## Bachelor of Science in Earth Sciences - Quantitative Reasoning Category III/IV and Stretch English

120 Total Units Required  
Minimum Number of Units in the Major: 67

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Semester</strong></td>
<td></td>
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<tr>
<td>ENG 104</td>
<td>Writing the First Year: Finding Your Voice Stretch I</td>
<td>3</td>
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<tr>
<td>MATH 197</td>
<td>Prelude to Calculus I (Prerequisite for MATH 226)</td>
<td>3</td>
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<tr>
<td>GE Area A</td>
<td></td>
<td>3</td>
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<tr>
<td>GE Area B: Life Science (B2)</td>
<td></td>
<td>3</td>
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<tr>
<td>GE Area C</td>
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<td>3</td>
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<tr>
<td><strong>Second Semester</strong></td>
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<tr>
<td>CHEM 115</td>
<td>General Chemistry I: Essential Concepts of Chemistry (Major Science and Math Foundation)</td>
<td>5</td>
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<tr>
<td>ENG 105</td>
<td>Writing the First Year: Finding Your Voice Stretch II (A2)</td>
<td>3</td>
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<tr>
<td>MATH 198</td>
<td>Prelude to Calculus II (Prerequisite for MATH 226, B4)</td>
<td>3</td>
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<tr>
<td>GE Area A</td>
<td></td>
<td>3</td>
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<tr>
<td><strong>Third Semester</strong></td>
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<tr>
<td>MATH 226</td>
<td>Calculus I (Major Science and Math Foundation, B4)</td>
<td>4</td>
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<tr>
<td>GE Area C</td>
<td></td>
<td>3</td>
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<tr>
<td>GE Area D: Take Two</td>
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<td>6</td>
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<tr>
<td>GE Area E</td>
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<td>3</td>
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<tr>
<td><strong>Fourth Semester</strong></td>
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<tr>
<td>MATH 227</td>
<td>Calculus II (Hidden Prerequisite if Selecting PHYS 220/222)</td>
<td>4</td>
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Select One Set of Courses (Major Science and Math Foundation): 5

- PHYS 111 & PHYS 112: General Physics I and General Physics I Laboratory (B1, B3)
- PHYS 220 & PHYS 222: General Physics with Calculus I and General Physics with Calculus I Laboratory (B1, B3)

GE Area C | 3  
GE Area D | 3

**Fifth Semester**

- ERTH 400: Earth Systems I (Major Core) | 3
- Select One Set of Courses (Major Science and Math Foundation): | 4
  - PHYS 121 & PHYS 122: General Physics II and General Physics II Laboratory
  - PHYS 240 & PHYS 242: General Physics with Calculus III and General Physics with Calculus III Laboratory

Major Emphasis (34 units) - Take Two | 6
GE Area UD-B: Upper-Division Physical and/or Life Sciences (Consider SF State Studies Course) | 3

**Sixth Semester**

- ERTH 205: Techniques in Earth Sciences (Major Core) | 2
- ERTH 500: Earth Systems II (Major Core) | 3
- ERTH 505: Quantitative Methods in Earth Sciences (Major Core) | 3
- ERTH 600GW: Earth's Climate History - GWAR (Major Core) | 3

Major Emphasis (34 units) - Take Four | 6

**Seventh Semester**

- Major Emphasis (34 units) - Take Four | 6
- GE Area UD-D: Upper-Division Social Sciences (Consider SF State Studies Course) | 3

**Eighth Semester**

- ERTH 690: Earth Sciences Capstone Presentation (Major Culminating Experience) | 1

Culminating Experience - Select One | 3-4
Major Emphasis (34 units) - Take Three | 10
GE Area UD-C: Upper-Division Arts and/or Humanities (Consider SF State Studies Course)

<table>
<thead>
<tr>
<th>Units</th>
<th>Total Units</th>
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<tr>
<td>17-18</td>
<td>124-125</td>
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</table>

1. **ENG 114 can only be taken if you complete Directed Self-Placement (DSP) and select ENG 114; if you choose ENG 104/ENG 105 through DSP you will satisfy A2 upon successful completion of ENG 105 in the second semester; multilingual students may be advised into alternative English courses.**

2. **QR Category III students with a grade of B or higher in high school pre-calculus in the past year may be able to enroll in MATH 226. Please see a department advisor.**

3. **Depending on courses completed through Early Start, students in Pathway/Category III or IV may be required to enroll in a support course to complement their Quantitative Reasoning/B4 requirement. There are multiple course options for this pathway. Before enrolling in a B4 course, students should verify their MATH Pathway/Category in their Student Center. Information regarding the courses that correspond with your MATH Pathway/Category can be found on the Developmental Studies Office Website.**

4. **To avoid taking additional units, it is recommended that you meet SF State Studies requirements (AERM, GP, ES, SJ) within your GE or major.**

5. **PHYS 111/PHYS 112 are prerequisites for PHYS 121/PHYS 122. PHYS 220/PHYS 222 are prerequisites for PHYS 240/PHYS 242.**

6. **Culminating Experience (4-5 units)**
   - In addition to ERTH 690, students must select one of the following options:
     - **ERTH 695 Senior Project (1-3 units)**
     - **or**
     - An honors thesis consisting of:
       - **ERTH 697 Undergraduate Research (2 units)**
       - and
       - **ERTH 698 Senior Thesis (2 units)**
     - **or** (for Geology emphasis and Hydrology emphasis only):
       - Field Geology or equivalent (at another institution) for 4 units

   (When choosing electives, keep in mind that SF State requires all students to complete at least 40 units of upper-division coursework to graduate.)

**Hydrology Emphasis**

The Hydrology emphasis provides students with an in-depth understanding of the behavior of water on and beneath Earth's surface, how water shapes the solid earth, and environmental problems associated with water. Students who complete these emphasis requirements will be prepared for graduate school in hydrology or to enter the workforce directly as a professional hydrologist.

**Requirements (21–22 units)**

Select one of the following (3-4 units):
- **ERTH 210 Physical Geology (4 units) (B1, B3, ES)**
- **ERTH 230 Environmental Geology (3 units) (B1, B3, ES)**
- **ERTH 330 California Water (3 units) (UD-B, ES)**
- **ERTH 425 Geomorphology (4 units)**
- **ERTH 430 Fluid Dynamics in Earth Systems (3 units)**
- **ERTH 442/GEOG 342 Surface Water Hydrology (4 units)**
- **ERTH 444 Hydrogeology (4 units)**
- **ERTH 544 Groundwater Contamination (3 units)**

**Electives (12–13 units)**

**Major Emphasis (34 units)**

Students must select one of the following emphases:

**Geology Emphasis**

The Geology emphasis provides students with an in-depth understanding of the solid Earth, the processes that shape it, and the skills to conduct field investigations of geologic problems. Students who complete these emphasis requirements will be prepared for graduate school in geology or to enter the workforce directly as a professional geologist. The coursework prepares students to pass the Association of State Board Geology (ASBOG) exam to be a licensed professional geologist.

**Required Courses (22–23 units)**

- **ERTH 210 Physical Geology (4 units) (B1, B3, ES)**
- **ERTH 420 Mineralogy and Petrology I (4 units)**
- **ERTH 510 Structural Geology (4 units)**
- **ERTH 620 Field Methods in Geology (2 units)**
- **and either**
  - **ERTH 522 Geochemistry (4 units)**
  - **CHEM 215 General Chemistry II: Quantitative Applications of Chemistry Concepts (3 units)**
- **and CHEM 216 General Chemistry II Laboratory: Quantitative Applications of Chemistry Concepts (2 units)**

**Electives (11–12 units)**

Select additional Geology emphasis elective courses upon advisement, subject to the constraints listed below. Electives plus emphasis requirements must total at least 34 units.
- Electives may be selected from among the following options:
  - Any ERTH course numbered 400 or higher
  - Up to 3 units of any of the following courses:
    - An Historical Geology course (or equivalent) from a community college
    - Any 300-level ERTH course
    - GEOG 312, GEOG 313, GEOG 314, GEOG 316, GEOG 317, GEOG 500GW, GEOG 602, GEOG 603, GEOG 606, GEOG 610, GEOG 611, GEOG 620, GEOG 621, GEOG 625, GEOG 629, or GEOG 642
    - Any BIOL, CHEM, CSC, ENGR, MATH, or PHYS course numbered 200 or higher; or ENGR 103
    - Any one, non-GE course not listed above, with the approval of a Department advisor