.

**Botany 2830. Readings in Botany (1) F. S**

Cannot be repeated.

**Botany 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.

**Botany 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.

**Botany 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: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2104.

**Botany 3204. Plant Physiology (4) S**

A study of the physiological processes of plants, including carbon metabolism, mineral assimilation, water relations, and phytotormones. Two hours of lecture and two 3-hour labs per week. Prerequisites: Botany LS/SI1105 (if previously taken - no longer offered) or Botany SI2104, Chem SI1120 or Chem SI1220, and Math QL1050 or Math QL1080.

**Botany 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: Botany LS/SI1105 (if previously taken - no longer offered) or Botany SI2104, or Geosci PS/SI1110, and Chem PS/SI1110 or Chem PS/SI1210.

**Botany 3303. Plant Genetics (3) 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: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2104, or Micro LS/SI2054, and Chem SI1120 or Chem SI1220, and Math QL1050 or Math QL1080.

**Botany 3403. Environment Appreciation (3) Su, F. S**

Development of awareness of the consequences of the impact of modern science through technology upon our environments and how we respond to issues related to threats 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. Three hours of lecture per week. An in-depth research paper on an environmental issue and an in-class lecture are required.
Prerequisite: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2104 or Botany SI2114. Cannot be repeated for lower division credit (Botany LS1403).

Botany 3454. Plant Ecology (4) F
Nature and development of plant communities and their relations to the environmental factors controlling them. Three hours of lecture and one 3-hour lab per week. Prerequisites: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2114, and Math QL11050 or QL1080.

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

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

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

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

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

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

Botany 3641C. 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: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2114.

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

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

Botany 4252. Cell Culture (2) S (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: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2114, or Micro LS/SI2054.

Botany 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: Botany LS/SI1105 (if previously taken - no longer offered), or Botany SI2104 and Botany SI2114, and any specified courses selected by the instructor.

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

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

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

Botany 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: Botany 4840 and approval of thesis advisor.

Botany 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.

**Botany 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: Botany LS/SI1105 (if previously taken - no longer offered), or Botany S2104 and Botany S2114 and Botany 2121, and any specified courses selected by the instructor.

**Botany 4950. Advanced Field Botany (1-5)**
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.

**Botany 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: Botany 4850 and approval of thesis advisor.

**Botany 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.

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

---

**CHEMISTRY MAJOR / TEACHING MAJOR**

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

- **Program Prerequisite:** Not required for Chemistry major. Chemistry Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).
- **Minor:** Not required for Options I and II; required for Teaching Major.
- **Grade Requirements:** Average GPA of 2.00 or better in Chemistry courses. Also refer to the general grade requirements for graduation on page 36. Teaching majors must achieve an overall GPA of 3.00 for admission to the Teacher Education program and have a “C” or better in chemistry courses.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation – 71 of these are required within Option 1, 66 are required within Option 2, and 41 are required within the teaching major. A total of 33 upper division credit hours is required for Options 1 and Option 2 (courses numbered 3000 and above) – 29 of these are required within Option 1 and 24 within Option 2. A total of 40 upper division credit hours is required for the teaching major.

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

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

**General Education**
Refer to pages 36-41 for Bachelor of Science requirements. The following courses required for the Chemistry major will also satisfy general education requirements: ChemPS/SI2110 and Phsx PS/SI2210 or Phsx PS/SI2220.

**Course Requirements for B.S.**

**Chemistry Core Courses Required (24 credit hours)**
- Chem PS/SI1210/SI1220 Principles of Chemistry (10)
- Chem 2310/2320 Organic Chemistry (10)
- Chem 3030 Quantitative Analysis (4)

**Additional Chemistry Courses Required (29 credit hours)**
- Chem 3020 Computer Applications in Chemistry (1)
- Chem 3050 Instrumental Analysis (3)
- Chem 3060 Applied Analysis (1)
- Chem 3070 Biochemistry (1) (4)
- Chem 3400 Molecular Symmetry and Applied Math for Physical Chemistry (3)
- Chem 3410/3420 Physical Chemistry (8)
- Chem 4540 Spectrometric & Separation Methods (4)
- Chem 4600 Inorganic Chemistry (4)
- Chem 4700 Special Topics in Chemistry (1)

**Support Courses Required (18 credit hours)**
- Math S1210-S1220 Calculus I & Calculus II (8)
- Phsx PS/SI2210/SI2220 Physics for Scientists (10)
- Chem 2600 (1) is highly recommended.

Study of Foreign Language and/or computer science is highly recommended for students who plan to pursue graduate studies in chemistry.
Additional upper division math courses (Math 2210, 2270, 2280, 3410, 3710, 4110) are strongly recommended for students planning to attend graduate school and study chemistry or chemical engineering.

**Option 2**

**Additional Chemistry Courses Required (16 credit hours)**
- Chem 3020 Computer Applications in Chemistry (1)
- Chem 3050 Instrumental Analysis (3)
- Chem 3060 Applied Analysis (1)
- Chem 3400 Molecular Symmetry and Applied Math for Physical Chemistry (3)
- Chem 3410 Physical Chemistry I (4)
- Chem 3420 Physical Chemistry II (4)

**Chemistry Electives (select at least 8 credit hours)**
- Chem 3070 Biochemistry I (4)
- Chem 3080 Biochemistry II (3)
- Chem 3090 Biochemical Techniques (1)
- Chem 4540 Spectrometric & Separation Methods (4)
- Chem 4600 Inorganic Chemistry (4)
- Chem 4700 Special Topics in Chemistry (1)

**Support Courses Required (18 credit hours)**
- Math S1210-S1220 Calculus I & II (8)
- Phsy S1210-S1220 Physics for Scientists (10)
- or Phsy S1210-S2200 General Physics (10)
- Chemistry 2600 (1) is highly recommended.
- Additional upper division courses should be chosen to support career plans.
- Students should consult with chemistry advisor.

**Teaching Major**

**Additional Chemistry Courses Required (4 credit hours)**
- Chem 2600 Lab Safety (1)
- Chem 4570 Science Teaching Methods (3)

**Electives (select at least 7 credit hours)**
- Chem 3050 Instrumental Analysis (3)
- Chem 3060 Applied Analysis (1)
- Chem 3070 Biochemistry I (4)
- Chem 3080 Biochemistry II (3)
- Chem 3410 Physical Chem I (note prerequisite) (4)
- Chem 3420 Physical Chemistry II (4)

**Support Courses Required (6 credit hours)**
- Comm HU1020 Principles of Public Speaking (3)
- Hist 3350 History & Philosophy of Science (3)
- Consult with an advisor early in program to choose elective courses which will fulfill teaching endorsement requirements.

**Suggested Course Sequence**

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

**PHYSICAL SCIENCE**

**COMPOSITE TEACHING MAJOR**

**BACHELOR DEGREE**

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

**CHEMISTRY**

**DEPARTMENTAL HONORS**

- **Program Prerequisites:** Enroll in the General Honors Program and complete 9 hours of General Honors courses (see the Honors Program on page 43).
- **Grade Requirements:** Maintain an overall GPA of 3.3.

**Credit Hour Requirements:** Fulfill requirements for either Option 1 or Option 2 of the departmental major, of which at least 12 hours must be completed on an Honors basis. A student may receive Chemistry Honors credit in the following courses:

- Chem PS/S1210-1220 Principles of Chemistry (10)
- Chem 2310-2320 Organic Chemistry (10)
- Chem 3030 Quantitative Analysis (4)
- Chem 3050 Instrumental Analysis (3)
- Chem 3060 Applied Analysis (1)
- Chem 3070-3080 Biochemistry (7)
- Chem 3090 Biochemical Techniques (1)
- Chem 3410-3420 Physical Chemistry (8)
- Chem 4540 Spectrometric & Separation Methods (4)
- Chem 4600 Inorganic Chemistry (4)
- Chem 4700 Special Topics in Chemistry (1)
- Chem 4710 Chemical Preparations (1-3)
- Chem 4800 Research & Independent Study (1-5)
- Chem 4990 Senior Seminar (1)

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

*Permission from the department chair should be sought before registering in a course for Honors credit. A written agreement should be reached with the appropriate professor regarding the work expected for Honors credit. (See the Honors Program on page 43.). This written contract must include regularly scheduled sessions with the professor. In addition, students will be required to complete a project associated with the course. Projects for each chemistry course (other than Chem 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.

**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/S1210 Principles of Chemistry I (5)
- Chem S1220 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 3020 Computer Applications in Chemistry (1)
- Chem 3030 Quantitative Analysis (4)
- Chem 3050 Instrumental Analysis (3)
- Chem 3060 Applied Analysis (1)
- Chem 3410-3420 Physical Chemistry (8)
- Chem 4540 Spectrometric & Separation Methods (4)
- Chem 4600 Inorganic Chemistry (4)
- Chem 4700 Special Topics in Chemistry (1)
- Chem 4710 Chemical Preparations (1-3)
- Chem 4800 Research & Independent Study (1-5)
- Chem 4990 Senior Seminar (1)

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

*Permission from the department chair should be sought before registering in a course for Honors credit. A written agreement should be reached with the appropriate professor regarding the work expected for Honors credit. (See the Honors Program on page 43.). This written contract must include regularly scheduled sessions with the professor. In addition, students will be required to complete a project associated with the course. Projects for each chemistry course (other than Chem 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.

**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/S1210 Principles of Chemistry I (5)
- Chem S1220 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 3020 Computer Applications in Chemistry (1)
- Chem 3030 Quantitative Analysis (4)
- Chem 3050 Instrumental Analysis (3)
- Chem 3060 Applied Analysis (1)
- Chem 3410-3420 Physical Chemistry (8)
- Chem 4540 Spectrometric & Separation Methods (4)
- Chem 4600 Inorganic Chemistry (4)
- Chem 4700 Special Topics in Chemistry (1)
- Chem 4710 Chemical Preparations (1-3)
- Chem 4800 Research & Independent Study (1-5)
- Chem 4990 Senior Seminar (1)

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

*Permission from the department chair should be sought before registering in a course for Honors credit. A written agreement should be reached with the appropriate professor regarding the work expected for Honors credit. (See the Honors Program on page 43.). This written contract must include regularly scheduled sessions with the professor. In addition, students will be required to complete a project associated with the course. Projects for each chemistry course (other than Chem 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.
**CHEMISTRY COURSES - CHEM**

**CHEMICAL TECHNICIAN**

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

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

**Credit Hour Requirements:** A total of 63 credit hours is required for graduation - 42 of these are required within the program.

**Advisement**

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

**General Education**

Refer to pages 36-41 for Associate of Applied Science requirements. The following courses required for the Chemical Technician program will also satisfy general education requirements: Chem PS/SI1210 and Phsx PS/SI2010.

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

**Courses Required (21 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem PS/SI1210</td>
<td>Principles of Chemistry I (5)</td>
<td></td>
</tr>
<tr>
<td>Chem SI1220</td>
<td>Principles of Chemistry II (5)</td>
<td></td>
</tr>
<tr>
<td>Chem 2600</td>
<td>Laboratory Safety (1)</td>
<td></td>
</tr>
<tr>
<td>Chem 2990</td>
<td>Chem Tech Seminar (1)</td>
<td></td>
</tr>
<tr>
<td>Chem 3020</td>
<td>Computer Applications in Chemistry (1)</td>
<td></td>
</tr>
<tr>
<td>Chem 3030</td>
<td>Quantitative Analysis (4)</td>
<td></td>
</tr>
<tr>
<td>Chem 3050</td>
<td>Instrumental Analysis (3)</td>
<td></td>
</tr>
<tr>
<td>Chem 3060</td>
<td>Applied Analysis (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Support Courses Required (21-23 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engl EN1010</td>
<td>Intro to Writing (3)</td>
<td></td>
</tr>
<tr>
<td>Engl EN2010</td>
<td>Intermediate Writing (3)</td>
<td></td>
</tr>
<tr>
<td>Math QL1050</td>
<td>College Algebra (4)</td>
<td></td>
</tr>
<tr>
<td>&amp; Math 1060</td>
<td>Trigonometry (3)</td>
<td></td>
</tr>
<tr>
<td>or Math QL1080</td>
<td>Precalculus (5)</td>
<td></td>
</tr>
<tr>
<td>Phsx PS/SI2010/SI2020</td>
<td>General Physics (10)</td>
<td></td>
</tr>
<tr>
<td>or Phsx PS/SI2210/SI2220</td>
<td>Physics for Scientists (10)</td>
<td></td>
</tr>
</tbody>
</table>

**Suggested Course Sequence**

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

**CHEMICAL TECHNICIAN**

**CERTIFICATE OF PROFICIENCY (INSTITUTIONAL CERTIFICATE)**

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

**Credit Hour Requirements:** A total of 42 credit hours is required.

**Course Requirements for Certificate of Proficiency**

**Courses Required (21 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem PS/SI1210-SI1220</td>
<td>Principles of Chemistry (10)</td>
<td></td>
</tr>
<tr>
<td>Chem 2600</td>
<td>Laboratory Safety (1)</td>
<td></td>
</tr>
<tr>
<td>Chem 2990</td>
<td>Chem Tech Seminar (1)</td>
<td></td>
</tr>
<tr>
<td>Chem 3020</td>
<td>Computer Applications in Chemistry (1)</td>
<td></td>
</tr>
<tr>
<td>Chem 3030</td>
<td>Quantitative Analysis (4)</td>
<td></td>
</tr>
<tr>
<td>Chem 3050</td>
<td>Instrumental Analysis (3)</td>
<td></td>
</tr>
<tr>
<td>Chem 3060</td>
<td>Applied Analysis (1)</td>
<td></td>
</tr>
</tbody>
</table>

**Support Courses Required (21 credit hours)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engl EN1010</td>
<td>Intro to Writing (3)</td>
<td></td>
</tr>
<tr>
<td>Engl EN2010</td>
<td>Intermediate Writing (3)</td>
<td></td>
</tr>
<tr>
<td>Math QL1050</td>
<td>College Algebra (4)</td>
<td></td>
</tr>
<tr>
<td>&amp; Math 1060</td>
<td>Trigonometry (3)</td>
<td></td>
</tr>
<tr>
<td>or Math QL1080</td>
<td>Precalculus (5)</td>
<td></td>
</tr>
<tr>
<td>Phsx PS/SI2010/SI2020</td>
<td>General Physics (10)</td>
<td></td>
</tr>
<tr>
<td>or Phsx PS/SI2210/SI2220</td>
<td>Physics for Scientists (10)</td>
<td></td>
</tr>
</tbody>
</table>

**CHEMISTRY COURSES - CHEM**

**Chem PS1010. Introduction to Chemistry (3) Su, F, S**

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

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

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

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

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

**Chem SI1120. Elementary Organic/Biochemistry (5) S**

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

**Chem 1200. Preparation for College Chemistry (3) Su, F, S**

A course designed to provide the minimal prerequisite skills needed for entry into Chem PS/SI1210. Three hours of lecture per week.

**Chem PS/SI1210. Principles of Chemistry I (5) Su, F, S**

The first course in a series designed primarily for science majors and others who will take more than one year of chemistry such as premedical students, clinical laboratory scientists and some engineering students. The fundamental principles of chemistry with
Chem 1220. Principles of Chemistry II (5) Su. F. S
Second semester of principles of chemistry. Three hours of lecture, one hour of recitation and one 3-hour lab a week. Prerequisite: Chem 1210.

Chem PS/SI 1360. Principles of Physical Science (3) F
A lecture/laboratory course designed to provide an introduction to the scientific method and its application to the study of selected topics in physics and chemistry. Two hours of lecture and one 3-hour lab per week. Recommended for Elementary Education majors.

Fundamentals of the chemistry of carbon compounds. Three hours of lecture, one hour of recitation and one 3-hour lab a week. Prerequisite: Chem SI 1220.

Second semester of organic chemistry. Three hours of lecture, one hour of recitation and one 3-hour lab a week. Prerequisite: Chem 2310.

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

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

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

Chem 2990. Chem Tech Seminar (1) S
A course designed to provide the skills necessary to enter the job market as a chem. tech. Prerequisite: Chem SI 1220. One hour of lecture/discussion a week.

Chem 3020. Computer Applications in Chemistry (1) F. S
A course designed to provide students computer skills for applications including computation and electronic data bases searches. It is required that this course be taken before or with Chem 3030. One hour of lecture/discussion a week. Prerequisite: Chem SI 1220.

Chem 3030. Quantitative Analysis (4) F. S
Theory and methods of gravimetric and volumetric analysis and simple instrumentation. Include statistical evaluation of results. Three hours of lecture and one 3-hour lab per week. Prerequisite: Chem SI 1220. Co-requisite: Chem 3020.

Chem 3050. Instrumental Analysis (3) F. S
Modern instrumental methods of chemical analysis for majors and non-majors. Two hours of lecture and one 3-hour lab per week. Prerequisite: Chem SI 1220 and Chem 3020. Prerequisite or co-requisite: Chem 3030.

Chem 3060. Applied Analysis (1) F. S
Applied Analysis using modern methods of analysis with an emphasis on speed and accuracy. One 3-hour lab per week. Prerequisite: Chem 3030. Prerequisite or Co-requisite: Chem 3050.

Chem 3070. Biochemistry I (4) F. S
Structure and function of biomolecules including proteins, nucleic acids, fats and carbohydrates. A focus on proteins as energy transforming and catalytic devices; their role in metabolism, defense and other biochemical processes. Three lectures and one 3-hour lab a week. Prerequisite: Chem 2310.

Chem 3080. Biochemistry II (3) S

Chem 3090. Biochemical Techniques (1) S
Advanced techniques including instrumentation for biochemistry. One 3-hour lab per week. Prerequisites Chem 2320 and Chem 3070. 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.

Chem 3410. Physical Chemistry I (4) F
Three hours of lecture and one 3-hour lab a week. Prerequisites: Chem 3030, Chem 3400, and Phys SI2220.

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

Chem 4540. Spectrometric and Separation Methods (4) S
Theory and practice of spectrometric and separation analytical 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 SI 1220 and Geosci 2050 or consent of instructor.

Acquaintance with the various methods and curriculum of secondary school science. Two hours of lectures and one 3-hour lab a week. It is recommended that this course be completed before student teaching. Prerequisite: Chem 3030 or approval of instructor, and admission to the Teacher Education Program.

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

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

Chem 4710. Chemical Preparations (1-3)
Synthesis and determination of the properties of selected chemical compounds. Three to nine hours of lab a week. Prerequisite: Permission of the instructor.
The Geosciences are concerned with the Earth, its origin, composition, and evolution through time as well as studying the processes that affect the Earth and the life forms that have lived on it in the past. Many geoscience applications use computer technology (GIS and Remote Sensing) for mapping the Earth and modeling the processes that affect the planet. The department offers bachelor degrees in Geology, Applied Environmental Geosciences, and Earth Science Teaching and an option in the Physical Science Composite Teaching Major. A geology minor, Earth science teaching minor, and a geospatial analysis minor are available. A certificate in Geomatics (Applied Computer Mapping) is also available.

**GEOLGY MAJOR**

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

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

- **Program Prerequisite:** None
- **Minor:** Required for Option A; Not required for Option B *
- **Grade Requirements:** A grade of "C-" or better is required for this major in addition to an overall GPA of 2.00 or higher.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation – 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.

**Advisement**

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

**Admission Requirements**

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

**General Education**

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

* 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.

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

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci PS/SI1110</td>
<td>Dynamic Earth: Physical Geology (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci SI120</td>
<td>Physical Geology Laboratory (1)</td>
<td></td>
</tr>
<tr>
<td>Geosci 1220</td>
<td>Historical Geology (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 2050</td>
<td>Earth Materials (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3060</td>
<td>Structural Geology (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3150</td>
<td>Geomorphology (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3550</td>
<td>Sedimentology &amp; Stratigraphy (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4060</td>
<td>Geoscience Field Methods (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4300</td>
<td>Igneous &amp; Metamorphic Petrology (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 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>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci 4890</td>
<td>Cooperative Work Experience (1-6)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4920</td>
<td>Short Courses, Workshops, Institutes and Special Programs (1-4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4990</td>
<td>Senior Seminar (1)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci PS/SI1540</td>
<td>Environmental Geosciences (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 1550</td>
<td>Environmental Geosciences Lab (1)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3010</td>
<td>Oceanography and Earth Systems (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3080</td>
<td>Water Resources (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3180</td>
<td>Paleontology (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3210</td>
<td>Quaternary Environmental Change (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3250</td>
<td>Geology of Utah (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3400</td>
<td>Remote Sensing I (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 3880</td>
<td>Groundwater (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4010</td>
<td>Ancient Environments &amp; Paleocology (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4100</td>
<td>Engineering Geology (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4150</td>
<td>Environmental Assessment (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4210</td>
<td>Intro to Computer Mapping and GIS (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4220</td>
<td>Technical &amp; Application Issues in GIS (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4400</td>
<td>Remote Sensing II (4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4550</td>
<td>Geochemistry (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4630</td>
<td>Global Tectonics (3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4750</td>
<td>Special Topics in Geosciences (1-4)</td>
<td></td>
</tr>
<tr>
<td>Geosci 4800</td>
<td>Independent Study (1-3)</td>
<td></td>
</tr>
<tr>
<td>Geosci 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>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botany 3214</td>
<td>Soils (4)</td>
<td></td>
</tr>
<tr>
<td>Chem 2310</td>
<td>Organic Chemistry I (5)</td>
<td></td>
</tr>
<tr>
<td>Chem 3030</td>
<td>Quantitative Analysis (4)</td>
<td></td>
</tr>
<tr>
<td>Geogr 4410</td>
<td>Land Use Planning Techniques (3)</td>
<td></td>
</tr>
<tr>
<td>Geogr 4420</td>
<td>Advanced Planning Techniques (3)</td>
<td></td>
</tr>
<tr>
<td>Micro 3484</td>
<td>Environmental Microbiology (4)</td>
<td></td>
</tr>
</tbody>
</table>

* No more than 4 combined credit hours from Geosci 4800 and 4970 may be counted toward the major requirements.
### Course Requirements for B.S. Degree

<table>
<thead>
<tr>
<th>Course Requirements (38 credit hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci PS/SI1110 Dynamic Earth: Physical Geology (3)</td>
</tr>
<tr>
<td>Geosci SI1120 Physical Geology Laboratory (1)</td>
</tr>
<tr>
<td>Geosci 1120 Historical Geology (4)</td>
</tr>
<tr>
<td>Geosci PS/SI1540 Environmental Geosciences (3)</td>
</tr>
<tr>
<td>Geosci 1550 Environmental Geosciences Lab (1)</td>
</tr>
<tr>
<td>Geosci 2050 Earth Materials (4)</td>
</tr>
<tr>
<td>Geosci 3080 Water Resources (3)</td>
</tr>
<tr>
<td>Geosci 3150 Geomorphology (4)</td>
</tr>
<tr>
<td>Geosci 3550 Sedimentology &amp; Stratigraphy (4)</td>
</tr>
<tr>
<td>Geosci 4060 Geoscience Field Methods (3)</td>
</tr>
</tbody>
</table>

*Select two of the following*

- Geosci 3400 Remote Sensing I (4)
- Geosci 4210 Intro to Computer Mapping & GIS (4)
- Geosci 4220 Technical & Application Issues in GIS (4)
- Geosci 4400 Remote Sensing II (4)

### Electives Required (12 credit hours)

Select 12 credit hours from the following:

- Geosci PS/SI1130 Intro to Meteorology (3)
- Geosci S3010 Oceanography and Earth Systems (3)
- Geosci 3060 Structural Geology (4)
- Geosci 3180 Paleontology (4)
- Geosci 3210 Quaternary Environmental Change (3)
- Geosci 3250 Geology of Utah (3)
- Geosci 3880 Groundwater (4)
- Geosci 4010 Ancient Environments & Paleooecology (3)
- Geosci 4100 Engineering Geology (3)
- Geosci 4150 Environmental Assessment (3)
- Geosci 4300 Igneous and Metamorphic Petrology (4)
- Geosci 4510 Geology Field Camp (4)
- Geosci 4550 Geochmistry (3)
- Geosci 4630 Global Tectonics (3)
- Geosci 4750 Special Topics in Geosciences (1-4)
- Geosci 4800 Independent Study (1-3)
- Geosci 4970 Senior Thesis (2) *

* or any of the following not taken as part of the core

- Geosci 3400 Remote Sensing I (4)
- Geosci 4210 Intro to Computer Mapping & GIS (4)
- Geosci 4220 Technical & Application Issues in GIS (4)
- Geosci 4400 Remote Sensing II (4)

### General Education

Refer to pages 36-41 for Bachelor of Science or Bachelor of Arts requirements. Math QL1050 or Math QL1080 is recommended for the Quantitative Literacy requirement. The following courses required for the Applied Environmental Geoscience major will also satisfy general education requirements: Chem PS/SI1210, Geosci PS/SI1110, Geosci PS/SI1540, Phsx PS/SI2010, and Phsx PS/SI2210.
**Students planning to attend graduate school in Geology or a related geotechnical area should take Phsx PS/SI2210-SI2220.**

**Students planning to attend graduate school in Geology or a related geotechnical area should also take Math SI1210/SI1220, Calculus I and II (8).**

Students planning a career or advanced degree in geospatial applications are encouraged to complete the Geomatics certificate program. Students planning a career or advanced degree in geotechnical applications are encouraged to take Geosci 3060, 3880, 4100, and 4150 as electives.

### Suggested Course Sequence

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

#### Earth Science Teaching Major

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

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

- **Program Prerequisite:** Must satisfy Teacher Education admission and certification requirements. (See Teacher Education Department.)
- **Minor:** Not required.
- **Grade Requirements:** A grade of "C-" or better in courses required for this major. An overall GPA of 3.00 is required for admission to the Teacher Education program.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation. 63 to 65 of these are required within the major. Teacher Education Certification requires a minimum of 9 credit hours of support courses and 31 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) - 13 of these are required Geosciences courses and 31 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 (call 801-626-6269).

### Admission Requirements

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

### General Education

Refer to pages 36-41 for either Bachelor of Science or Bachelor of Arts requirements. Math QL1050 or Math QL1080 is recommended for the Quantitative Literacy requirement. The following courses required for the Earth Science Teaching major will also satisfy general education requirements: Botany LS1203, Chem PS/SI1210, Geosci PS/SI1110, Geosci PS/SI1130, Geosci PS1540, Phsx PS/SI1030, Phsx PS/SI2010, and Phsx PS/SI2210. The following required education support courses will also satisfy general education requirements: ChFam SS1500 and Comm HU1020.

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

**Earth Science Courses Required (38 credit hours)**

- Geosci PS/SI1110 Dynamic Earth: Physical Geology (3)
- Geosci SI1120 Physical Geology Laboratory (1)
- Geosci SI1130 Meteorology (3)
- Geosci 1220 Historical Geology (4)
- Geosci SI1540 Environmental Geosciences (3)
- Geosci 1550 Environmental Geosciences Lab (1)
- Geosci 2050 Earth Materials (4)
- Geosci SI3010 Oceanography & Earth Systems (3)
- Geosci 3150 Geomorphology (4)
- Geosci 4570 Secondary School Science Teaching Methods (3)
- Phsx PS/SI1030 Intro to Astronomy (3)
- Botany LS1203 Plant Biology (3)

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

- Geosci 3060 Structural Geology (4)
- Geosci 3080 Water Resources (3)
- Geosci 3180 Paleontology (4)
- Geosci 3210 Quaternary Environmental Change (3)
- Geosci 3250 Geology of Utah (3)
- Geosci 3550 Sedimentology & Stratigraphy (4)
- Geosci 4210 Intro to Computer Cartography & GIS (4)
- Geosci 4750 Special Topics in the Geosciences (2-4)
- Geosci 4800 Independent Research (1-3)
- Geosci 4950 Advanced Geoscience Fieldtrips (1-3)

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

- Chem PS/SI1210/SI1220 Principles of Chemistry (10)
- Phsx PS/SI2010/SI2220 General Physics (10)
- or Phsx PS/SI2210/SI2220 Physics for Scientists & Engineers (10)

**Recommended Support Courses**

- any additional upper division Geoscience course (numbered 3000 and above)
- Botany 3214 Soils (4)
- Botany 3303 Plant Genetics (3) *
- Botany 3473 Plant Geography (3)
- Geogr 3060 World Environmental Issues (3)
- Hist 3350 History & Philosophy of Science (3)
- Zool LS1010 Animal Biology (3) *

* Completion of Zool LS1010 and Botany 3303 will allow students to receive the Integrated Science teaching endorsement (7th grade) in addition to the Earth Science endorsement (8th & 9th grade).

#### Suggested Course Sequence

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

#### Physical Science Composite

**Teaching Major**

**BACHELOR DEGREE**

See the Department of Physics section 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 43).
If a student is not obtaining a teaching major in the sciences, then the following course is required:

Geosci 4570 Secondary School Science Teaching Methods (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

**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)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci 3400</td>
<td>4</td>
</tr>
<tr>
<td>Geosci 4210</td>
<td>4</td>
</tr>
<tr>
<td>Geosci 4220</td>
<td>4</td>
</tr>
<tr>
<td>Geosci 4400</td>
<td>4</td>
</tr>
<tr>
<td>Either</td>
<td></td>
</tr>
<tr>
<td>Geogr PS/S1100 &amp; Geosci S1120</td>
<td></td>
</tr>
<tr>
<td>Geosci 4400</td>
<td>4</td>
</tr>
</tbody>
</table>

*or Geosci S1110 & Geosci S1120 Physical Geology Lab (1)*

*or Geosci S1100 & Geosci S1120 Physical Geology Lab (1)*

Any 4 hours of Geosci courses numbered 3000 or above

If any required courses for the Geospatial Analysis Minor are also required toward the minor (a grade of "C-" is not acceptable).

If a student is not obtaining a teaching major in the sciences, then the following course is required:

Geosci 4570 Secondary School Science Teaching Methods (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.

### Geomatics (Applied Mapping Sciences) Certificate

**Grade Requirements:** A grade of "C" or better in all courses used toward the certificate (a grade of "C-" is not acceptable). An overall GPA of 2.75 is required for the six core courses in the Certificate Program.

**Credit Hour Requirements:** Minimum of 16 credit hours from Geosciences courses.

#### Course Requirements for the Certificate Program

**Geosciences Courses Required (16 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci 3400</td>
<td>4</td>
</tr>
<tr>
<td>Geosci 4210</td>
<td>4</td>
</tr>
<tr>
<td>Geosci 4220</td>
<td>4</td>
</tr>
<tr>
<td>Geosci 4400</td>
<td>4</td>
</tr>
<tr>
<td>Either</td>
<td></td>
</tr>
<tr>
<td>Geogr PS/S1100 &amp; Geosci S1120</td>
<td></td>
</tr>
<tr>
<td>Geosci 4400</td>
<td>4</td>
</tr>
</tbody>
</table>

*or Geosci S1100 & Geosci S1120 Physical Geology Lab (1)*

*or Geosci S1100 & Geosci S1120 Physical Geology Lab (1)*

Any 4 hours of Geosci courses numbered 3000 or above

If any required courses for the Geospatial Analysis Minor are also required toward the minor (a grade of "C-" is not acceptable). An overall GPA of 2.75 is required for the six core courses in the Certificate Program.

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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geosci 4400</td>
<td>Remote Sensing II: Advanced Digital Image Processing (4)</td>
</tr>
</tbody>
</table>

**Computer Science Courses Required (6 credit hours)**

Select at least 6 hours from the following:

- CS SI1023: Selected Programming Language (4)
- CS SI1220: Object-Oriented Programming
- Using C++ (4)
- IS&T SI2110: Software Development I (3)
- IS&T SI2310: Database Design and Implementation (4)
- IS&T SI3720: 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 compliment 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 (B.I.S.) Degree. The Geomatics Certificate will serve to improve employment opportunities for students engaged in the mapping sciences.

---

**GEOSCIENCES COURSES - GEOSCI**

**Geosci PS/SI1130. Introduction to Meteorology (3)Su, F, S**

The study 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.

**Geosci SI1120. Physical Geology Laboratory (1) F, S**

Survey of atmospheric processes that create weather. Readings, written and oral reports, and/or examinations may be required. Prerequisite: consent of instructor.

**Geosci SI1130. Principles of Earth Science (3) F, S**

Overview of the Earth's systems through the use of lecture, laboratory analysis, data collection, peer interaction groups, problem solving, and field experiences. Two lectures and one three-hour lab per week; several of the labs are field trips requiring an additional field trip fee. Recommended for Elementary Education majors.

**Geosci SI1540. Environmental Geosciences (3) F, S**

The scientific study of the interaction of humans and earth systems including topics of natural hazards; soil, water, energy and mineral resources; and issues of global change. Three lectures per week.

**Geosci 1550. Environmental Geosciences Laboratory (1) F, S**

Laboratory and field exercises involving analysis of geologic data related to environmental issues or problems. Application of the scientific method and development of basic computational and map interpretation skills will be stressed. One three-hour lab per week. Prerequisite: Geosci PS1540, or concurrent enrollment.

**Geosci 1600. Dinosaurs and the Fossil Record (3) F**

An introduction to the nature of the fossil record and a review of the major events in the history of life, including the rise of dinosaurs and mass extinctions. A writing intensive course requiring a term paper using library resources. Three lectures per week.

**Geosci 2050. Earth Materials (4) F**

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: Geosci SI1120 or permission of instructor.

**Geosci 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 be taught in a lecture/demonstration format.

**Geosci 2890. Cooperative Work Experience (1-6)**

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.

**Geosci 2920. Short Courses, Workshops, Institutes and Special Programs (1-4) (offered as needed)**

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

**Geosci 2950. Geoscience Fieldtrips (1-3) Su, F, S**

Application of basic Geoscience field methods during fieldtrips. Readings, written and oral reports, and/or examinations may be required. Prerequisite: consent of instructor.

**Geosci SI3100. Oceanography and Earth Systems (3) (alternate years)**

Study of the world's oceans as a framework for examining the major issues in Earth system science. Topics include plate tectonics and the origin of ocean basins, atmosphere-ocean linkages and feedbacks, El Niño events, the ocean's role in biogeochemical cycles, structure and organization of marine ecosystems, and scientific basis for understanding human impacts on marine systems. Three lectures per week. Prerequisite: Geosci PS1110 or Geosci PS1310 or Geogr PS1010.

**Geosci 3060. Structural Geology (4) (alternate years)**

Origin and characteristics of structural features in deformed rock. Topics include basic principles of stress, strain, and rock deformation; analysis of faults and folds; and relations to major tectonic features of Earth. Field trips required. Three lectures and one three-hour lab per week. Prerequisites: Geosci 2050 and either Math QL1050 or Math QL1080; or consent of instructor.
Geosci 3080. Water Resources (3) F
A detailed examination of the water cycle, including, precipitation, surface water, groundwater, glaciers, water conservation, water management, and water pollution with special emphasis on the water resources of Utah and neighboring areas. Three lectures per week. Prerequisite: Geosci 31120.

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

Geosci 3180. Palaeontology (4) F (alternate years)
Characteristics of important fossil groups and their geologic distribution and paleoecology. Emphasis on the invertebrate record with some treatment of vertebrates and plants. Three lectures and one three-hour lab per week. Prerequisite: Geosci 1220 or Zool 31110 or consent of instructor.

Geosci 3210. Quaternary Environmental Change (3) S (alternate years)
Overview of the geologic and paleoclimatic history of the Earth during the last 2 million years (the "Ice Age"), focusing on the interactions between geological, climatological, and biological processes and systems. Topics include the methods used to date Quaternary deposits, nature of Quaternary glaciations, use of proxy data to model past climates, causes of Quaternary climatic oscillations, history of Pleistocene Lake Bonneville, and the increasing role of humans as agents of environmental change. Field trips required. Three lectures per week. Prerequisite: Geosci 1220 or Geogr PS1010 or Anthro SS2100.

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

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

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

Geosci 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: Geosci 91120 and either Math QL1050 or Math QL1080; or consent of instructor.

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

Geosci 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: Geosci 2050, Geosci 3150, and Geosci 3550.

Geosci 4100. Engineering Geology (3)
Introduction to basic concepts in engineering geology and geotechnical engineering; emphasizes problem solving as the primary method. Three lectures per week. Prerequisite: Geosci 1540 and Geosci 1550, or Geosci 2050, or consent of instructor.

Geosci 4150. Environmental Assessment (3)
Interdisciplinary study of geology applied to transport of contaminants in groundwater, environmental site assessment and remediation. Three hours of lecture per week. Prerequisite: Geosci 1540 and Geosci 1550, or Geosci 2050, or consent of instructor.

Geosci 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 ArcView and ArcInfo 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, or consent of instructor, and a demonstrated proficiency in DOS and WINDOWS operating systems through completion of TBE 2200 or concurrent registration, or satisfactory results on the computer proficiency exam, or consent of instructor.

Geosci 4220. Technical and Application Issues in GIS (4) S
A capstone course in spatial analysis in which data entry, data manipulation, spatial modeling, and analysis are addressed through the completion of the research project addressing a spatial problem using GIS and the computer as a modeling instrument. Advanced level, computer-intensive applications are employed using ArcInfo, ArcView, and Surfer software, in concert with optical scanning, digitizing, and global positioning systems (GPS) technology. Three lectures and one three-hour lab per week. Prerequisite: Geosci 4210.

Geosci 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: Geosci 2050 and Chem 91220; 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. Advanced level global positioning system (GPS) mapping techniques are undertaken. Two lectures and two three-hour lab per week. Prerequisite: Geosci 3400.
Geosci 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: Geosci 3060, Geosci 3550, and Geosci 4060; or consent of instructor.

Geosci 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 Geosci 2050; or consent of instructor.

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

Geosci 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: Geosci 3060 and Math SI1220; or consent of instructor.

Geosci 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: Geosci 2050 and Geosci 3060; or consent of instructor.

Geosci 4750. Special Topics in Geosciences (1-4)
An opportunity to examine in depth topics in the Geosciences not regularly offered as part of the standard course offerings. The specific title and credit authorized will appear on the student transcript. The course may be repeated for credit. Prerequisites: Geosci PS/SI1110, Geosci SI1120, and any specific courses selected by the instructor.

Geosci 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.)

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

Geosci 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.

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

Geosci 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.

Geosci 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.

Departments of Weber State University
Chair: Dr. Kent O. Kidman
Location: Building 4, Room 518C
Telephone Contact: Ruth Wright 801-626-6095
Professors: Lee Badger, James H. Foster, Afsin Ghoreishi, Kent O. Kidman, Richard R. Miller, Franklin B. Richards, Paul C. Talaga; Associate Professors: George Kvernadze, James E. Peters, Monika Serbinowska, Timothy Steele, Tamas Szabo, John S. Thaeler; Visiting Assistant Professor: Jennifer Hooper; Instructor Specialists: Dixie Blackinton, Diane C. Pugmire; Instructor: Eric Jacobsen; Lecturers: Alice Alred, Loyal Baker, Mary Jo Hansen, Jonathon Harper, Darrell Poore, John Spence, Phillip A. Walthers

The Department of Mathematics offers a departmental major and minor, an Honors major, a major with an applied mathematics emphasis, and a teaching major and minor. In addition, many support courses are provided for the entire campus.

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.
• All students are eligible to enroll in Math 0950 and 0955.
• To enroll in mathematics courses Math 0960 or Math 1010, a student must have within the past twelve months either:
  1. Scored sufficiently high on a placement exam at the WSU testing center. or
  2. Completed the prerequisite course with a grade of "C" or higher.
• To enroll in mathematics courses Math QL1030, Math QL1040, Math QL1050, Math 1060, or Math QL1080 a student must have either:
  1. Received a Math ACT score of 23 or above, within the past 24 months or
  2. Scored sufficiently high on a placement exam at the WSU testing center within the past 12 months. or
  3. Completed the prerequisite course with a grade of "C" or higher within the past 12 months.
It is recommended that students have their programs (majors and minors) approved before registering for upper division courses.

**MATHEMATICS MAJOR**

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

- **Program Prerequisite**: Not required for Regular and Applied Mathematics Emphases. Mathematics Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).
- **Minor**: Required for the departmental major.
- **Grade Requirements**: A grade of “C” or better in courses required for this major (a grade of “D” is not acceptable), in addition to an overall 2.0 GPA and a 2.0 GPA in mathematics classes numbered 1210 or above. Mathematics Teaching majors must achieve an overall GPA of 3.00 for admission to the Teacher Education program.
- **Credit Hour Requirements**: A total of 120 credit hours is required for graduation - 40-46 of these are required in the major. A total of 40 upper division credit hours is required (courses numbered 3000 and above) - at least nine credit hours of upper division Mathematics must be completed at Weber State University.

**Advisement**

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

**Admission Requirements**

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

**General Education**

Refer to pages 36-41 for either Bachelor of Science or Bachelor of Arts requirements. Phsx PS/SI2210 will fulfill requirements for both the major and general education. Psych SI1010 (3) in the Social Sciences area is recommended for the Mathematics Teaching Emphasis.

## Mathematics Sequences

### A. Probability and Statistics Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 3410</td>
<td>3</td>
</tr>
<tr>
<td>Math 3420</td>
<td>3</td>
</tr>
</tbody>
</table>

### B. Combinatorics Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 3610</td>
<td>3</td>
</tr>
<tr>
<td>Math 3620</td>
<td>3</td>
</tr>
</tbody>
</table>

### C. Differential Equations Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 3710</td>
<td>3</td>
</tr>
<tr>
<td>Math 3730</td>
<td>3</td>
</tr>
<tr>
<td>or Math 3750</td>
<td>3</td>
</tr>
</tbody>
</table>

### D. Algebra Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 4110</td>
<td>3</td>
</tr>
<tr>
<td>Math 4120</td>
<td>3</td>
</tr>
</tbody>
</table>

### E. Analysis Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 4210</td>
<td>3</td>
</tr>
<tr>
<td>Math 4220</td>
<td>3</td>
</tr>
</tbody>
</table>

### F. Numerical Analysis Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 4610</td>
<td>3</td>
</tr>
<tr>
<td>Math 4620</td>
<td>3</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math SI1210</td>
<td>4</td>
</tr>
<tr>
<td>Math SI1220</td>
<td>4</td>
</tr>
<tr>
<td>Math 2210</td>
<td>4</td>
</tr>
<tr>
<td>Math 2270</td>
<td>3</td>
</tr>
<tr>
<td>Math 2280</td>
<td>3</td>
</tr>
<tr>
<td>Math 4110</td>
<td>3</td>
</tr>
<tr>
<td>Math 4120</td>
<td>3</td>
</tr>
<tr>
<td>Math 4210/4220</td>
<td>6</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phsx SI2210</td>
<td>5</td>
</tr>
<tr>
<td>Phsx SI2220</td>
<td>5</td>
</tr>
</tbody>
</table>

**Graduate School Preparation**

It is highly recommended that students planning on graduate work in Mathematics take Linear Algebra (Math 3350) and Topology (Math 4320) in addition to the above. See the Mathematics Department for counseling.

### Course Requirements for Applied Mathematics Emphasis B.S. or B.A. Degree

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math SI1210</td>
<td>4</td>
</tr>
<tr>
<td>Math SI1220</td>
<td>4</td>
</tr>
<tr>
<td>Math 2210</td>
<td>4</td>
</tr>
<tr>
<td>Math 2270</td>
<td>3</td>
</tr>
<tr>
<td>Math 2280</td>
<td>3</td>
</tr>
<tr>
<td>Math 3410</td>
<td>3</td>
</tr>
<tr>
<td>Math 3550</td>
<td>3</td>
</tr>
<tr>
<td>Math 3710</td>
<td>3</td>
</tr>
<tr>
<td>or Math 3750</td>
<td>3</td>
</tr>
<tr>
<td>Math 4610</td>
<td>3</td>
</tr>
</tbody>
</table>

## Mathematics Sequences

### A. Probability and Statistics Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 3410</td>
<td>3</td>
</tr>
<tr>
<td>Math 3420</td>
<td>3</td>
</tr>
</tbody>
</table>

### B. Combinatorics Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 3610</td>
<td>3</td>
</tr>
<tr>
<td>Math 3620</td>
<td>3</td>
</tr>
</tbody>
</table>

### C. Differential Equations Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 3710</td>
<td>3</td>
</tr>
<tr>
<td>Math 3730</td>
<td>3</td>
</tr>
<tr>
<td>or Math 3750</td>
<td>3</td>
</tr>
</tbody>
</table>

### D. Algebra Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 4110</td>
<td>3</td>
</tr>
<tr>
<td>Math 4120</td>
<td>3</td>
</tr>
</tbody>
</table>

### E. Analysis Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 4210</td>
<td>3</td>
</tr>
<tr>
<td>Math 4220</td>
<td>3</td>
</tr>
</tbody>
</table>

### F. Numerical Analysis Sequence

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 4610</td>
<td>3</td>
</tr>
<tr>
<td>Math 4620</td>
<td>3</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math SI1210</td>
<td>4</td>
</tr>
<tr>
<td>Math SI1220</td>
<td>4</td>
</tr>
<tr>
<td>Math 2210</td>
<td>4</td>
</tr>
<tr>
<td>Math 2270</td>
<td>3</td>
</tr>
<tr>
<td>Math 2280</td>
<td>3</td>
</tr>
<tr>
<td>Math 4110</td>
<td>3</td>
</tr>
<tr>
<td>Math 4120</td>
<td>3</td>
</tr>
<tr>
<td>Math 4210/4220</td>
<td>6</td>
</tr>
</tbody>
</table>

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)

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phsx SI2210</td>
<td>5</td>
</tr>
<tr>
<td>Phsx SI2220</td>
<td>5</td>
</tr>
</tbody>
</table>

**Graduate School Preparation**

It is highly recommended that students planning on graduate work in Mathematics take Linear Algebra (Math 3350) and Topology (Math 4320) in addition to the above. See the Mathematics Department for counseling.

### Course Requirements for Applied Mathematics Emphasis B.S. or B.A. Degree

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math SI1210</td>
<td>4</td>
</tr>
<tr>
<td>Math SI1220</td>
<td>4</td>
</tr>
<tr>
<td>Math 2210</td>
<td>4</td>
</tr>
<tr>
<td>Math 2270</td>
<td>3</td>
</tr>
<tr>
<td>Math 2280</td>
<td>3</td>
</tr>
<tr>
<td>Math 3410</td>
<td>3</td>
</tr>
<tr>
<td>Math 3550</td>
<td>3</td>
</tr>
<tr>
<td>Math 3710</td>
<td>3</td>
</tr>
<tr>
<td>or Math 3750</td>
<td>3</td>
</tr>
<tr>
<td>Math 4610</td>
<td>3</td>
</tr>
</tbody>
</table>
**Mathematics Electives** (at least 12 credit hours)

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

**Support Courses Required (14 credit hours)**

- Math SI1210 Calculus I (4)
- Math SI1220 Calculus II (4)
- Math 2210 Calculus III (4)
- Math 2270 Elementary Linear Algebra (3)
- Math 2280 Ordinary Differential Equations (3)
- Math 3120 Euclidean & non-Euclidean Geometry (3)
- Math 3160 Number Theory (3)
- Math 3410 Probability & Statistics I (3)
- Math 3420 Probability & Statistics II (3)
- Math 4110 Modern Algebra I (3)
- Math 4210 Intro Real Analysis (3)
- MathEd 3010 Methods & Technology for Teaching
- MathEd 3020 Methods & Techniques for Teaching
- MathEd 3030 Methods & Techniques for Teaching
- MathEd 3040 Advanced Secondary Math (3)

**Support Courses Required (5-10 credit hours)**

Complete either

- Phsx PS/SI2210 Physics for Scientists & Engineers I (5)
- Phsx SI2220 Physics for Scientists & Engineers II (5)
- CS SI1220 Object Oriented Programming Using C++ (4)

A minor is required in either Physics, Computer Science, or Electronics Engineering Technology. Other minors having a strong mathematical base are acceptable if the courses to be taken are pre-approved by the chair of the Mathematics Department.

**Graduate School Preparation**

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

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

- **Mathematics Courses Required (42 credit hours)**
  - Math SI1210 Calculus I (4)
  - Math SI1220 Calculus II (4)
  - Math 2210 Calculus III (4)
  - Math 2270 Elementary Linear Algebra (3)
  - Math 2280 Ordinary Differential Equations (3)
  - Math 3120 Euclidean & non-Euclidean Geometry (3)
  - Math 3160 Number Theory (3)
  - Math 3410 Probability & Statistics I (3)
  - Math 3420 Probability & Statistics II (3)
  - Math 4110 Modern Algebra I (3)
  - Math 4210 Intro Real Analysis (3)
  - MathEd 3010 Methods & Techniques for Teaching
  - MathEd 3020 Methods & Techniques for Teaching
  - MathEd 3030 Methods & Techniques for Teaching
  - MathEd 3040 Advanced Secondary Math (3)

- **Support Courses Required (5-10 credit hours)**
  - Complete Phsx PS/SI2210 Physics for Scientists & Engineers I (5)
  - or Chem PS/SI1210 Principles of Chemistry (5)
    & Chem SI1220 Principles of Chemistry (5)

A minor is required. A student must also complete requirements for a secondary education degree as determined by the Jerry and Vickie Moyes 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 43).
- **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 the form in to the Honors 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 (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 (23 credit hours)**
  - Math SI1210 Calculus I (4)
  - Math SI1220 Calculus II (4)
  - Math 2270 Elementary Linear Algebra (3)
  - Math 3120 Euclidean & non-Euclidean Geometry (3)
  - Math 3410 Probability & Statistics I (3)
  - Math 3160 Number Theory (3)
  - or Math 4110 Modern Algebra I (3)
  - MathEd 3010 Methods & Technology for Teaching
  - MathEd 3020 Methods & Techniques for Teaching
  - Intermediate Secondary Math (3)
Math ND0950. Pre-algebra (3) S
Fundamental concepts of arithmetic including pre-algebra. Does not count for graduation.

Math ND0955. Integrated Arithmetic and Beginning Algebra (6) Su. 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. 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. S
Graphs; linear equations and systems; exponents and radicals; polynomial, rational, and logarithmic functions; applications. Prerequisite: Math ND0955, Math ND0960 or placement test.

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

Math QL1030. Contemporary Mathematics (3) Su. S
Topics from mathematics which convey to the student the beauty and utility of mathematics, and which illustrate its application to modern society. Topics include geometry, statistics, probability, and utility of mathematics, and which illustrate its application to modern society. Prerequisite: Math 1010 and ACT Math score 23 or higher or placement test.

Math QL1040. Introduction to Statistics (3) Su. S
Basic concepts of probability and statistics with an emphasis on applications. Prerequisite: Math 1010 or Math ACT score 23 or higher or placement test.

Math QL1050. College Algebra (4) Su. S
Selected topics in algebra including inequalities, logarithms, theory of equations, matrices, determinants and progressions. Prerequisite: Math 1010 or Math ACT score of 23 or higher or placement test.

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

Math QL1080. Pre-calculus (5) Su. S
A course covering college algebra and trigonometry concepts preparatory to calculus. Prerequisite Math 1010 or Math ACT score of 23 or higher or placement test.

Math 1100. Mathematics Computer Laboratory (1) S
Computer solution of mathematics problems using a computer algebra system. Prerequisites: Math QL1050 and 1060, or Math QL1080, and Co-requisite Math SI1210.

Math 1140. Discrete Mathematics Applied to Computing (3)
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. Prerequisite: Math QL1050 or Math QL1080.
Math 3620. Enumeration (3) S
Principles of Enumeration including counting principles, generating functions, recurrence relations, inclusion-exclusion, and applications. Prerequisite: Math SI1210.

Math 3710. Boundary Value Problems (3) F

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

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

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

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

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

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

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

Math 4610, 4620. Numerical Analysis (3-3) F, S
Introduction to numerical methods. Use of the digital computer in solving otherwise intractable problems. Prerequisite: Math 2270 and CS SI1220 or other approved programming language; Math 4610 for 4620.

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

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

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

MATHEMATICS EDUCATION COURSES - MATHED

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

MathEd 2310. Mathematics for Elementary Teachers (3) F, S
Geometry, sets, logic, problem solving. Prerequisite: Math QL1050.

MathEd 2320. Mathematics for Elementary Teachers (3) F, S
Properties of whole numbers, integers, rational numbers, and real numbers; number theory; probability and statistics. Prerequisites: Math QL1050 and MathEd 2310.

MathEd 3010. Methods and Technology for Teaching Intermediate Secondary Mathematics (3) F
Basic topics in intermediate mathematics are taught to prospective teachers using a variety of methods of presentation and assessment that have special application to the intermediate Math classroom. Prerequisite: Math 91220.

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

MathEdSI 3060. Probability and Statistics for Elementary Teachers (3) F
Basic Probability and statistics with an emphasis on topics and methods pertinent to prospective elementary school teachers. Prerequisite: MathEd 2310 and 2320.

MathEdSI 3070. Geometry for Elementary Teachers (3) F
Basic Geometry with an emphasis on the topics and methods pertinent to prospective elementary school teachers. Prerequisite: MathEd 2310 and 2320.

MathEdSI 3080. Number Theory for Elementary Teachers (3) S
Survey of elementary number theory concepts with applications to topics of interest plus teaching suggestions. Prerequisite: MathEd 2310 and 2320.

MathEdSI 4040. Mathematical Problem Solving for Elementary Teachers (3) S
Mathematical problem solving, discussion of process, writing solutions, and writing extensions. Prerequisite: MathEd 2310 and 2320.

MathEdSI 4100. Intuitive Calculus for Elementary Teachers (3) F
Prerequisite: MathEd 2310 and 2320.

MathEd 4700. Senior Project in Elementary Mathematics Teaching (3) F, S
Projects in preparing, teaching and revising sequential mathematics lessons for elementary students. Prerequisite: MathEd 2310 and 2320.
MathEd 5210. Calculus with Analytic Geometry (4)
Analytic geometry, differentiation, integration, and applications.
Prerequisite: Math QL1050 and 1060 or Math QL1080 or
placement test.

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

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

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

MathEd 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: MathEd 5220.

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

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

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

MathEd 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:
MathEd 5310 or prerequisite of MathEd 5220 and consent of
instructor. Further prerequisites: MathEd 6410 for 6420.

MathEd 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: MathEd 5310 and 5350.

MathEd 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: MathEd 5210.

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

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

MathEd 6640. Differential Equations II (3)
Matrix approach to linear systems, non-linear systems, Laplace
transforms. Prerequisite: MathEd 5350.
### Microbiology Major

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

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

### Advisement

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

### Admissions Requirements

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

### General Education

Refer to pages 36-41 for Bachelor of Science requirements. The following courses required for the Microbiology major also will satisfy general education requirements: Micro LS/SI2054, Chem PS/SI1210, Phsx PS/SI1010 or Phsx PS/SI2010, Botany LS1203, and Zool LS1010.

### Course Requirements for B.S. Degree

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

- Micro LS/SI2054 Principles of Microbiology (4)
- Micro 3053 Microbiological Procedures (3)
- Micro 3254 Immunology (4)
- Micro 4054 Microbial Physiology (4)
- Micro 4154 Microbial Genetics (4)

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

- **Category A (8 credit hours minimum)**
  - Micro 3154 Microbial Ecology (4)
  - Micro 3305 Medical Microbiology (5)
  - Micro 3484 Environmental Microbiology (4)
  - Micro 3502 Environmental Health (2)
  - Micro 3853 Food Microbiology (3)
  - Micro 4252 Cell Culture (2)
  - Micro 4354 Industrial Microbiology & Biotech (4)
  - Micro 4554 Virology (4)

- **Category B**
  - Micro 2600 Laboratory Safety (1)
  - Micro 3290 Short Courses, Workshops, . . . (1)
  - Micro 3340 Info Resources in the Life Sciences (2)
  - Micro 4800* Directed Research (1-2)
  - Micro 4830* Directed Readings (1-2)
  - Micro 4920 Short Courses, Workshops, . . . (1)
  - Micro 4991 Microbiology Seminar (1)

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

- **Category C (8 credit hours maximum)**

  elective courses in other life science departments
  
  - Botany 3504 Mycology (4)
  - Botany 3514 Algology (4)
  - Zool 3200 Cell Biology (4)
  - Zool 3300 Genetics (4)
  - or Botany 3303 Plant Genetics (3)
  - Zool 4600 Protozoology (4)

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

- Chem PS/SI1210/SI2220 Principles of Chemistry (10)
- Chem 2310 Organic Chemistry (5)
- Chem 3070 Biochemistry I (4)
- Math QL1050 College Algebra (4)
- or Math QL1080 Pre-Calculus (5)
- or Math SI1210 Calculus I (4)
- Phsx PS/SI1010 Intro to Physics I (3)
- or Phsx PS/SI2010/SI2020 General Physics w/lab (10)
- or Phsx PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
- Botany LS1203 Plant Biology (3)
- or Botany SI2104 Plant Form and Function (4)
- or Botany SI2114 Evolutionary Survey of Plants (4)
- Zool 1010 Animal Biology (3)
- or Zool SI1110 Principles of Zoology I (4)
- or Zool SI1120 Principles of Zoology II (4)

### Suggested Course Sequence

Please refer to this program in the on-line 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

- Micro 3154 Microbial Ecology (4)
- Micro 3484 Environmental Microbiology (4)
- Micro 3502 Environmental Health (2)
- Micro 3853 Food Microbiology (3)
- Micro 4252 Cell Culture (2)
- Micro 4354 Industrial Microbiology & Biotech (4)
- Zool 3300 Genetics (4)

and consider the following

- Botany 3504 Mycology (4)
- Botany 3514 Algology (4)
- Botany 3523 Marine Biology (3)
- Chem 3050 Instrumental Analysis (3)

#### Public Health

Students emphasizing Public Health should include the following

- Micro LS1153 Elementary Public Health (3)
- Micro 3305 Medical Microbiology (5)
- Micro 3502 Environmental Health (2)
- Micro 3853 Food Microbiology (3)
- Micro 4354 Industrial Microbiology & Biotech (4)
- Micro 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
- Engl 1010/2010 College Writing (6)
- Engl 2100 Technical Writing (3)
- or Engl 2250 Fiction Writing (3)
- or Engl 3210 Advanced College Writing (3)
- or Comm HU1020 Principles of Public Speaking (3)
**MICROBIOLOGY COURSES - MICRO**

**Micro**

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

**Micro 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 General Education majors.

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

**Micro 2600. Laboratory Safety (1)** F

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.

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

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

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

**Micro 3053. Microbiological Procedures (3)** F

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. Prerequisite: Micro LS/SI2054 and Math QL1050.

**Micro 3154. Microbial Ecology (4)** F

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: Micro LS/SI2054.

**Micro 3254. Immunology (4)** F

The study of the immune response in mammals. Three lectures and one 3-hour lab per week. Prerequisite: Micro LS/SI2054 or consent of instructor.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro 3305.</td>
<td>Medical Microbiology (5) S</td>
</tr>
<tr>
<td>Micro 3340.</td>
<td>Information Resources in the Life Sciences (2) S</td>
</tr>
<tr>
<td>Micro 3484.</td>
<td>Environmental Microbiology (4) S</td>
</tr>
<tr>
<td>Micro 3502.</td>
<td>Environmental Health (2) F</td>
</tr>
<tr>
<td>Micro 3603.</td>
<td>Advanced Microbiology for the Health Professions (3) Su. F. S</td>
</tr>
<tr>
<td>Micro 3853.</td>
<td>Food Microbiology (3) F</td>
</tr>
<tr>
<td>Micro 4054.</td>
<td>Microbial Physiology (4) F</td>
</tr>
<tr>
<td>Micro 4154.</td>
<td>Microbial Genetics (4) S</td>
</tr>
<tr>
<td>Micro 4252.</td>
<td>Cell Culture (2) F</td>
</tr>
<tr>
<td>Micro 4354.</td>
<td>Industrial Microbiology and Biotechnology (4) S</td>
</tr>
<tr>
<td>Micro 4354.</td>
<td>Virology (4) S</td>
</tr>
<tr>
<td>Micro 4800.</td>
<td>Directed Research (1-2) F. S</td>
</tr>
<tr>
<td>Micro 4830.</td>
<td>Directed Readings (1-2) Su. F. S</td>
</tr>
<tr>
<td>Micro 4890.</td>
<td>Cooperative Work Experience (1-5) Su. F. S</td>
</tr>
<tr>
<td>Micro 4920.</td>
<td>Short Courses, Workshops, Institutes and Special Programs (1-3)</td>
</tr>
<tr>
<td>Micro 4991.</td>
<td>Microbiology Seminar (1) F. S</td>
</tr>
<tr>
<td>Micro 5034.</td>
<td>Microbiology for Teachers (4)</td>
</tr>
</tbody>
</table>

**DEPARTMENT OF PHYSICS**

**Chair:** Dr. Dale Ostlie  
**Location:** Science Lab, Room 202  
**Telephone Contact:** Kathy Stewart 801-626-6163  
**E-mail:** kstewart1@weber.edu  
**WWW:** http://physics.weber.edu  
**Professors:** Farhang Amiri, Bradley W. Carroll, Dale A. Ostlie, Daniel V. Schroeder, John E. Sohl, Walther N. Spjeldvik;  
**Associate Professor:** Jay W. Phippen;  
**Assistant Professors:** Michelle Lynn Arnold, Colin Inglefield, Adam Johnston, 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, chaotic dynamics of fluids, and the evolution of stars and galaxies, among many other applications.

Our courses in physics introduce all of the most important fundamental laws and many of their applications. Equally valuable, however, are the skills that students develop in these courses, from analytical thinking and problem solving to experimental design and interpretation. Majoring in physics can thus prepare a student for a variety of careers in research, education, business, industry, and government.
The Department offers three major programs, Physics, Applied Physics, and Physics Teaching. The Physics major places emphasis on understanding nature at the deepest possible level. It also provides a strong foundation for graduate work in pure physics. The Applied Physics major places more emphasis on physical phenomena and hands-on experience. Thus, it is more suitable for those planning to go either directly into industrial employment or into graduate programs in certain applied fields. Since the course requirements for these two majors overlap considerably, students can easily switch from one major to the other any time before their senior year. The Physics Teaching major is designed specifically for those planning to teach physics at the secondary school level.

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

### PHYSICS MAJOR

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

- **Program Prerequisite:** Not required for Physics or Applied Physics. Physics Teaching majors must meet the Teacher Education admission and certification requirements (see Teacher Education Department).
- **Minor:** No minor is required; however a math minor may be satisfied with one additional upper division math course beyond the minimum required for the Physics major.
- **Grade Requirements:** An overall GPA of 2.00 is required for Physics and Applied Physics majors. Physics Teaching majors must achieve an overall GPA of 3.00 for admission to the Teacher Education program. Also refer to the general grade requirements for graduation on page 36.
- **Credit Hour Requirements:** A total of 120 semester credit hours is required for graduation – 75 of these are required within the Physics major, 72 within the Applied Physics Major, and 32 hours are required within the Physics Teaching major, plus the credits required by the Teacher Education department. Forty upper division credit hours are required (courses numbered 3000 and above) – 31 of these are required within the Physics major, 26 to 31 within the Applied Physics major, and 12 upper division physics hours within the Physics Teaching major.

**Advisement**

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

**Admissions Requirements**

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

**General Education**

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

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

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

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phxs PS/SI2210/SI2220</td>
<td>Physics for Scientists &amp; Engineers (10)</td>
</tr>
<tr>
<td>Phxs 2300</td>
<td>Scientific Computing with C++ and Fortran (3)</td>
</tr>
<tr>
<td>Phxs 2740</td>
<td>Introductory Modern Physics (3)</td>
</tr>
<tr>
<td>Phxs 3180</td>
<td>Thermal Physics (3)</td>
</tr>
<tr>
<td>Phxs 3410</td>
<td>Electronics I (4)</td>
</tr>
<tr>
<td>Phxs 3500</td>
<td>Analytical Mechanics (3)</td>
</tr>
<tr>
<td>Phxs 3510</td>
<td>Electromagnetic Theory (3)</td>
</tr>
<tr>
<td>Phxs 3540</td>
<td>Mech. &amp; Electromagnetic Waves (3)</td>
</tr>
<tr>
<td>Phxs 3640</td>
<td>Advanced Physics Lab (2)</td>
</tr>
<tr>
<td>Phxs 4610</td>
<td>Quantum Mechanics (3)</td>
</tr>
<tr>
<td>Phxs 4620</td>
<td>Atomic, Nuclear, &amp; Particle Physics (3)</td>
</tr>
<tr>
<td>Phxs 4970</td>
<td>Seminar in Physics (1)</td>
</tr>
</tbody>
</table>

**Physics Electives (3 credit hours)**

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

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phxs 3160</td>
<td>Astrophysics (3)</td>
</tr>
<tr>
<td>Phxs 3190</td>
<td>Applied Optics (3)</td>
</tr>
<tr>
<td>Phxs 3200</td>
<td>Solid State Physics (3)</td>
</tr>
<tr>
<td>Phxs 3300</td>
<td>Computational Physics (3)</td>
</tr>
<tr>
<td>Phxs 3420</td>
<td>Electronics II (3)</td>
</tr>
<tr>
<td>Phxs 4800</td>
<td>Individual Research Problems (1-3)</td>
</tr>
<tr>
<td>Phxs 4830*</td>
<td>as approved by instructor</td>
</tr>
<tr>
<td>Phxs 4970</td>
<td>Senior Thesis (2)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chem PS/SI2210/SI2220</td>
<td>Principles of Chemistry (10)</td>
</tr>
<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>
<tr>
<td>Math 3710</td>
<td>Boundary Value Problems (3)</td>
</tr>
</tbody>
</table>

### Course Requirements for B.S. or B.A. Degree Applied Physics Major

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

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phxs PS/SI2210/SI2220</td>
<td>Physics for Scientists &amp; Engineers (10)</td>
</tr>
<tr>
<td>Phxs 2300</td>
<td>Scientific Computing with C++ and Fortran (3)</td>
</tr>
<tr>
<td>Phxs 2740</td>
<td>Introductory Modern Physics (3)</td>
</tr>
<tr>
<td>Phxs 3190</td>
<td>Applied Optics (3)</td>
</tr>
<tr>
<td>Phxs 3410</td>
<td>Electronics I (4)</td>
</tr>
<tr>
<td>Phxs 3500</td>
<td>Analytical Mechanics (3)</td>
</tr>
<tr>
<td>Phxs 3510</td>
<td>Electromagnetic Theory (3)</td>
</tr>
<tr>
<td>Phxs 3540</td>
<td>Mech. &amp; Electromagnetic Waves (3)</td>
</tr>
<tr>
<td>Phxs 3640</td>
<td>Advanced Physics Lab (2)</td>
</tr>
<tr>
<td>Phxs 4800</td>
<td>Individual Research Problems (1-3)</td>
</tr>
<tr>
<td>Phxs 4990</td>
<td>Seminar in Physics (1)</td>
</tr>
</tbody>
</table>

**Physics Electives (9 credit hours)**

Select a minimum of nine credit hours with departmental approval from the following courses.

<table>
<thead>
<tr>
<th>Course ID</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phxs 2600</td>
<td>Laboratory Safety (1)</td>
</tr>
<tr>
<td>Phxs 3160</td>
<td>Astrophysics (3)</td>
</tr>
<tr>
<td>Phxs 3180</td>
<td>Thermal Physics (3)</td>
</tr>
<tr>
<td>Phxs 3200</td>
<td>Solid State Physics (3)</td>
</tr>
<tr>
<td>Phxs 3300</td>
<td>Computational Physics (3)</td>
</tr>
<tr>
<td>Phxs 3420</td>
<td>Electronics II (3)</td>
</tr>
<tr>
<td>Phxs 4610</td>
<td>Quantum Mechanics (3)</td>
</tr>
<tr>
<td>Phxs 4620</td>
<td>Atomic, Nuclear, &amp; Particle Physics (3)</td>
</tr>
<tr>
<td>Phxs 4830*</td>
<td>as approved by instructor</td>
</tr>
<tr>
<td>Phxs 4970</td>
<td>Senior Thesis (2)</td>
</tr>
</tbody>
</table>
Course Requirements for B.S. or B.A. Degree

Physics Teaching Major

**Physics Courses Required (23 credit hours)**
- Phsx PS/SI1010 Intro to Physics (3)
- Phsx PS/SI1030 Intro to Astronomy (3)
- Phsx PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
- Phsx 2600 Laboratory Safety (1)
- Phsx 2740 Introductory Modern Physics (3)
- Phsx 4570 Secondary School Science Teaching Methods (3)

**Support Courses Required (11 credit hours)**
- Comm HU1020 Principles of Public Speaking (3)
- Math SI1210/SI1220 Calculus I, II (8)

**Elective Courses (9 credit hours)**
Select nine credit hours in approved Physics classes (courses numbered 3000 and above).

**Physics Electives (9 credit hours)**
- Select nine credit hours in approved Physics classes (courses numbered 3000 and above).

**Physics Electives (9 credit hours)**
- Select nine credit hours in approved Physics classes (courses numbered 3000 and above).

**Support Courses Required (25 credit hours)**
- Chem PS/SI1210/SI1220 Principles of Chemistry (10)
- Math SI1210 Calculus I (4)
- Math SI1220 Calculus II (4)
- Math 2210 Calculus III (4)
- Math 2280 Ordinary Differential Equations (3)

**Recommended elective courses:**
- Chemistry
  - Chem 2310 Organic Chemistry I (5)
  - Chem 2320 Organic Chemistry II (5)
  - Chem 3050 Instrumental Analysis (3)
  - Chem 3070 Biochemistry I (4)
- Geosciences
  - Geosci PS1540 Environmental Geosciences (3)
  - Geosci 3150 Geomorphology (4)
  - Geosci 3180 Paleontology (4)
  - Geosci 3250 Geology of Utah (3)
  - Geosci 3400 Remote Sensing (4)
  - Geosci 3550 Sedimentology & Stratigraphy (4)

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

---

**Physical Science Composite Teaching Major**

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

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

**Minor:** Not required.

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

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

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

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

**General Education**
Refer to pages 36-41 for specific requirements. Psych SS1010 is recommended in the Social Science area. The following courses required for this major will also satisfy general education requirements: Chem PS/SI1210, Geosci PS/SI1110 and Phsx PS/SI2210.

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

**Required Courses (minimum of 49 credit hours)**
- Chemistry (14 credit hours required)
  - Chem PS/SI1210-1220 Principles of Chemistry (10)
  - Chem 3030 Quantitative Analysis (4)
- Geosciences (16 credit hours required)
  - Geosci PS/SI1110 Dynamic Earth/Physical Geology (3)
  - Geosci SI1120 Physical Geology Laboratory - Surficial Processes (1)
  - Geosci 1220 Historical Geology (4)
  - Geosci 2050 Earth Materials (4)
- Physics (13 credit hours required)
  - Phsx PS/SI2210/SI2220 Physics for Scientists & Engineers (10)
  - Elective Courses (3 credit hours)
    - Phsx 2740 Introductory Modern Physics (3)
    - Phsx 3160 Astrophysics (3)
    - Phsx 3180 Thermal Physics (3)
    - Phsx 3190 Applied Optics (3)
    - Phsx 3200 Solid State Physics (3)
    - Phsx 3300 Computational Physics (3)
    - Phsx 3500 Analytical Mechanics (3)
    - Phsx 3510 Electromagnetic Theory (3)
    - Phsx 3540 Mechanical & Electromagnetic Waves (3)
    - Phsx 3640 Advanced Physics Lab (2)
    - Phsx 4610 Quantum Mechanics (3)
    - Phsx 4620 Atomic, Nuclear, & Particle Physics (3)

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

**Recommended elective courses:**
- Chemistry
  - Chem 2310 Organic Chemistry I (5)
  - Chem 2320 Organic Chemistry II (5)
  - Chem 3050 Instrumental Analysis (3)
  - Chem 3070 Biochemistry I (4)
- Geosciences
  - Geosci PS1540 Environmental Geosciences (3)
  - Geosci 3150 Geomorphology (4)
  - Geosci 3180 Paleontology (4)
  - Geosci 3250 Geology of Utah (3)
  - Geosci 3400 Remote Sensing (4)
  - Geosci 3550 Sedimentology & Stratigraphy (4)
**PHYSICS COURSES - PHSX**

**DEPARTMENTAL HONORS**

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

- **Credit Hour Requirements**: Maintain an overall GPA of 3.5.

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

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

**PHYSICS MINOR**

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

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

**Course Requirements for Minor**

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phsx PS/SI2210/92220</td>
<td>2</td>
</tr>
<tr>
<td>Physics for Scientists &amp; Engineers (10)</td>
<td></td>
</tr>
</tbody>
</table>

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

Select at least three Physics courses from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phsx 2740</td>
<td>3</td>
</tr>
<tr>
<td>Phsx 3160</td>
<td>3</td>
</tr>
<tr>
<td>Phsx 3180</td>
<td>3</td>
</tr>
<tr>
<td>Phsx 3190</td>
<td>3</td>
</tr>
<tr>
<td>Phsx 3200</td>
<td>3</td>
</tr>
<tr>
<td>Phsx 3300</td>
<td>3</td>
</tr>
<tr>
<td>Phsx 3410</td>
<td>4</td>
</tr>
<tr>
<td>Phsx 3420</td>
<td>3</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 91210-91220</td>
<td>2</td>
</tr>
<tr>
<td>Calculus I &amp; II (8)</td>
<td></td>
</tr>
<tr>
<td>Phsx 2600</td>
<td>3</td>
</tr>
<tr>
<td>or Chem 2600</td>
<td>3</td>
</tr>
<tr>
<td>or Geosci 2600</td>
<td>3</td>
</tr>
<tr>
<td>Hist 3350</td>
<td>3</td>
</tr>
<tr>
<td>History &amp; Philosophy of Science (3)</td>
<td></td>
</tr>
<tr>
<td>or Zool 2800</td>
<td>3</td>
</tr>
<tr>
<td>History of Life Science (3)</td>
<td></td>
</tr>
<tr>
<td>Comm HU1020</td>
<td>3</td>
</tr>
<tr>
<td>Public Speaking (3)</td>
<td></td>
</tr>
<tr>
<td>Chem 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
<tr>
<td>or Geosci 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
<tr>
<td>or Phsx 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 91210-91220</td>
<td>2</td>
</tr>
<tr>
<td>Calculus I &amp; II (8)</td>
<td></td>
</tr>
<tr>
<td>Phsx 2600</td>
<td>3</td>
</tr>
<tr>
<td>or Chem 2600</td>
<td>3</td>
</tr>
<tr>
<td>or Geosci 2600</td>
<td>3</td>
</tr>
<tr>
<td>Hist 3350</td>
<td>3</td>
</tr>
<tr>
<td>History &amp; Philosophy of Science (3)</td>
<td></td>
</tr>
<tr>
<td>or Zool 2800</td>
<td>3</td>
</tr>
<tr>
<td>History of Life Science (3)</td>
<td></td>
</tr>
<tr>
<td>Comm HU1020</td>
<td>3</td>
</tr>
<tr>
<td>Public Speaking (3)</td>
<td></td>
</tr>
<tr>
<td>Chem 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
<tr>
<td>or Geosci 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
<tr>
<td>or Phsx 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
</tbody>
</table>

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

**PHYSICS COURSES - PHSX**

**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 25 credit hours in Physics and support courses. Prior department approval is required.

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

**Course Requirements for Minor**

**Physics Courses Required (11 credit hours)**

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phsx PS/SI2210/92220</td>
<td>2</td>
</tr>
<tr>
<td>Physics for Scientists &amp; Engineers (10)</td>
<td></td>
</tr>
<tr>
<td>Phsx 2600</td>
<td>3</td>
</tr>
<tr>
<td>Laboratory Safety (1)</td>
<td></td>
</tr>
</tbody>
</table>
| *Elective Physics Courses (6 credit hours)*

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

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

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math 91210-91220</td>
<td>2</td>
</tr>
<tr>
<td>Calculus I &amp; II (8)</td>
<td></td>
</tr>
<tr>
<td>Phsx 2600</td>
<td>3</td>
</tr>
<tr>
<td>or Chem 2600</td>
<td>3</td>
</tr>
<tr>
<td>or Geosci 2600</td>
<td>3</td>
</tr>
<tr>
<td>Hist 3350</td>
<td>3</td>
</tr>
<tr>
<td>History &amp; Philosophy of Science (3)</td>
<td></td>
</tr>
<tr>
<td>or Zool 2800</td>
<td>3</td>
</tr>
<tr>
<td>History of Life Science (3)</td>
<td></td>
</tr>
<tr>
<td>Comm HU1020</td>
<td>3</td>
</tr>
<tr>
<td>Public Speaking (3)</td>
<td></td>
</tr>
<tr>
<td>Chem 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
<tr>
<td>or Geosci 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
<tr>
<td>or Phsx 4570</td>
<td>3</td>
</tr>
<tr>
<td>Science Teaching Methods (3)</td>
<td></td>
</tr>
</tbody>
</table>

**Physics Courses - PHSX**

**Phsx PS/SI1100. Introduction to Physics (3) Su. F. S**

A brief survey of physics at the introductory level. Topics covered include laws of motion, gravity, electricity, magnetism, atomic and nuclear physics, radioactivity, and relativity. Three hours of lecture per week.

**Phsx PS/SI1030. Introduction to 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.

**Phsx PS/SI1360. Principles of Physical Science (3) F**

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

**Phsx PS/SI2010. General Physics I (5) Su. F. S**

First semester of a two-semester sequence in general physics, primarily for students in pre-medication, 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.
Second semester of a two-semester sequence in general physics. This semester covers topics in electricity and magnetism, electromagnetic waves, light and optics, relativity, atomic, and nuclear physics. Prerequisite: Phsx PS/SI2010. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week.

Phsx 2920. Cooperative Work Experience (1-6)
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.

Phsx 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.

Phsx 2890. 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.

Phsx 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 S1120. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week.

Phsx 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, quantum, atomic, and nuclear physics. Prerequisite: Phsx PS/SI2210. Co-requisite: Math S1120. Class meets five hours per week in lecture/discussion format. One 3-hour lab per week.

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

Phsx 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.

Phsx 2740. 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: Phsx SI2220, Math SI1220.

Phsx 2800. Introductory Individual Research Problems (1-3)
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.

Phsx 2830. Introductory Readings in Physics (1-3)
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.

Phsx 2890. Cooperative Work Experience (1-6)
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.

Phsx 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.

Phsx 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: Phsx SI2220.

Phsx 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: Phsx SI2220 and Math S1120.

Phsx 3190. Applied Optics (3) F
Geometrical and physical optics, lasers, lenses, optical instruments, interference, thin films, interferometry, holography, diffraction, gratings, crystal diffraction, polarization. Prerequisites: Phsx SI2220, Math S1120. Two lectures and one 3-hour lab a week.

Phsx 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: Phsx 2740.

Phsx 3300. Computational Physics (3) S (alternate years - odd)
Computational techniques are discussed in the context of addressing important physical problems. Topics may include root-finding algorithms, curve fitting, interpolation methods, linear systems, numerical integrations, differential equations, boundary value problems, finite difference methods, eigenvalue problems, Fourier analysis, and Monte Carlo methods. Prerequisites: Phsx SI2220, Phsx 2300.

Phsx 3410. Electronics I (4) F
An introductory course in electronics for students in physics and other sciences. The course includes a brief review of a.c. circuit analysis using complex impedances and covers basic principles of semiconductor operation, transistor switching, analog and digital integrated circuits, analog-digital conversion techniques used in computer interfacing, and noise. Prerequisite: Phsx SI2220.

Phsx 3420. Electronics II (3) S (alternate years - odd)
Intermediate-level course in electronics for students in physics and other sciences. Topics may include: power supplies and voltage regulation, analog transistor operation, silicon-controlled rectifiers, phototransistors, LEDs, uni-junction transistors, active filters, oscillators, phase-locked loops, computer modeling of circuit operation, etc. Prerequisite: Phsx 3410.
Phsx 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: Phsx S2220 and Math 2280.

Phsx 3510. Electromagnetic Theory (3) F
Vector analysis; electrodynamics; 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: Phsx S2220, Math 2210 and Math 2280.

Phsx 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: Phsx 3500, 3510.

Phsx 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: Phsx S2220 and Phsx 3410.

Phsx 4570. Secondary School Science Teaching Methods (3) F
Acquaintance with the various methods and curriculum of secondary school science. Two lectures and one 3-hour lab a week. It is recommended that this course be completed before student teaching. Prerequisites: Phsx 3500 or approval of instructor, and admission to the Teacher Education Program.

Phsx 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: Phsx 2740, Math 2270. Co-requisites: Phsx 3500; Math 3710.

Phsx 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: Phsx 4610.

Phsx 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.

Phsx 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.

Phsx 4890. Cooperative Work Experience (1-6) Su, F S
A continuation of Phsx 2890. Open to all students.

Phsx 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.

Phsx 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 (Phsx 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.

Phsx 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.

Phsx 5030. Physics for Teachers (2-3)
Science content course for teachers in the M.Ed. Science Emphasis Program. To register, select another departmental course and develop a contract detailing additional work required for graduate credit. Course may be repeated. Contract must be approved by instructor, department chair, and Director of the Master of Education Program.

DEPARTMENT

ZOOLOGY

Chair: Dr. Samuel I. Ziveloff
Location: Science Lab, Room 402
Telephone Contact: Julie Baker 801-626-6165


Zooiology 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 common to many groups. Zoologists have made many important contributions to our understanding of the natural world. Furthermore, they benefit humankind through their work in areas such as medicine and environmental conservation.

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

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

DNA Laboratory

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

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

- **Program Prerequisites:** Not required.
- **Minor:** Required.
- **Grade Requirements:** Zoology majors must have an average GPA of 2.0 or higher. Students are required to earn a grade of "C-" in each prerequisite course before taking the next course.
- **Credit Hour Requirements:** A total of 120 credit hours is required for graduation. 41 of these are required within Zoology. A total of 40 upper division hours is required (courses numbered 3000 and above) – 32 of these are required within the major.

**Advisement**

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

**Admissions Requirements**

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

**General Education**

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

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

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zool 3110</td>
<td>Principles of Zoology I</td>
<td>4</td>
</tr>
<tr>
<td>Zool 3120</td>
<td>Principles of Zoology II</td>
<td>4</td>
</tr>
<tr>
<td>Zool 3210</td>
<td>Zoology Orientation</td>
<td>1</td>
</tr>
<tr>
<td>Zool 3220</td>
<td>Cell Biology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 3300</td>
<td>Genetics</td>
<td>4</td>
</tr>
<tr>
<td>Zool 3350</td>
<td>Ecology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 3720</td>
<td>Evolution</td>
<td>3</td>
</tr>
<tr>
<td>Zool 4060</td>
<td>Comparative Physiology</td>
<td>4</td>
</tr>
<tr>
<td>or Zool 4210</td>
<td>Advanced Human Physiology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4990</td>
<td>Seminar</td>
<td>1</td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zool 3340</td>
<td>Information Resources in the Life Sciences</td>
<td>2</td>
</tr>
<tr>
<td>Zool 3470</td>
<td>Zoogeography</td>
<td>3</td>
</tr>
<tr>
<td>Zool 3500</td>
<td>Conservation Biology</td>
<td>3</td>
</tr>
<tr>
<td>Zool 3730</td>
<td>Population Biology</td>
<td>3</td>
</tr>
<tr>
<td>Zool 4050</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 4212</td>
<td>Histology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4060*</td>
<td>Comparative Physiology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4210*</td>
<td>Advanced Human Physiology</td>
<td>4</td>
</tr>
</tbody>
</table>

*If not taken as a required course

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zool 4220</td>
<td>Neuroendocrinology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4250</td>
<td>Radiation Biology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4300</td>
<td>Molecular Genetics</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4350</td>
<td>Animal Behavior</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4470</td>
<td>Wildlife Ecology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4480</td>
<td>Aquatic Ecology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4500</td>
<td>Parasitology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4600</td>
<td>Protozoology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4640</td>
<td>Entomology</td>
<td>4</td>
</tr>
<tr>
<td>Zool 4650</td>
<td>Ichthyology</td>
<td>4</td>
</tr>
</tbody>
</table>

**Support Courses Required**

- **Chem PS/SI1110** Elementary Chemistry (5)
- & Chem SI120 Elementary Organic/Biochemistry (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.

- Premedical 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). Premedical professional students are required to take one year of mathematics.
- **Phsx PS/SI1010** Intro to Physics (3)
- or **Phsx PS/SI2010/SI2020** General Physics (10)
- or **Phsx PS/SI2210/SI2220** Calculus Physics (10)

- Premedical professional students should take **Phsx PS/SI2010/SI2020** with labs.

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

- **Botany LS1203** Plant Biology (3)
- **Botany SI2104** Plant Form and Function (4)
- **Botany SI2114** Evolutionary Survey of Plants (4)
- **Botany DV2303** Ethnobotany (3)
- **Botany 3105** Anatomy & Morphology of Vascular Plants (5)
- **Botany 3204** Plant Physiology (4)
- **Botany 3214** Soils (4)
- **Botany 3454** Plant Ecology (4)
- **Botany 3504** Mycology (4)
- **Botany 3514** Algology (4)
- **Zool 4660** Herpetology (4)
- **Zool 4670** Ornithology (4)
- **Zool 4680** Mammalogy (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.

**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)

Weber State University
2003-2004 Catalog
Students desiring employment as a conservation officer should minor in Support Course Electives in Botany. 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 careers such 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 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**

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

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

**Biology Composite Teaching Major**

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

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

**Program Prerequisite:** Must meet the Teacher Education admission and certification requirements (see Teacher Education Department).

**Minor:** Not required.

**Grade Requirements:** A grade of "C" or better in courses required for this major (a grade of "C-" is not acceptable). An overall GPA of 3.00 is required for admission to the Teacher Education Program.

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

**Advisement:**

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

**Admission Requirements:**

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

**General Education**

Refer to pages 36-41 or either Bachelor of Science or Bachelor of Arts requirements. The following courses required for the Biology Composite Teaching major also will satisfy general education requirements: Micro LS/SI1205, Geosci PS/SI1110, Chem PS/SI1110 or Chem PS/SI1210, Phsx PS/SI1010, Comm HU1020, and Math QL1050 (15 credit hours).

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

**Biological Science Courses Required (47 credit hours)**

- Botany S2104
- or Botany S2114
- Plant Form and Function (4)
- Evolutionary Survey of Plants (4)
- Botany 3624 Taxonomy of Vascular Plants (4)
- Micro LS/SI2054 Principles of Microbiology (4)
- Zool S1110/1120 Principles of Zoology I & II (8)
- Zool 2200 Human Physiology (4)
- Zool 3300 Genetics (4)
- Zool 3720 Evolution (3)
- Zool 4570 Science Teaching Methods (3)
- Botany 3454 Plant Ecology (4)
- or Zool 3450 Ecology (4)
- Botany 2600 Laboratory Safety (1)
- or Micro 2600 Laboratory Safety (1)

**Biology Electives (7 credit hours)**

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

**Support Courses Required (26-28 credit hours)**

- Chem PS/SI1120 & Chem PS/SI1220 Principles of Chemistry I & II (10)
- Geosci PS/SI1110 Dynamic Earth: Physical Geology (3)
- Phsx PS/SI1010 Intro to Physics (3)
- or Phsx PS/SI2010 General Physics I (5)
- Math QL1050 College Algebra (4)
- Hist 3350 History & Philosophy of Science (3)
- or Zool 2800 History of the Life Sciences (3)
- Comm HU1020 Public Speaking (3)

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

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

### Zoology

#### DEPARTMENTAL HONORS

- **Program Prerequisite:** Enroll in the General Honors Program and complete 26 hours of General Honors courses (see the Honors Program on page 43).
- **Grade Requirements:** Maintain an overall GPA of 3.5.
- **Credit Hour Requirements:** Fulfill the requirements for the Zoology major, of which at least 30 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 Zoology 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 43.)

#### Course Requirements for Minor

**Zoology Courses Required (19 Credit Hours)**

- Zool 1110 or SI1120
- Zool 11120
- Zool 3720

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

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

#### 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 1110: Principles of Zoology I (4)
- Zool 11120: 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.

#### Zoology

#### TEACHING MINOR

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

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

**Course Requirements for Teaching Minor**

**Zoology Courses Required (11 credit hours)**

- Zool 1110: Principles of Zoology I (4)
- Zool 11120: Principles of Zoology II (4)
- Zool 3720: Evolution (3)
  
  or Botany 4113: Plant Evolution (3)

**Elective Zoology Courses (minimum 8)**

Select at least 8 credit hours at the 2000 level or above.

**Required Support Courses (3 credit hours)**

- Hist 3350: History & Philosophy of Science (3)
  
  or Zool 2800: History of Life Sciences (3)

### Biotechnician Training Program

#### ASSOCIATE OF SCIENCE AND CERTIFICATE

The Department of Zoology participates with the Department 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 - Zoool

**Zool LS1010. Animal Biology (3)**

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

**Zool LS1020. Human Biology (3)**

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

**Zool SI1110. Principles of Zoology I (4)**

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

**Zool SI1120. Principles of Zoology II (4)**

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

**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 Zool1110 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 basic understanding of body functions is required. Three lecture hours and one 2-hour lab a week.

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

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

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

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

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

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

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

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

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

Zool 4050. Comparative Vertebrate Anatomy (4)
Dissection-based, in-depth comparative study of vertebrate functional anatomy. Two lecture hours and two 3-hour labs 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 4130. Advanced Human Physiology (4)
A study of vertebral physiological processes with human emphasis, focusing on cardiovascular, digestive, and neuromuscular systems. Three lecture hours and one 3-hour lab a week. Prerequisites: 1110 and SI1120, or approval of instructor. Organic Chemistry recommended.

Zool 4140. Neuroendocrinology (4)
The study of the function of neural and hormonal control in animals, with emphasis on humans. Three lecture hours and one 3-hour lab a week. Prerequisites: Zool SI1110, SI1120, either 4210 or 4210, 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 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 (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 4350, 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.

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.

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

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

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

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

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

Zool 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 Zool SI1120, or approval of instructor.

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

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