GEOPHYSICAL SCIENCES

Department Website: http://geosci.uchicago.edu

PROGRAM OF STUDY

The Department of the Geophysical Sciences (GEOS) offers unique programs of study in the earth, atmospheric, and planetary sciences. Topics include the physics, chemistry, and dynamics of the atmosphere, oceans, and ice sheets; past and present climate change; the origin and history of the Earth, moon, and meteorites; properties of the deep interior of the Earth and the dynamics of crustal movements; and the evolution and geography of life and the Earth’s surface environments through geologic time. These multidisciplinary topics require an integrated approach founded on mathematics, physics, chemistry, and biology.

Both the BA and BS programs prepare students for careers that draw upon the earth, atmospheric, and planetary sciences. However, the BS degree provides a more focused and intensive program of study for students who intend to pursue graduate work in these disciplines. The BA degree also offers thorough study in the geophysical sciences, but it provides a wide opportunity for elective freedom to pursue interdisciplinary interests, such as environmental policy, law, medicine, business, and precollege education.

PROGRAM REQUIREMENTS FOR THE BA IN GEOPHYSICAL SCIENCES

The requirements for the BA degree in Geophysical Sciences involve completion of:

- six required courses that fulfill general education requirements for the physical sciences, biological sciences, and mathematics
- eight required science or mathematics courses
- seven elective courses pertinent to the major from the electives lists below, which must include:
  - one course in Computational Sciences (List 2)
  - four 20000-level courses designated GEOS in List 1
  - two more 20000-level science courses from any of Lists 1–2

Candidates for the BA in Geophysical Sciences complete a year of chemistry, a year of physics, a year of mathematics (including Calculus I-II), and a year of biology (GEOS 27300 Biological Evolution and BIOS 20198 Biodiversity).

The requirement for the third quarter of mathematics may be satisfied by either completing the calculus sequence (recommended for students taking the more introductory MATH 13000s sequence but not specifically required or recommended for the higher tracks such as MATH 15000s, as the first two quarters offer a sufficiently comprehensive calculus training for students to move on to other courses) or taking one of the designated mathematical methods courses instead. In
addition, students must complete one elective course from Computational Sciences (List 2).

Students are encouraged to begin discipline-specific courses as early as possible. Required disciplinary courses include GEOS 13100 Physical Geology, GEOS 13200 Earth History, and GEOS 13300 The Atmosphere. With prior consent of the departmental counselor, students with the appropriate background may substitute a 20000-level course, which may be taken during or after the third year.

A minimum of six additional 20000-level science courses are required. At least four must be GEOS courses from List 1. Up to two may be chosen from other science courses in List 1. Up to two may be chosen from Computational Sciences (List 2). One may be a field course.

Summary of Requirements for the BA in Geophysical Sciences

GENERAL EDUCATION

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>200</td>
<td>CHEM 10100 &amp; CHEM 10200</td>
<td>Introductory General Chemistry I and Introductory General Chemistry II</td>
</tr>
<tr>
<td></td>
<td>CHEM 11100-11200</td>
<td>Comprehensive General Chemistry I-II *</td>
</tr>
<tr>
<td></td>
<td>CHEM 12100-12200</td>
<td>Honors General Chemistry I-II</td>
</tr>
<tr>
<td>200</td>
<td>MATH 13100-13200</td>
<td>Elementary Functions and Calculus I-II *</td>
</tr>
<tr>
<td></td>
<td>MATH 15100-15200</td>
<td>Calculus I-II</td>
</tr>
<tr>
<td></td>
<td>MATH 16100-16200</td>
<td>Honors Calculus I-II</td>
</tr>
<tr>
<td>200</td>
<td>BIOS 20198</td>
<td>Biodiversity</td>
</tr>
<tr>
<td></td>
<td>GEOS 27300</td>
<td>Biological Evolution %</td>
</tr>
</tbody>
</table>

Total Units: 600

MAJOR

<table>
<thead>
<tr>
<th>Course</th>
<th>Course Name</th>
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<tbody>
<tr>
<td>GEOS 13100 &amp; GEOS 13200 &amp; GEOS 13300</td>
<td>Physical Geology and Earth History and The Atmosphere</td>
<td>300</td>
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<tr>
<td>CHEM 11300 or CHEM 12300</td>
<td>Comprehensive General Chemistry III *</td>
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<td>Honors General Chemistry III</td>
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<td>PHYS 12100-12200-12300</td>
<td>General Physics I-II-III *§</td>
<td></td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>PHYS 13100-13200-13300</td>
<td>Mechanics; Electricity and Magnetism; Waves, Optics, and Heat</td>
<td></td>
</tr>
<tr>
<td>PHYS 14100-14200-14300</td>
<td>Honors Mechanics; Honors Electricity and Magnetism; Honors Waves, Optics, and Heat</td>
<td></td>
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</tbody>
</table>

One of the following: 100

<table>
<thead>
<tr>
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<th>Course Title</th>
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<tbody>
<tr>
<td>MATH 20000</td>
<td>Mathematical Methods for Physical Sciences I</td>
</tr>
<tr>
<td>MATH 20250</td>
<td>Abstract Linear Algebra</td>
</tr>
<tr>
<td>PHYS 22000</td>
<td>Introduction to Mathematical Methods in Physics</td>
</tr>
<tr>
<td>MATH 13300</td>
<td>Elementary Functions and Calculus III *</td>
</tr>
<tr>
<td>MATH 15300</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MATH 16300</td>
<td>Honors Calculus III</td>
</tr>
</tbody>
</table>

One Computational Sciences course (List 2) 100

Six electives as follows: 600

- Four courses designated GEOS from List 1: Physical and Biological Sciences
- Two additional courses from List 1: Physical and Biological Sciences and/or from List 2: Computational Sciences

**Total Units** 1500

* Credit may be granted by examination.

** Only Environmental Science and Geophysical Sciences majors may use this pairing to satisfy the general education requirement in the biological sciences. Geophysical Sciences majors can take these courses without the Biological Sciences prerequisites (BIOS 20150-20151) unless they pursue a double major in Biological Sciences. They are expected to show competency in mathematical modeling of biological phenomena covered in BIOS 20151.

† Only one of these electives may be a field course (GEOS 29001, GEOS 29002, GEOS 29005) and only one of these electives may be GEOS 29700 Reading and Research in the Geophysical Sciences.

§ PHYS 13100-13200-13300 or PHYS 14100-14200-14300 are the preferred courses. PHYS 12100-12200-12300 is allowable on a case-by-case basis but may not provide adequate preparation to allow for enrollment in higher level PHYS courses. Additionally, PHYS 12100 has a prerequisite of a year of chemistry. Special petition to the department counselor is required for PHYS 12100-12200-12300 approval.

% Biological Evolution has several cross-listings. Geophysical Sciences majors must register for it under the GEOS 27300 listing.

**Program Requirements for the BS in Geophysical Sciences**

The requirements for the BS degree in Geophysical Sciences involve completion of:

- six required courses that fulfill general education requirements for the physical sciences, biological sciences, and mathematics
- eight required science or mathematics courses
• ten elective courses pertinent to the major from the electives lists below, which must include:
  —two courses in Computational Sciences (List 2)
  —four 20000-level courses designated GEOS in List 1
  —four more 20000-level science courses from any of Lists 1–2: up to three non-GEOS courses from List 1, up to two from List 2

Candidates for the BS in Geophysical Sciences complete a year of chemistry, a year of physics, a year of mathematics (including Calculus I-II), and a year of biology (BIOS 20197 Evolution and Ecology, and BIOS 20198 Biodiversity).

The requirement for the third quarter of mathematics may be satisfied by either completing the calculus sequence (recommended for students taking the more introductory MATH 13000s sequence but not specifically required or recommended for the higher tracks such as MATH 15000s, as the first two quarters offer a sufficiently comprehensive calculus training for students to move on to other courses) or taking one of the designated mathematical methods courses instead. In addition, students must complete two elective courses from Computational Sciences (List 2). The requirements are structured to allow and encourage students to complete sequences that extend through the study of differential equations.

Students are encouraged to begin discipline-specific courses as early as possible. Required disciplinary courses include GEOS 13100 Physical Geology, GEOS 13200 Earth History, and GEOS 13300 The Atmosphere, which is the introductory sequence. With prior consent of the departmental counselor, students with the appropriate background may substitute a 20000-level course, which may be taken during or after the third year.

A minimum of eight additional 20000-level science courses are required. At least four must be GEOS courses from List 1. Up to three may be chosen from other science courses in List 1. Up to two may be chosen from Computational Sciences (List 2). One may be a field course. One may be GEOS 29700 Reading and Research in the Geophysical Sciences.

Summary of Requirements for the BS in Geophysical Sciences

GENERAL EDUCATION

<table>
<thead>
<tr>
<th>One of the following sequences:</th>
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<tbody>
<tr>
<td>CHEM 10100 &amp; CHEM 10200</td>
<td>Introductory General Chemistry I and Introductory General Chemistry II</td>
</tr>
<tr>
<td>CHEM 11100-11200</td>
<td>Comprehensive General Chemistry I-II *</td>
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<tr>
<td>CHEM 12100-12200</td>
<td>Honors General Chemistry I-II</td>
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<table>
<thead>
<tr>
<th>One of the following sequences:</th>
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<tbody>
<tr>
<td>MATH 13100-13200</td>
<td>Elementary Functions and Calculus I-II *</td>
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</tbody>
</table>

*Note: MATH 13100-13200 is recommended for students taking the more introductory MATH 13000s sequence but not specifically required or recommended for the higher tracks such as MATH 15000s.
<table>
<thead>
<tr>
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<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>MATH 15100-15200</td>
<td>Calculus I-II</td>
</tr>
<tr>
<td>MATH 16100-16200</td>
<td>Honors Calculus I-II</td>
</tr>
<tr>
<td>BIOS 20198</td>
<td>Biodiversity</td>
</tr>
<tr>
<td>GEOS 27300</td>
<td>Biological Evolution</td>
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</table>

**Total Units**: 600

### Major

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
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<tbody>
<tr>
<td>GEOS 13100 &amp; GEOS 13200 &amp; GEOS 13300</td>
<td>Physical Geology and Earth History and The Atmosphere</td>
</tr>
<tr>
<td>CHEM 11300 or CHEM 12300</td>
<td>Comprehensive General Chemistry III *</td>
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</table>

One of the following sequences:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
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</thead>
<tbody>
<tr>
<td>PHYS 12100-12200-12300</td>
<td>General Physics I-II-III *§</td>
</tr>
<tr>
<td>PHYS 13100-13200-13300</td>
<td>Mechanics; Electricity and Magnetism; Waves, Optics, and Heat</td>
</tr>
<tr>
<td>PHYS 14100-14200-14300</td>
<td>Honors Mechanics; Honors Electricity and Magnetism; Honors Waves, Optics, and Heat</td>
</tr>
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</table>

One of the following:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
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<tbody>
<tr>
<td>MATH 20000</td>
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</tr>
<tr>
<td>MATH 20250</td>
<td>Abstract Linear Algebra</td>
</tr>
<tr>
<td>PHYS 22000</td>
<td>Introduction to Mathematical Methods in Physics</td>
</tr>
<tr>
<td>BIOS 20152</td>
<td>Introduction to Quantitative Modeling in Biology (Advanced)</td>
</tr>
<tr>
<td>MATH 13300</td>
<td>Elementary Functions and Calculus III *</td>
</tr>
<tr>
<td>MATH 15300</td>
<td>Calculus III</td>
</tr>
<tr>
<td>MATH 16300</td>
<td>Honors Calculus III</td>
</tr>
</tbody>
</table>

Two Computational Sciences courses from List 2:

* Four courses designated GEOS from List 1: Physical and Biological Sciences

* Four additional courses from List 1: Physical and Biological Sciences and/or List 2: Computational Sciences, but only up to three courses may be non-GEOS courses from List 1 and only up to two courses may be from List 2.

**Total Units**: 1800

* Credit may be granted by examination.
** Only Environmental Science and Geophysical Sciences majors may use this pairing to satisfy the general education requirement in the biological sciences. Geophysical Sciences majors can take these courses without the Biological Sciences prerequisites (BIOS 20150-20151) unless they pursue a double major in Biological Sciences. They are expected to show competency in mathematical modeling of biological phenomena covered in BIOS 20151.

¶ Only one of these electives may be a field course (GEOS 29001, GEOS 29002, GEOS 29005) and only one of these electives may be GEOS 29700 Reading and Research in the Geophysical Sciences.

§ PHYS 13100-13200-13300 or PHYS 14100-14200-14300 are the preferred courses. PHYS 12100-12200-12300 is allowable on a case-by-case basis but may not provide adequate preparation to allow for enrollment in higher level PHYS courses. Additionally, PHYS 12100 has a prerequisite of a year of chemistry. Special petition to the department counselor is required for PHYS 12100-12200-12300 approval.

% Biological Evolution has several cross-listings. Geophysical Science majors must register for it under the GEOS 27300 listing.

## Lists of Elective Courses 1–2

### List 1: Physical and Biological Sciences

#### Geophysical Sciences

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOS 20500</td>
<td>Topics in the Geophysical Sciences ***</td>
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</tr>
<tr>
<td>GEOS 21000</td>
<td>Introduction to Mineralogy</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 21005</td>
<td>Mineral Science</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 21100</td>
<td>Introduction to Petrology</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 21200</td>
<td>Physics of the Earth</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 21205</td>
<td>Introduction to Seismology, Earthquakes, and Near-</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Surface Earth Seismicity</td>
<td></td>
</tr>
<tr>
<td>GEOS 21400</td>
<td>Thermodynamics and Phase Change</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 22000</td>
<td>Origin and Evolution of the Solar System</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 22040</td>
<td>Formation of Planetary Systems in Our Galaxy: From</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Dust to Planetesimals</td>
<td></td>
</tr>
<tr>
<td>GEOS 22050</td>
<td>Formation of Planetary Systems in our Galaxy: From</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Planetesimals to Planets</td>
<td></td>
</tr>
<tr>
<td>GEOS 22060</td>
<td>What Makes a Planet Habitable?</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 22200</td>
<td>Geochronology</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 23205</td>
<td>Introductory Glaciology</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 23400</td>
<td>Global Warming: Understanding the Forecast</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 23800</td>
<td>Global Biogeochemical Cycles</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 23805</td>
<td>Stable Isotope Biogeochemistry</td>
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</tr>
<tr>
<td>GEOS 23900</td>
<td>Environmental Chemistry</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 24220</td>
<td>Climate Foundations</td>
<td>100</td>
</tr>
<tr>
<td>GEOS 24230</td>
<td>Geophysical Fluid Dynamics: Foundations</td>
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</tbody>
</table>
GEOS 24240  Geophysical Fluid Dynamics: Rotation and Stratification  100
GEOS 24250  Geophysical Fluid Dynamics: Understanding the Motions of the Atmosphere and Oceans  100
GEOS 24705  Energy: Science, Technology, and Human Usage  100
GEOS 25400  Introduction to Numerical Techniques for the Geophysical Sciences  100
GEOS 26100  Phylogenetics and the Fossil Record  100
GEOS 26300  Invertebrate Paleobiology and Evolution  100
GEOS 26600  Geobiology  100
GEOS 26650  Environmental Microbiology  100
GEOS 28000  Introduction to Structural Geology  100
GEOS 28100  Global Tectonics  100
GEOS 28300  Principles of Stratigraphy  100
GEOS 28600  Earth and Planetary Surface Processes  100
GEOS 29700  Reading and Research in the Geophysical Sciences  100

*** Petition to department counselor required to count GEOS 20500 toward degree requirements.

Field Courses in Geophysical Sciences
The department sponsors field trips that range in length from one day to several weeks. Shorter field trips typically form part of lecture-based courses and are offered each year. (The trips are open to all students and faculty if space permits.) Longer trips are designed as undergraduate field courses, and one such course may be used as an elective science course for the major. Destinations of field courses have recently included Baja California, Death Valley, Nevada, Salton Trough, Newfoundland, and the Bahamas.

GEOS 29001  Field Course in Geology  100
GEOS 29002  Field Course in Modern and Ancient Environments  100
GEOS 29005  Field Course in Environmental Science  100

Biological Sciences*
BIOS 20188  Fundamentals of Physiology  100
BIOS 20189  Fundamentals of Developmental Biology  100
BIOS 20196  Ecology and Conservation  100
BIOS 20200  Introduction to Biochemistry  100
BIOS 21208  Fundamentals of Molecular Biology  100
BIOS 22243  Biomechanics of Organisms  100
BIOS 22244  Introduction to Invertebrate Biology  100
BIOS 22250  Chordates: Evolution and Comparative Anatomy  100
BIOS 23262  Mammalian Evolutionary Biology  100
BIOS 23289  Marine Ecology  100
Semester in Environmental Science/MBL

The following courses are the College designations for the Semester in Environmental Science that is taught at the Marine Biological Laboratory (MBL) in Woods Hole, Massachusetts. Registration in BIOS 27710, BIOS 27711, and BIOS 27712, plus one of BIOS 27713, BIOS 27714, or BIOS 27715 is required. Admission to the Semester in Environmental Science program is by application, which must be received by the MBL generally in March of the year preceding the start of the semester. Admissions decisions will generally be sent in April. Note that these courses start at the beginning of September, typically four weeks prior to the start of the College’s Autumn Quarter, and are completed by the end of Autumn Quarter. More information on the course content, the application process, and deadlines can be found at college.uchicago.edu/academics/semester-environmental-science-ses. Students participating in the Semester in Environmental Science receive credit for four courses in environmental science, one of which can be used to substitute for BIOS 20196 Ecology and Conservation.

<table>
<thead>
<tr>
<th>BIOS 27710</th>
<th>Ecology – Marine Biological Laboratory</th>
<th>100</th>
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<tbody>
<tr>
<td>BIOS 27711</td>
<td>Biogeochemical Analysis in Terrestrial and Aquatic Ecosystems – Marine Biological Laboratory</td>
<td>100</td>
</tr>
<tr>
<td>BIOS 27712</td>
<td>Independent Undergraduate Research in Environmental Sciences – Marine Biological Laboratory</td>
<td>100</td>
</tr>
<tr>
<td>BIOS 27713</td>
<td>Quantitative Environmental Analyses – Marine Biological Laboratory</td>
<td>100</td>
</tr>
<tr>
<td>BIOS 27714</td>
<td>Methods in Microbial Ecology – Marine Biological Laboratory</td>
<td>100</td>
</tr>
<tr>
<td>BIOS 27715</td>
<td>Roles of Animals in Ecosystems – Marine Biological Laboratory</td>
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* Excluding courses used to meet the general education requirement for the biological sciences

Chemistry

<table>
<thead>
<tr>
<th>CHEM 20100-20200</th>
<th>Inorganic Chemistry I-II</th>
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</thead>
<tbody>
<tr>
<td>CHEM 22000-22100-22200</td>
<td>Organic Chemistry I-II-III</td>
<td>300</td>
</tr>
<tr>
<td>CHEM 23000-23100-23200</td>
<td>Honors Organic Chemistry I-II-III</td>
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</tr>
<tr>
<td>CHEM 26100-26200-26300</td>
<td>Quantum Mechanics; Thermodynamics; Chemical Kinetics and Dynamics</td>
<td>300</td>
</tr>
<tr>
<td>CHEM 26700</td>
<td>Experimental Physical Chemistry †</td>
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† requires CHEM 26100
## Physics

<table>
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<th>Credit</th>
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<tbody>
<tr>
<td>PHYS 18500</td>
<td>Intermediate Mechanics</td>
<td>100</td>
</tr>
<tr>
<td>PHYS 19700</td>
<td>Statistical and Thermal Physics</td>
<td>100</td>
</tr>
<tr>
<td>PHYS 22500</td>
<td>Intermediate Electricity and Magnetism I</td>
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<td>PHYS 22700</td>
<td>Intermediate Electricity and Magnetism II</td>
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<tr>
<td>PHYS 22600</td>
<td>Electronics</td>
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### List 2: Computational Sciences

#### Mathematics

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<th>Credit</th>
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<tr>
<td>MATH 20000-20100</td>
<td>Mathematical Methods for Physical Sciences I-II §</td>
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<tr>
<td>MATH 15910</td>
<td>Introduction to Proofs in Analysis</td>
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</tr>
<tr>
<td>or STAT 24300</td>
<td>Numerical Linear Algebra</td>
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<tr>
<td>MATH 20250</td>
<td>Abstract Linear Algebra</td>
<td>100</td>
</tr>
<tr>
<td>MATH 20300</td>
<td>Analysis in Rn I</td>
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</tr>
<tr>
<td>MATH 20400</td>
<td>Analysis in Rn II</td>
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<tr>
<td>MATH 20500</td>
<td>Analysis in Rn III</td>
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</tr>
<tr>
<td>MATH 21100</td>
<td>Basic Numerical Analysis</td>
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</tr>
<tr>
<td>MATH 27000</td>
<td>Basic Complex Variables</td>
<td>100</td>
</tr>
<tr>
<td>MATH 27300</td>
<td>Basic Theory of Ordinary Differential Equations</td>
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</tr>
<tr>
<td>MATH 27500</td>
<td>Basic Theory of Partial Differential Equations</td>
<td>100</td>
</tr>
<tr>
<td>MATH 38300</td>
<td>Numerical Solutions to Partial Differential Equations</td>
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#### Biological Sciences

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<th>Course</th>
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<tbody>
<tr>
<td>BIOS 20152</td>
<td>Introduction to Quantitative Modeling in Biology (Advanced)</td>
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#### Physics

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</tr>
<tr>
<td>PHYS 22100</td>
<td>Mathematical Methods in Physics §§ §§</td>
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#### Statistics

Any course in statistics at the 22000 level or higher. Some recommendations follow:

<table>
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<th>Title</th>
<th>Credit</th>
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<tbody>
<tr>
<td>STAT 22000</td>
<td>Statistical Methods and Applications * ††</td>
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<td>or STAT 23400</td>
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<td>STAT 22400</td>
<td>Applied Regression Analysis</td>
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<tr>
<td>STAT 22600</td>
<td>Analysis of Categorical Data</td>
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<tr>
<td>STAT 24400-24500</td>
<td>Statistical Theory and Methods I-II †† †</td>
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<td>STAT 26100</td>
<td>Time Dependent Data</td>
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#### Computing

<table>
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<tr>
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<tbody>
<tr>
<td>GEOS 25400</td>
<td>Introduction to Numerical Techniques for the Geophysical Sciences</td>
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<tr>
<td>CMSC 12100-12200-12300</td>
<td>Computer Science with Applications I-II-III</td>
<td>300</td>
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<tr>
<td>CMSC 23710</td>
<td>Scientific Visualization</td>
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<tr>
<td>CMSC 28510</td>
<td>Introduction to Scientific Computing</td>
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<tr>
<td>CMSC 34200</td>
<td>Numerical Hydrodynamics</td>
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* AP credit for STAT 22000 does not count toward the major requirements. Students with AP credit for STAT 22000 should plan to take at least one other course from List 2 (BA program) or two other courses from List 2 (BS program).

§ Recommended prerequisite is MATH 19620 or MATH 15300 or MATH 16300

§§ Would generally substitute for MATH 20000-20100

§§§ Recommended in addition to MATH 20000-20100 for advanced students—covers partial differential equations

‡‡ STAT 23400 has a higher programming component than STAT 22000

‡‡‡ Recommended for advanced students. Must be taken as a sequence to be credited. STAT 24400-24500 have no prerequisite but it is possible to take both STAT 23400 and STAT 24400-24500.

**GRADING**

Students majoring in geophysical sciences must receive quality grades in all courses taken to meet requirements in the major.

**HONORS**

The BA or BS degree with honors is awarded to students who meet the following requirements: (1) a GPA of 3.25 or higher in the major and of 3.0 or higher overall; (2) completion of a paper based on original research, supervised and approved by a faculty member in geophysical sciences; (3) an oral presentation of the thesis research. All theses will be examined by the supervisor and a second reader from the faculty. Manuscript drafts will generally be due in the sixth week of the quarter in which the student will graduate (fifth week in Summer Quarter), and final manuscripts and oral presentations in the eighth week (seventh week in Summer Quarter).

Students are strongly encouraged to reach out to potential faculty supervisors no later than their third year, since theses generally arise out of research projects already begun with faculty members. When a thesis topic is determined, students should notify the undergraduate adviser of their intent to complete a thesis and confirm their eligibility. GEOS 29700 Reading and Research in the Geophysical Sciences can be devoted to the preparation of the required paper; however, students using this course to meet a requirement in the major must take it for a quality grade.

Students who wish to submit a single paper to meet the honors requirement in geophysical sciences and the BA paper requirement in another major should discuss their proposals with the undergraduate advisers from both programs no later than the end of third year. Certain requirements must be met. A consent form, to be signed by the undergraduate advisers, is available from the College adviser. It must be completed and returned to the College adviser by the end of Autumn Quarter of the student’s year of graduation.
SAMPLE BS PROGRAMS

Each student will design an individual plan of course work, choosing from a wide range of selections that take advantage of rich offerings from a variety of subdisciplines. The sample programs that appear below are merely for the purpose of illustration; many other variations would be possible. NOTE: Courses that meet general education requirements and are required for the major are not listed.

### Environmental Geochemistry
- **CHEM 26200-26300** Thermodynamics; Chemical Kinetics and Dynamics 200
- **GEOS 21000** Introduction to Mineralogy 100
- **GEOS 23800** Global Biogeochemical Cycles 100
- **GEOS 23805** Stable Isotope Biogeochemistry 100
- **GEOS 23900** Environmental Chemistry 100
- **GEOS 26650** Environmental Microbiology 100
- **GEOS 28300** Principles of Stratigraphy 100
- **GEOS 25400** Introduction to Numerical Techniques for the Geophysical Sciences 100
- **STAT 23400** Statistical Models and Methods 100

### Geochemistry
- **CHEM 26100-26200-26300** Quantum Mechanics; Thermodynamics; Chemical Kinetics and Dynamics 300
- **GEOS 21000** Introduction to Mineralogy 100
- **GEOS 21100** Introduction to Petrology 100
- **GEOS 22200** Geochronology 100
- **GEOS 23800** Global Biogeochemical Cycles 100
- **GEOS 23900** Environmental Chemistry 100
- **MATH 20000-20100** Mathematical Methods for Physical Sciences I-II 200

### Geophysics
- **CMSC 12100-12200-12300** Computer Science with Applications I-II-III 300
- **GEOS 21000** Introduction to Mineralogy 100
- **GEOS 21100** Introduction to Petrology 100
- **GEOS 21200** Physics of the Earth 100
- **GEOS 21205** Introduction to Seismology, Earthquakes, and Near-Surface Earth Seismicity 100
- **GEOS 28100** Global Tectonics 100
- **PHYS 18500** Intermediate Mechanics 100
- **PHYS 22100** Mathematical Methods in Physics 100

### Paleontology
- **BIOS 22243** Biomechanics of Organisms 100
- **BIOS 23289** Marine Ecology 100
<table>
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<td>GEOS 26300</td>
<td>Invertebrate Paleobiology and Evolution</td>
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<td>GEOS 26600</td>
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<td>STAT 23400</td>
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**Physics of Climate**

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<td>GEOS 24220</td>
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<td>GEOS 24230</td>
<td>Geophysical Fluid Dynamics: Foundations</td>
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<td>GEOS 24240</td>
<td>Geophysical Fluid Dynamics: Rotation and Stratification</td>
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<td>GEOS 24250</td>
<td>Geophysical Fluid Dynamics: Understanding the Motions of the Atmosphere and Oceans</td>
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<td>MATH 20000-20100</td>
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<td>GEOS 25400</td>
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<td>STAT 23400</td>
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**Structure/Tectonics**

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<td>GEOS 21100</td>
<td>Introduction to Petrology</td>
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<tr>
<td>GEOS 21200</td>
<td>Physics of the Earth</td>
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<tr>
<td>GEOS 21205</td>
<td>Introduction to Seismology, Earthquakes, and Near-Surface Earth Seismicity</td>
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<td>Introduction to Structural Geology</td>
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<td>GEOS 28100</td>
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<td>Mathematical Methods for Physical Sciences I</td>
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