

GPHY-GEOPHYSICS

GPHY 1103 Adventures in Geophysics 3 Credit Hours

The field of applied near-surface geophysics will be introduced within the broader scope of the geophysical sciences. Key geophysical techniques and tools will be covered through exploration of existing case studies involving fields such as archaeology, law enforcement and ground water resources. There will also be opportunities for 'hands on' experience with high-tech geophysical tools. (Sp) [II-NS].

GPHY 2013 Frontiers of Geophysics 3 Credit Hours

Prerequisite: GEOL 1114 or co-enrollment. Introduction to the basic theories, methods, and modern applications of geophysics. This sampler course will address topics such as, but not limited to: seismology, deep earth geophysics, remote sensing, reflection seismology, computational geophysics, and machine learning. (Sp)

GPHY 3013 Data Analysis in Geoscience 3 Credit Hours

Prerequisite: GEOL 1114, and MATH 2924 or MATH 2423. This course introduces theories and techniques in data analysis and their applications in the Earth and Environmental Sciences, with examples demonstrated in MatLab. Topics include data visualization, probability theory, linear models, periodicity detection, filtering, correlation, interpolation, approximations, and hypothesis testing. (Sp)

GPHY 3423 Introductory Petroleum Geology and Geophysics 3 Credit Hours

Prerequisite: GEOL 1114, MATH 2924 or MATH 2423, PHYS 2514, and GEOL 3003. Fundamentals of the utilization of geological and geophysical data in the exploration for and development of petroleum reserves. Fundamental principles, geological and geophysical data acquisition, processing and interpretation. (F)

GPHY 3440 Mentored Research Experience 3 Credit Hours

0 to 3 hours. Prerequisites: ENGL 1113 or equivalent, and permission of instructor. May be repeated; maximum credit 12 hours. For the inquisitive student to apply the scholarly processes of the discipline to a research or creative project under the mentorship of a faculty member. Student and instructor should complete an Undergraduate Research & Creative Projects (URCP) Mentoring Agreement and file it with the URCP office. Not for honors credit. (F, Sp, Su)

GPHY 3960 Honors Reading 1-3 Credit Hours

1 to 3 hours. Prerequisite: Admission to Honors Program. May be repeated; maximum credit six hours. Consists of topics designated by the instructor in keeping with the student's major program. The topics will cover materials not usually presented in the regular courses. (F, Sp, Su)

GPHY 3970 Honors Seminar 1-3 Credit Hours

1 to 3 hours. Prerequisite: admission to Honors Program. May be repeated; maximum credit six hours. Subjects covered vary. Deals with concepts not usually treated in regular courses. (Irreg.)

GPHY 3980 Honors Research 1-3 Credit Hours

1 to 3 hours. Prerequisite: Admission to Honors Program. May be repeated; maximum credit six hours. Will provide an opportunity for the gifted Honors candidate to work at a special project in the student's field. (F, Sp, Su)

GPHY 3990 Independent Study 1-3 Credit Hours

1 to 3 hours. Prerequisite: permission of instructor and junior standing. May be repeated once with change of content. Independent study may be arranged to study a subject not available through regular course offerings. (F, Sp, Su)

GPHY 4133 Colorado Field Geophysics 3 Credit Hours

Prerequisite: 4113; Geology 3123; or permission of instructor. Students become familiar with field methods in geophysics and apply principles of geophysical methods to survey design, data acquisition, data processing, and interpretation. Students plan geophysical surveys, collect field geophysical data in small groups, interpret the acquired datasets in terms of earth structure, and learn about the tectonics and structure of the front range of the Rocky Mountains. Field course is taught at the OU field camp near Canon City, Colorado, and is predominantly field based. Three-week field experience required. (Su) [V].

GPHY 4153 Fractures, Faults, and Earthquakes 3 Credit Hours

(Slashlisted with GPHY 5153) Prerequisite: Junior Standing or permission of instructor. This course provides an introduction to the principles of fracturing, brittle faulting and earthquake mechanics. We will examine content including: brittle failure, fractures, fluid-flow and hydrothermal alteration, the state of stress in Earth's crust, borehole interpretation of fractures and faults, fault rocks and structures, the strength, rheology, and friction of faults, the seismic cycle, and scientific drilling. No student may earn credit for both 4153 and 5153. (Irreg.)

GPHY 4413 Global Geophysics 3 Credit Hours

Prerequisite: GEOL 3114 or concurrent enrollment; MATH 2924 or 2423; PHYS 2524 or concurrent enrollment; or equivalent coursework or permission of instructor. Introduces students to geophysical methods, the structure and physical properties of earth's interior, active processes on earth, and the use of geophysical methods to study structure and processes. Laboratory (Alt. F)

GPHY G4553 Introduction to Seismology 3 Credit Hours

Prerequisite: MATH 2924 or 2423, and PHYS 2514; or permission of instructor. This course presents an overview of seismology to introduce students to the fundamentals of seismic wave, quantitative data analyses, and the utilization of seismic wave for the study of earthquakes and the Earth's interior structure. Students will gain hand-on experiences with real data analysis. Course is appropriate for upper-class undergraduates and graduate students. (Sp)

GPHY G4874 Seismic Exploration 4 Credit Hours

Prerequisite: PHYS 2524; MATH 2433 or MATH 2924 or concurrent enrollment. Lectures, projects, and laboratory/problem sessions covering theory and advanced methods of reflection seismic methods and applications to energy exploration, carbon capture, paleosedimentation and paleotectonics. (F)

GPHY 4953 Senior Thesis in Geophysics 3 Credit Hours

Prerequisite: senior standing with a major in geophysics and permission. May not be repeated. Individual research of a geophysical topic selected by the student in consultation with the instructor. The project may involve fieldwork, theoretical analysis, computer modeling, and/or data analysis and interpretation, culminating in a written thesis. (F, Sp, Su) [V].

GPHY 4960 Directed Readings 1-4 Credit Hours

1 to 4 hours. Prerequisite: good standing in University; permission of instructor and dean. May be repeated; maximum credit four hours. Designed for upper-division students who need opportunity to study a specific problem in greater depth than formal course content permits. (Irreg.)

GPHY G4970 Seminar 3 Credit Hours

1 to 3 hours. Prerequisite: permission of instructor. May be repeated with change of content; maximum credit nine hours. (F, Sp)

- GPHY 4990 Independent Study 1-3 Credit Hours**
1 to 3 hours. Prerequisite: three courses in general area to be studied; permission of instructor and department. May be repeated; maximum credit nine hours. Contracted independent study for topics not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (F, Sp, Su)
- GPHY 5021 Geophysical Journal Seminar 1 Credit Hour**
Prerequisite: Graduate Standing or Instructor Permission. This seminar course involves undergraduate and graduate students in selecting, reviewing, and discussing frontier research papers in geophysics about the solid Earth system and problems related to geo-hazards, energy, and the environment. Students will share research progress and discuss important topics for career development. (F, Sp)
- GPHY 5023 Computational Geophysics 3 Credit Hours**
Prerequisite: Graduate standing or permission of instructor. This course introduces concepts and practices in numerical modeling in geophysics, including the formulation of finite-difference and finite-element methods and their applications in problems of heat and fluid flow, deformation, and wave propagation. Students learn to program numerical methods in MATLAB or Python, use open-source software, and discuss topics about computational methods in seismology, geomechanics, and geodynamics. (F, Sp)
- GPHY 5031 Near-Surface Geophysics Seminar 1 Credit Hour**
Prerequisite: Graduate Standing or Instructor Permission. In this course, we will discuss the latest scientific research and learn about new approaches for studying near-surface problems. We will also learn how to develop a proposal and how to review papers. At the end, students should be able to analyze and review scientific geophysical articles. Additionally, students should be able to prepare presentations based on the articles discussed. (F, Sp)
- GPHY 5153 Fractures, Faults, and Earthquakes 3 Credit Hours**
(Slashlisted with GPHY 4153) Prerequisite: Graduate Standing or permission of instructor. This course provides an introduction to the principles of fracturing, brittle faulting and earthquake mechanics. We will examine content including: brittle failure, fractures, fluid-flow and hydrothermal alteration, the state of stress in Earth's crust, borehole interpretation of fractures and faults, fault rocks and structures, the strength, rheology, and friction of faults, the seismic cycle, and scientific drilling. No student may earn credit for both 4153 and 5153. (Irreg.)
- GPHY 5203 Near-Surface Geophysics 3 Credit Hours**
Prerequisite: graduate Standing or instructor permission. Near-surface geophysics is a branch of geophysics that deals with a zone that spans within a few 100s of meters of the Earth's surface. In near-surface geophysics, we use methods such as seismic refraction and electrical resistivity to address environmental, engineering (civil), forensic, archaeological and mineral exploration issues. There is a required Field Research project as part of this course.
- GPHY 5303 Electrical Environmental Geophysics 3 Credit Hours**
Prerequisite: graduate Standing or permission of instructor. Introduction to "electrical-based" near-surface geophysical methods and the application of these techniques to environmental and engineering studies. Participation in problems set in class is expected. A minimum of time equivalent to one day of fieldwork will be organized for each student: participation in fieldwork is mandatory as it provides an opportunity to work with the different geophysical methods.
- GPHY 5364 Paleomagnetism 4 Credit Hours**
Prerequisite: permission. Concerns the magnetic properties of minerals and rocks and the physical and chemical processes which produce them. Laboratory techniques used in investigations are discussed. (F)
- GPHY 5413 Global Geophysics 3 Credit Hours**
Prerequisite: Graduate standing or permission of instructor. Introduces students to geophysical methods, the structure and physical properties of earth's interior, active processes on earth, and the use of geophysical methods to study structure and processes. Will be taught every other fall semester. Laboratory included. No student may earn credit for both 4413 and 5413. (Irreg.)
- GPHY 5513 3-D Seismic Interpretation 3 Credit Hours**
Prerequisite: graduate standing or permission of instructor. Principles of seismic stratigraphy, seismic geomorphology, structural geology, and rock physics to interpret seismic reflection data and associated attributes to delineate faults, fractures, folds, fluvial-deltaic complexes, turbidites, mass transport complexes, karst, and other structural and stratigraphic features of interest. Course is intended for graduate students in geophysics, geology, and petroleum engineering. Laboratory (F)
- GPHY 5523 3-D Seismic Processing 3 Credit Hours**
Prerequisite: GPHY 4874 or equivalent and MATH 3333. Theory and application of seismic signal analysis to modern 3-D surface seismic surveys including sorting, statics, deconvolution, coherent noise suppression, velocity analysis and migration. At the end of the course, the student will be able to apply appropriate modern work flows to 3-D land data surveys resulting in prestack time migrated images amenable to AVO, attribute, and velocity anisotropy analysis. (Sp)
- GPHY 5533 Quantitative Seismic Interpretation 3 Credit Hours**
Prerequisite: graduate standing, and GPHY 5513 or current research work in reservoir characterization or simulation. This course is the second part of a two-course sequence on seismic interpretation and will investigate the theoretical foundation and application of tools used in quantitative reservoir characterization. This course is intended for upper level graduate students in geophysics, geology, and petroleum engineering doing research in reservoir imaging, characterization, and simulation. (Sp-even yrs)
- GPHY 5613 Introduction to Seismic Stratigraphy 3 Credit Hours**
Prerequisite: Physics 2524, Mathematics 3333, or permission. Introduction to the stratigraphic interpretation of reflection seismic data, emphasizing 2-D exploration seismic reflection group analysis. Topics covered include the theory and practice of borehole constrained interpretation, analysis, and mapping of seismic sequences, fault mechanical stratigraphy, chronostratigraphy, seismic facies, relative changes in sea level, and integrated geohistory analysis with emphasis upon providing a foundation for petroleum system analysis. Seismic sections for the analyses are taken from varying tectonic and depositional settings worldwide. (Alt. F)
- GPHY 5864 Gravimetric and Magnetic Exploration 4 Credit Hours**
Prerequisite: Graduate standing, MATH 2924 or MATH 2433, PHYS 2524, or permission of instructor. Lectures and laboratory/ problem sessions covering theory and applications of gravimetric and magnetic exploration. Includes potential theory, filtering, modeling and interpretation. Emphasis is on exploration for minerals, oil and gas. Concepts of geodesy and isostasy are briefly considered. Laboratory (Sp)
- GPHY 5960 Directed Readings 1-3 Credit Hours**
1 to 3 hours. Prerequisite: graduate standing and permission of department. May be repeated; maximum credit twelve hours. Directed readings and/or literature reviews under the direction of a faculty member. (F, Sp, Su)

GPHY 5970 Special Topics/Seminar 1-3 Credit Hours

1 to 3 hours. Prerequisite: Graduate standing or permission of instructor. May be repeated; maximum credit nine hours. Special topics or seminar course for content not currently offered in regularly scheduled courses. May include library and/or laboratory research and field projects. (Irreg.)

GPHY 5980 Research for Master's Thesis 2-9 Credit Hours

Variable enrollment, two to nine hours; maximum applicable toward degree, four hours. (F, Sp, Su)

GPHY 5990 Special Studies 1-3 Credit Hours

1 to 3 hours. Prerequisite: permission. May be repeated; maximum credit nine hours. Advanced special studies in geophysical problems. May include directed reading in geophysics, fieldwork, laboratory research or preparation of reports. (F, Sp, Su)

GPHY 6873 Seismic Imaging 3 Credit Hours

Prerequisite: Graduate standing. Seismic imaging is a fundamental tool to understand Earth's structure. This class will focus on various migrations used in exploration geophysics including ray-based and wavefield-based methods. Also, it will cover velocity analyses of the structure such as travel-time tomography and full-waveform inversion. (Sp)

GPHY 6950 Research 1-4 Credit Hours

1 to 4 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated with change of content; maximum credit 12 hours. Individual research in various areas of geophysics. (F, Sp, Su)

GPHY 6960 Directed Readings 1-6 Credit Hours

1 to 6 hours. Prerequisite: graduate standing and permission of faculty supervisor. May be repeated; maximum credit six hours. Supervised reading at an advanced graduate level. (F, Sp, Su)

GPHY 6970 Seminar 1-4 Credit Hours

1 to 4 hours. Prerequisite: graduate standing, permission. May be repeated with change of subject matter; maximum credit twenty hours. Directed seminar on selected aspects of geophysical knowledge and inquiry. (F, Sp)

GPHY 6980 Research for Doctoral Dissertation 2-16 Credit Hours

2 to 16 hours. Prerequisite: Graduate standing and permission of instructor; may be repeated. Directed research culminating in the completion of the doctoral dissertation. (F, Sp, Su)

GPHY 6990 Independent Study 1-3 Credit Hours

1 to 3 hours. Prerequisite: Graduate standing and permission of instructor. May be repeated; maximum credit nine hours. Contracted independent study for a topic not currently offered in regularly scheduled courses. Independent study may include library and/or laboratory research and field projects. (Irreg.)