The Geophysics Major Curriculum

Undergraduates in Geophysics are exposed to a broad spectrum of topics including resource exploration, environmental geophysics, seismology, and tectonics. Majors build on a solid foundation of math, physics, and geology with advanced coursework in geophysics to develop the in-depth knowledge they need to pursue advanced graduate study and professional careers in government or the private sector.

**OPTIONAL PRE-MAJOR CLASSES**
+Geophys 70 The Water Course (AQR, SMA) 4
•Geophys 80 The Energy-Water Nexus 3
Geophys 90 Earthquakes and Volcanoes (AQR, SMA) 3

**GEOPHYSICS CORE COURSES** (24-35 units)
Geophys 110 Earth on the Edge: Introduction to Geophysics (AQR,SMa) 3
Geophys 120 Ice, Water, Fire (FR, SMA) 3-5
Geophys 130 Introductory Seismology (AQR, SMA) 3
•Geophys 150 Geodynamics: Our Dynamic Earth (SMa) 3
Geophys 162 Laboratory Methods in Geophysics 2-3
•Physics 67, Intro. to Laboratory Physics 2
•Geophys 190 Near-Surface Geophysics (SMa) 3
Geophys 196 Undergraduate Research in Geophysics 5
or approved research internship
Geophys 197 Senior Thesis 3
or Geophys 198 Honors Thesis 3
Geophys 199 Senior Seminar: Issues in Earth Sci (WIM) 3
Geophys 201 Frontiers of Geophysical Research 1

**SUPPORTING MATHEMATICS** (15-19 units)
CME 100 Vector Calculus for Engineers 5
CME 102 ODEs for Engineers 5
CME 104 Linear Algebra and PDEs for Engineers 5
(Math 51 (5IM recommended), 52, and 53 plus either Geophys 112 or CME 192 may substitute for CME series)

**SUPPORTING SCIENCE** (8-25 units)
GS 1A, B, or C Introduction to Geology 4-5
Chem 31A, B Chemical Principles I & II 10
or Chem 31X Chemical Principles (accelerated) 5
or a score of 5 on the Chemistry AP exam
Physics 41 (or 61) Mechanics 4
or a score of 4-5 on the Physics C Mechanics AP exam
Physics 43 (or 63) Electricity and Magnetism 4
or a score of 4-5 on the Physics C E&M AP exam
Physics 45 (or 65) Light and Heat 4

**OPTIONAL FIELD CLASSES**
GS 105 Introduction to Field Methods 3
•Geophys 171 Tectonics Field Trip 3

Geophysics majors must acquire basic familiarity with commonly used software including Matlab, unix, GMT, etc.

- class taught alternate years
+ uncertain whether/when this class will next be taught
$ first offered 2017/18; can only satisfy one breadth area
# not offered after 2016/17
* has additional pre-requisites outside the Geophys major
WIM, AQR, FR, SMA: satisfies those GE requirements

**GEOPHYSICS BREADTH** (18-29 units)
Choose six upper-level courses, one from each of the following six areas (but an additional Geophysics class may substitute for either the Physics or the Geology breadth areas):

**Whole-Earth Geophysics**
•Geophys 122 Planetary Systems: Dynamics & Origins 3
•Geophys 141 Remote Sensing of the Oceans (AQR) 3-4
•Geophys 145 Glaciology 3
•Geophys 170 Global Geodynamics, Crust to Core (SMa) 3
•Geophys 186 Tectonophysics & Global Tectonics 3

**Resources, Hazards, and the Environment**
•Geophys 118 D*3 Disasters, Decisions, Development (AQR,SMa)3-5
•Geophys 182 Reflection Seismology 3
•Geophys 183 Reflection Seismology Interpretation (SMa) 3
•Geophys 185 Rock Physics for Reservoir Characterization 3

**Energy**
Energy 120 Fundamentals of Petroleum Engineering 3
#GS 130 Soil Physics and Hydrogeology 3
#GS 131 Hydrologically-Driven Landscape Evolution 3

**Numerical and Computational Methods**
Geophys 188 Practical Earth Imaging 3
Geophys 211 Environmental Soundings Image Estimation 3
Geophys 281 Geophysical Inverse Problems 3
•Earth 211 Software Development for Sci/Engineering 3
+Energy 160 Modeling Uncertainty 3
EE 102A Signal Processing and Linear Systems I 4
CME 108 Introduction to Scientific Computing 3-4
CS 106A & 106B Programming 6-10
*Physics 113 Computational Physics 4

**Geophysical Fluid Dynamics**
•Geophys 145 Glaciology 3
Geophys 146A Atmospheric Circulation 3
Geophys 146B Ocean Circulation 3
•Geophys 181 Fluids and Flow 3
Energy 121 Fundamentals of Multiphase Flow 3
CEE 164 Introduction to Physical Oceanography 4
ESS 220 Physical Hydrogeology 4

**Physics**
*EE 141 or *EE142 Engineering Electromagnetics 4
*ME 80 Mechanics of Materials 4
*Physics 110 Advanced Mechanics 4
*Physics 120 Intermediate Electricity & Magnetism I 4

**Geology**
GS 102 Earth Materials: Intro. to Mineralogy 4
GS 104 Introduction to Petrology 3-4
GS 110 Structural Geology and Tectonics 5
*GS 151 Sedimentary Geology & Petrography 4

Substitutions allowed with consent of Director of Undergrad.
Studies; classes to be taken LGI if possible, grade C or better.

For more information: visit [https://earth.stanford.edu/geophysics/](https://earth.stanford.edu/geophysics/) or contact Professor Simon Klemperer (sklemp@stanford.edu) Director of Undergraduate Studies, Mitchell 353
The Geophysics Minor Curriculum

The Geophysics minor provides students with a general knowledge of Geophysics in addition to a background in the related fields of physics, mathematics, and geology. The minor consists of one required class (3 units), three electives (min. 9 units), and supporting classes in geology, mathematics and physics.

GEOPHYSICS CORE COURSES (12-14 units)

Geophys 110 Earth on the Edge: Introduction to Geophysics (AQR, SMA) 3

Plus three additional approved electives, typically chosen from:
- Geophys 118 D^3: Disasters, Decisions, Development (AQR, SMA) 3-5
- Geophys 120 Ice, Water, Fire (FR, SMA) 3-5
- Geophys 130 Introductory Seismology (AQR, SMA) 3
- Geophys 145 Glaciology 3
- Geophys 150 Geodynamics: Our Dynamic Earth (SMA) 3
- Geophys 162 Laboratory Methods in Geophysics 2-3
- Geophys 170 Global Geodynamics, Crust to Core (SMA) 3
- Geophys 183 Reflection Seismology Interpretation (SMA) 3
- Geophys 186 Tectonophysics & Global Tectonics 3
- Geophys 190 Near-Surface Geophysics (SMA) 3

SUPPORTING MATH & SCIENCE (9-18 units)

- Geophys 20N Predicting Volcanic Eruptions (AQR, SMA) 3 units
- Geophys 60N Man vs. Nature: coping with disasters using space technology (GEE 3, 4, 5) 4
- +Geophys 70 The Water Course (THINK 33) (AQR, SMA) 4
- Geophys 80 The Energy-Water Nexus 3
- Geophys 90 Earthquakes and Volcanoes (GEE 3, 5) 3

$ denotes class taught alternate years; (GEE 3, 5) denotes a class satisfying General Education Elective areas 3 and 5, etc.

Introductory Classes in Geophysics
(requiring no, or minimal, pre-requisites)

The Geophysics major core class sequence targets the typical sophomore (or advanced freshman) (enrolled in or already completed the CME 100-102-104 or the Math 51-52-53 sequence). We encourage interested freshmen to take one or more of the following classes that have no, or minimal, pre-requisites:

INTRODUCTORY GEOPHYSICS COURSES

- Geophys 20N Predicting Volcanic Eruptions (AQR, SMA) 3 units
- Geophys 60N Man vs. Nature: coping with disasters using space technology (GEE 3, 4, 5) 4
- +Geophys 70 The Water Course (THINK 33) (AQR, SMA) 4
- Geophys 80 The Energy-Water Nexus 3
- Geophys 90 Earthquakes and Volcanoes (GEE 3, 5) 3

Research in Geophysics
(open to non-majors, pre-majors and majors)

Many Stanford undergraduates first learn about Geophysics by participating in SESUR (Stanford Earth Sciences Undergraduate Research program). SESUR provides a summer stipend for on- or off-campus research in Geophysics for any undergraduate continuing at Stanford beyond the funded summer. For more details of this opportunity, and the Winter quarter application deadline (as well as other funded internships and free geophysics field camp opportunities around the country) visit https://pangea.stanford.edu/departments/geophysics/academics/undergraduate-research

For more information: visit http://geo.stanford.edu/GP
or Professor Simon Klemperer (sklemper@stanford.edu) Director of Undergraduate Studies, Mitchell 353