

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 CLASS

Geophys 90 Earthquakes and Volcanoes (GEE 3, 5) 3

GEOPHYSICS CORE COURSES (24-35 units)

Geophys 110 Earth on the Edge: Introduction to Geophysics (GEE 3, 5) 3
 Geophys 120 Ice, Water, Fire (GEE 3, 4) 3-5
 •Geophys 130 Introductory Seismology (GEE 3) 3
 •Geophys 150 Geodynamics: Our Dynamic Earth (3, 4) 3
 Geophys 162 Laboratory Methods in Geophysics 2-3
or Physics 67, Intro. to Laboratory Physics 2
 •Geophys 190 Near-Surface Geophysics (GEE 3) 3
 Geophys 196 Undergraduate Research in Geophysics 5
or approved research internship
 Geophys 197 Honors Thesis 3
or Geophys 198 Senior 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 (51M recommended), 52, and 53 plus either Geophys 112 or CME 192 may substitute for CME series)

SUPPORTING SCIENCE (8-25 units)

GES 1A, B, or C Introduction to Geology 4-5
 Chem 31A, B Chemical Principles I & II 8
or Chem 31X Chemical Principles (accelerated) 4
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 CLASS

GES 105 Introduction to Field Methods 3

Appropriate substitutions are allowed with the consent of the Director of Undergraduate Studies; all classes are to be taken LGI if so offered, for a grade of C or better

• denotes class taught alternate years

* has additional pre-requisites outside the Geophysics major

GEE: satisfies one or more General Education Elective areas

Geophysics majors are expected to acquire basic familiarity with software in common use in geophysics including Matlab, unix, GMT, etc.

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 132 What Makes a Habitable Planet? 3
 •Geophys 141 Remote Sensing of the Oceans 3-4
 •Geophys 184 Journey to the Center of the Earth (3, 4) 3
 •Geophys 186 Tectonophysics & Global Tectonics 3

Resources, Hazards, and the Environment

•Geophys 160 D³: Disasters, Decisions, Development 3
 •Geophys 182 Reflection Seismology (GEE 5) 3
 •Geophys 183 Reflection Seismology Interpretation (GEE3) 3
 •Geophys 185 Rock Physics for Reservoir Characterization 3
 •Geophys 191 Observing Freshwater (2015-16 only) 3
 Energy 120 Fundamentals of Petroleum Engineering 3
 GES 130 Soil Physics and Hydrogeology 3
 GES 131 Hydrologically-Driven Landscape Evolution 3

Numerical and Computational Methods

Geophys 211 Environmental Soundings Image Estimation 3
 •Geophys 281 Geophysical Inverse Problems 3
 •EarthSci 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 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
 EESS 220 Physical Hydrogeology 4

Physics

•Geophys 292 Magnetotelluric methods (2015-16 only) 3
 *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

GES 102 Earth Materials: Intro. to Mineralogy 3
 GES 110 Structural Geology and Tectonics 5
 GES 111 Fundamentals of Structural Geology 3
 •*GES 151 Sedimentary Geology & Petrography 4

For more information: visit <http://pangea.stanford.edu/GP>

or contact **Professor Simon Klempner** (sklemp@stanford.edu) Director of Undergraduate Studies, Mitchell 353
 or contact **Dr. Sara Cina** (saracina@stanford.edu) Undergraduate Program Coordinator, Bldg 320-112, 724-8899

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 (GEE 3, 5)	3
<i>Plus three additional approved electives, typically chosen from:</i>	
Geophys 120 Ice, Water, Fire (GEE 3, 4)	3-5
•Geophys 130 Introductory Seismology (GEE 3)	3
•Geophys 141 Remote Sensing of the Oceans	3-4
•Geophys 150 Geodynamics: Our Dynamic Earth (3, 4)	3
•Geophys 160 D ³ : Disasters, Decisions, Development	3
•Geophys 162 Laboratory Methods in Geophysics	2-3
•Geophys 184 Journey to the Center of the Earth	3
•Geophys 186 Tectonophysics & Global Tectonics	3
•Geophys 190 Near-Surface Geophysics (GEE 3)	3

SUPPORTING MATH & SCIENCE (9-18 units)

GES 1A, B, or C Introduction to Geology	4-5
CME 100 Vector Calculus for Engineers	5
or Math 51 Multivariate Calculus	5
Physics 21, 22, 23, 24	8
or Physics 41 and Physics 43 or 45	8
or equivalent AP scores	
(GEE 3, 4) or (3, 4) denotes a class satisfying General Education Elective areas 3 and 4, etc.	
• denotes class taught alternate years	
Appropriate substitutions are allowed with the consent of the Director of Undergraduate Studies; all classes are to be taken LGI if so offered, for a grade of C or better	

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 20Q Predicting Volcanic Eruptions (GEE 3, 5)	3 units
•Geophys 50N Planetary Habitability, worldview and sustainability (GEE 3, 4, 5)	3
Geophys 60N Man vs. Nature: coping with disasters using space technology (GEE 3, 4, 5)	4
Geophys 70 The Water Course (THINK 33) (GEE 5)	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.	

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 Klempner (sklemp@stanford.edu) Director of Undergraduate Studies, Mitchell 353
or contact Dr. Sara Cina (saracina@stanford.edu) Undergraduate Program Coordinator, Bldg 320-112, 724-8899