

# GEOSCIENCES (GES)

## GES 101 INTRODUCTORY GEOLOGY

3, 3/0; NS23

Physical aspects and processes on and in the Earth, including the formation and change of properties of rocks and minerals, the theory of plate tectonics, the Solar System, volcanoes, the continents and the oceans. Aspects of earthquakes, tsunamis, glaciers, the ice ages and environmental issues. Concurrent registration in GES 103 is recommended for sciences majors. Offered every semester.

## GES 102 HISTORICAL GEOLOGY

3, 3/0

Introduction to principles and methods of delineating Earth history from the rock record first locally then through correlation and dating techniques worldwide. The role of plate tectonics in changing continental configurations. Survey of the history of the Earth and from the fossil record its life forms through geologic time. Offered every year

## GES 103 INTRODUCTORY GEOLOGY LABORATORY

1, 0/2

Identification of rocks and minerals. Map and aerial photograph interpretation. Offered occasionally.

## GES 104 GEOLOGY OF THE SEVEN SUMMITS

3, 2/2

Themed-based introductory geology course based on highest mountain on each continent known as the Seven Summits. Mountains represent a range of geological processes and show impact of climate change. Readings, maps and spectacular satellite images used to understand geology of the Seven Summits. Offered every Fall semester.

## GES 111 OCEANOGRAPHY

3, 3/0; NS23

Study of the oceans including the application of geology, biology, chemistry, physics and engineering and how they interact in different parts of the ocean environment. Strong interdisciplinary focus of ocean processes and how they are connected to our lives. Topics include how technology has advanced our understanding of the oceans, sampling seawater and sediments and mapping the seafloor, opening and closing of ocean basins, formation and erosion of beaches, life in the oceans, ocean resources, marine pollution, and the role of the oceans in global climate change. Offered fall only.

## GES 123 ENVIRONMENTAL EARTH SCIENCE

3, 3/0; NS23

An investigation of the impact of society on the natural environment. Examines natural resources; global climate change; and soil, water, and land use issues. The complex interrelationship of global systems and societies' attempts to control or alter them. The unique perspective of geoscientists to environmental issues. Offered every semester.

## GES 124 NATURAL HAZARDS

3, 3/0; NS23

A study of natural events and processes that impact human life and health, with an emphasis on catastrophic geological events including earthquakes, volcanic eruptions, and landslides. Includes causes, physical effects, prediction and societal implications.

## GES 131 INTRODUCTORY ASTRONOMY

3, 3/0; NS23

Non-mathematical survey of the astronomical universe, including naked-eye astronomy, physical nature of planets, satellites, stars, galaxies, and the "Big Bang". How composition, distance, temperature, size, mass, and age are found for stars. Origins of planets, stars, and galaxies. Invention of technology as a driving force in astronomy. Planetarium visualizations, assignments, and demonstrations.

## GES 132 THE SOLAR SYSTEM

3, 3/0; NS23

Makeup and characteristics of our solar system; formation hypotheses; geologic processes acting on solar system bodies; comparison of the planets; the search for other solar systems and life elsewhere. Expansion of solar system exploration due to advances in technology and its effect on society.

## GES 189 TOPIC COURSE

1-4, 1/0

Current introductory topics in Geology and Earth Sciences. Offered occasionally.

## GES 200 FIRST YEAR GEOLOGY EXPERIENCE

3, 1/4

Introduction to research for geology and earth sciences students and preparation for engaging in undergraduate geology research. Laboratory and field techniques used by geoscientists and the types of questions investigated by geoscientists. Students conduct a class research project to investigate a laboratory or field problem. Includes field trips. Offered every spring semester.

## GES 201 PHYSICAL GEOLOGY

4, 3/2; IN23, RE23

First of a two-course sequence introducing the physical processes that formed Earth and have shaped our planet through time. Topics include Earth materials; plate tectonics; climate, ocean, and atmosphere; and deep time. Student experiences through skill-building activities and experiments. Field trips required. Offered every fall semester.

**GES 202 EARTH AND ENVIRONMENTS THROUGH TIME**

4, 2/4

How the Earth and its atmosphere and biosphere have changed over geologic time, and how this has impacted life on Earth. Labs include the identification of major fossil groups and interpreting geologic data used to construct ancient environments. Required field trips. Offered every spring semester.

**GES 241 METEOROLOGY**

3, 3/0; NS23

An introduction to weather, including the makeup of the atmosphere, seasonality, heat and radiation balance, temperature, humidity, and precipitation, atmospheric motion, atmospheric pressure and wind, air masses and fronts, severe weather, meteorological instrumentation, local weather, climate controls, and synoptic forecasting. Includes laboratory modules. Emphasis on the relationship between weather systems, technology, and humans. Offered at least once a year. Equivalent Course: GEG 241

**GES 295 RESEARCH EXPERIENCE IN EARTH SCIENCES**

1-3, 0/0

Prerequisite: Instructor Permission. Scholarship or creative work conducted under the supervision of a faculty member. Offered occasionally.

**GES 300 SEDIMENTOLOGY**

3, 3/0

Prerequisites: GES 101 and GES 103 or GES 201. Introduction to the dynamics of erosion, transport, deposition of sedimentary particles. Introduction to modern and ancient sedimentary environments. Offered fall only.

**GES 301 STRATIGRAPHY**

3, 3/0

Prerequisites: GES 101 and GES 103 or GES 201. Prerequisite or corequisite: GES 102. Basic principles and interpretation of the stratigraphic record, with emphasis on the practical application of stratigraphic data in interpretation of earth history and exploration for fossil fuels and groundwater resources. Offered spring only.

**GES 302 INVERTEBRATE PALEONTOLOGY**

4, 4/2

Prerequisite: GES 101 or GES 201 or instructor permission. Prerequisite or corequisite: GES 102. Basic principles of the nature and interpretation of the invertebrate fossil record, with an overview of the types of organisms commonly preserved as fossils. Emphasis on practical applications of paleontology. Offered occasionally.

**GES 303 MINERALOGY**

4, 3/3

Prerequisites: GES 101 and GES 103 or GES 201 or instructor permission; one semester chemistry recommended. Crystals, minerals, and rocks, emphasizing description, identification, and origin. Offered fall only.

**GES 306 SEDIMENTOLOGY AND STRATIGRAPHY**

4, 3/1

Prerequisites: GES 101 and GES 103, or GES 201, or equivalent or instructor permission. The study of sediments and strata. Topics include: properties of fluid flow; sediment transport processes; sediment texture and composition; sedimentary structures; facies and stratigraphic concepts; sedimentary environments; and interpretation of strata. Field excursions in WNY required for some laboratories.

**GES 307 GEOMORPHOLOGY**

3, 3/0

Prerequisite: GES 101 or GEG 101 or GES 201 or instructor permission. Internal and external processes and structural controls that shape the surface of Earth and other solid solar system bodies. Emphasis on selected geologic environments. Field trips required. Offered spring only.

**GES 323 THIRD- YEAR RESEARCH AND FIELD METHODS EXPERIENCE**

3, 1/4

Prerequisites: GES 203 or instructor permission. The second of a three-course sequence focused on basic to intermediate data analysis methods in the geosciences and the application these methods to explore relevant geology problems. Critical thinking about how geologic research contributes to understanding Earth history and global challenges related to resources and hazards. Offered every fall semester.

**GES 331 MODERN SOLAR SYSTEM ASTRONOMY**

3, 3/0

Prerequisite: GES 131 or equivalent. The moon and planets, their appearance, atmospheres, and surfaces. Planetary magnetic fields, asteroids, meteoroids, comets. Theories of the origin of the planetary system, the possibility of extraterrestrial life. Emphasis on recent problems in our understanding of the solar system. Offered occasionally.

**GES 332 STELLAR AND GALACTIC ASTRONOMY**

3, 3/0

Prerequisite: GES 131 or equivalent. How astronomers have determined the properties, energy, masses, and composition of stars, stellar evolution, the structure of the galaxy, and the movement of stars in the galaxy. Offered occasionally.

**GES 335 METHODS OF OBSERVATIONAL ASTRONOMY**

3, 3/0

Prerequisite: GES 131 or equivalent. Locating celestial objects in the night sky. Use of astronomical telescopes to locate, observe, and photograph stars, nebulae, and galaxies. Use of observing aids. Offered occasionally.

**GES 339 ASTRONOMY AND COSMOLOGY**

3, 3/0

Prerequisite: GES 131 or equivalent. Cosmology, the primeval fireball, quasars, pulsars, black holes, origin of the elements. Offered occasionally.

**GES 350 ENVIRONMENTAL GEOCHEMISTRY**

3, 3/0

Prerequisites: GES 101 or GES 201 and upper-division status. Chemical nature of the earth, emphasizing chemistry associated with the polluted environment. Offered alternate years.

### GES 360 FORENSIC GEOSCIENCE

3, 3/0

Prerequisite: Upper-division status or permission of instructor. Application of the principles of earth science to the law. With a "hands-on" approach, and details from actual criminal cases, introduces a variety of geological subjects such as rock and mineral types, geological and topographical maps, fossils, sand and soil through their forensic application. Offered alternate years.

### GES 389 TOPIC COURSE

3, 0/0

Current advanced topics in Geology and Earth Sciences. Offered occasionally.

### GES 401 IGNEOUS AND METAMORPHIC PETROLOGY

4, 3/3

Prerequisite: GES 303 or permission of instructor. Advanced study of igneous and metamorphic rocks and petrogenetic processes, including the thermodynamics of magma, crystallization and recrystallization, and the field relations, fabrics and tectonics associated with these rocks. Required term project and field trips. Offered occasionally.

### GES 403 GLACIAL GEOLOGY

3, 3/0

Prerequisite: GES 307. Glacial processes, landforms, and landscapes, with emphasis on New York State. Develops a model for the sequence of glacial events and the causes of climate change. Field trips. Offered occasionally.

### GES 405 GEOLOGY OF NORTH AMERICA

3, 3/0

Prerequisites: GES 101 or 201 and GES 102 or instructor permission. Major physical provinces of the United States and adjacent areas; their geologic history, structure, and topographic development. Offered occasionally.

### GES 408 STRUCTURAL GEOLOGY

4, 3/3

Prerequisites: GES 101 and GES 103 or GES 201. Folds, faults, and other structural features in sedimentary and metamorphic terrains. Introduction to rock mechanics, regional tectonics. Offered spring only.

### GES 410 UNDERGRADUATE RESEARCH SEMINAR

1, 1/0

Prerequisites: GES 101 and GES 103 or GES 201; instructor permission. Common topics related to undergraduate research in the geosciences including research methods, handling data, making interpretations, preparing for oral and poster presentations, and preparing for graduate school and professional geology. Must be engaged in (or planning) research with an Earth Sciences faculty member. May be taken more than once. Offered every semester.

### GES 418 STRUCTURAL GEOLOGY FIELD EXPERIENCE

3, 3/0

Prerequisites: GES 303 or instructor permission; Corequisite: GES 408. Field study topics in igneous and metamorphic rocks related to field sites visited in conjunction with GES 408 Structural Geology. Required weekend field trip (4 days). Students must be enrolled in GES 408. Offered every spring semester.

### GES 428 GEOLOGICAL HAZARDS

3, 3/0

Prerequisites: GES 306, GES 307, GES 408 or instructor permission. Causes, risk assessment, and mitigation of geologic hazards in marine and terrestrial environments, including volcanos, earthquakes, tsunamis, shoreline erosion, flooding, subsidence, avalanches, landslides, mud and debris flows. Emphasis on identifying and modeling underlying natural and human-induced disturbances that result in hazards and delineating risk potential. Use of case studies to map and model hazards with consideration of mitigation options. Offered every fall semester.

### GES 431 PLANETARIUM SEMINAR

3, 2/2

Prerequisites: Two semesters of astronomy. The celestial sphere; operating, maintaining, and administering the planetarium; audiovisual aids in the planetarium; planetarium programming; using the planetarium to teach. Includes supervised teaching experience. Offered occasionally.

### GES 433 GEOLOGY INDEPENDENT RESEARCH

3, 1/4

Prerequisites: GES 203 and GES 323, or instructor permission. Designing and conducting original undergraduate research in an approved geoscience topic. Advanced-level research methodologies are applied and research findings are presented using professional writing and oral presentations. Faculty mentor guidance is provided throughout the course. May be taken more than once. Offered every semester.

### GES 444 GLOBAL SYSTEMS GEOMORPHOLOGY

3, 0/0

Prerequisite: GES 307. Fundamentals of remote sensing and image processing will be presented early in the course as an introduction to the interpretation of planetary data sets. The goal is to understand the relationships between processes influencing landscape evolution on the Earth and to address possible reasons for similarities and/or differences in the number and intensity of processes operating on other planets. Offered occasionally.

### GES 450 FIELD GEOLOGY

3, 2/3

Prerequisites: GES 303 and GES 408, or permission of instructor. Theory and application of principles and techniques in the mapping and interpretation of geological structures in the field. Using geological data to construct geological maps and reports. Classroom and field study. Includes field trips and technical report writing. Offered fall only.

### GES 452 HYDROGEOLOGY

3, 3/0

Prerequisites: GES 101 or GEG 101 or GES 201 and at least one 300-level GES course. Fundamentals of the occurrence, movement, and management of our largest resource of readily available fresh water. Includes groundwater protection and remediation of already contaminated supplies to increase environmental awareness. Offered every year.

**GES 460 ENVIRONMENTAL FIELD METHODS**  
3, 2/2  
Prerequisites: Completion of IF Natural Science requirement, IF Mathematics/Quantitative Reasoning requirement, and upper division standing. GES 350 is strongly encouraged. Applied study of environmental contaminant migration and distribution with particular emphasis on sampling and detection methods. Discussion of federal and local environmental laws and regulations, classification of hazardous chemicals, and remediation approaches used by environmental professionals. Offered spring only.

**GES 465 TECTONICS**  
3, 3/0  
Prerequisites: GES 101 or GES 201 and GES 408 (or equivalent), upper-division status or instructor permission. Advanced principles, evidence and examples of the plate tectonics paradigm as the unifying theory of geology. Topics include kinematics of plates, the nature of plate boundaries and the analysis of theories involved in the current and historical design of the paradigm. Required term project and oral presentations. Offered occasionally.

**GES 471 GEOLOGY RESEARCH SEMINAR**  
3, 3/0  
Prerequisites: GES 203 and GES 323 or instructor permission. Seminar on common topics related to undergraduate research in the geosciences including research methods, handling data, making interpretations, preparing for oral and poster presentations, and preparing for graduate school and professional geology. These topics are addressed from an advanced standpoint. Offered every fall semester.

**GES 472 GEOLOGY SENIOR SEMINAR**  
3, 3/0  
Prerequisites: Senior status Geology or Earth Science major, or instructor permission. Detailed presentation of a selected topic in geological sciences. Capstone course integrating geological content covered in the sequence of courses taken in the major. High level survey of a specific topic reflecting current and emerging themes in the geosciences; advanced data analysis and critical review of scientific literature. Interconnectedness of and feedbacks between geoscience processes. Connections between the geosciences and other disciplines. Offered spring semester only.

**GES 488 INTERNSHIP**  
1-12, 0/0  
Prerequisites: 2.5 GPA overall. Requires department application and approval. Practical work on an individual basis with a participating organization.

**GES 495 SPECIAL PROJECT**  
1-3, 0/0  
Prerequisite: Approval of a faculty sponsor. Environment-, energy-, geology-, or astronomy -related areas.

**GES 497 WORKSHOP**  
1, 0/0  
Workshop on topics in Geology or Earth Sciences. Offered occasionally.

**GES 498 HONORS RESEARCH**  
1-3, 0/0  
Prerequisite: Acceptance in geology or earth science honors program. Includes completion of honor's thesis and seminar. May be repeated for a maximum of 6 credit hours.

**GES 499 INDEPENDENT STUDY**  
3-12, 0/0  
Prerequisite: Faculty sponsor permission. Environment-, energy-, geology-, or astronomy-related areas.

**GES 502 THE RESTLESS EARTH**  
3, 3/0  
Prerequisite: GES 101 or GES 201 or equivalent. Dynamic history of the Earth, movement of the continents, opening and closing of oceans, and the effect of such events on ancient climates; the evolution of life and the inter-relatedness of earth and life processes.

**GES 503 MINERALOGY AND PETROLOGY FOR EARTH SCIENCE TEACHERS**  
3, 3/0  
Origin and identification of crystals, minerals, and rocks.

**GES 504 FIELD INVESTIGATIONS FOR EARTH SCIENCE TEACHERS**  
3, 2/2  
Measuring surface changes: techniques necessary to construct base maps and topographic maps, collect stream gauging data, and measure slopes; applications to secondary earth science classrooms. Field trips.

**GES 506 GEOLOGY OF NEW YORK STATE**  
3, 3/0  
Prerequisites: GES 101 and GES 102 or GES 502 or equivalent. Physiography, stratigraphy, paleontology, glacial and economic geology of New York State; geological history of New York region; geology of selected recreational sites. Field trips.

**GES 508 FIELD GEOLOGY OF WESTERN NEW YORK**  
3, 3/0  
Prerequisites: GES 101 and GES 102 or GES 502 or equivalent. A study of the evolution, stratigraphy, and surficial geology of Western New York through observation of selected field sites.

**GES 513 APPLIED FORENSIC GEOSCIENCE**  
3, 2/2  
Prerequisites: GES 101 and; GES 103 or GES 201 or equivalents. Application of the principles of earth science to the law. Hands-on approach includes details from actual criminal cases. Forensic application of a variety of geological subjects, such as rock and mineral types, geological and topographical maps, fossils, sand, and soil.

**GES 521 LOW TEMPERATURE GEOCHEMISTRY**  
3, 3/0  
Prerequisites: GES 101, GES 103, CHE 112, or equivalents. The chemical nature of the earth. Emphasis on how natural systems work and the fundamental geochemical processes that affect the fate and transport of inorganic and organic pollutants in the environment.

**GES 525 GROUNDWATER SCIENCE**  
3, 3/0  
Prerequisites: GES 101 or GEG 101, at least one 300-level GES course, and college algebra. The interaction of groundwater and geologic material. Occurrence and movement of groundwater, assessment of aquifer properties, and chemical interactions between groundwater and rock. Includes groundwater protection and remediation strategies, as well as mathematical principles of groundwater flow.



GES 529 FIELD METHODS IN ENVIRONMENTAL SCIENCE

3, 3/0

Prerequisites: GES 101 or GEG 101, at least one 300-level GES course, and college algebra. Environmental detection of contaminants. Applied study of contaminant distribution and movement. Emphasis on environmental law and regulations, hazardous chemicals, and remediation approaches used by environmental professionals.

GES 535 ASTRONOMY FOR EARTH SCIENCE TEACHERS

3, 3/0

Prerequisite: Prior experience or assignment to teach secondary science. The dynamic universe: solar system, stars, galaxies, and quasars. Night sky and planetarium observation.

GES 541 METEOROLOGY FOR EARTH SCIENCE TEACHERS

3, 3/0

Prerequisite: Prior experience or assignment to teach secondary science. Weather as a response to the unequal distribution of energy from the sun; data-collecting techniques; interpretation and predictions appropriate for secondary science education classes.

GES 588 TOPICS COURSE

3, 3/0

GES 590 INDEPENDENT STUDY

1-3, 0/0

GES 594 GRADUATE WORKSHOP

1-3, 0/0

Workshop on topics in teaching Earth Sciences. Offered occasionally.

GES 598 MICRO COURSE

1-3, 1/0

Micro course on topics in teaching Earth Sciences. Offered occasionally.

GES 605 PALEONTOLOGY

3, 3/0

Prerequisite: GES 101 or equivalent; prerequisite or corequisite: GES 102 or GES 502. Basic principles of the nature and interpretation of the fossil record, with an overview of the types of organisms commonly preserved as fossils. Emphasizes practical applications of paleontology and the dynamic nature of science.

GES 606 ADVANCED INVERTEBRATE PALEONTOLOGY

3, 3/0

Prerequisite: GES 302 or GES 605 or equivalent. Methods and techniques used in the identification and classification of selected fossil invertebrate groups.

GES 607 REGIONAL GEOMORPHOLOGY OF THE UNITED STATES

3, 3/0

Prerequisite: GES 307 or equivalent. Factors and forces that led to the development of the surface features of selected areas of the United States.

GES 639 TOPICS IN MODERN ASTRONOMY

3, 3/0

Prerequisite: GES 131, GES 535, or equivalent. The expanding universe, primeval fireball, quasars, missing mass in the universe, black holes, pulsars, neutron stars, origin of the elements, current research.

GES 690 MASTER'S PROJECT

3, 0/0

Research or investigation of a particular problem, planned and carried out by the student with consultation and guidance from the instructor, submitted in acceptable form according to directions given by the Earth Sciences and Science Education Department.

GES 695 MASTER'S THESIS

3, 0/0

GES 721 THESIS/PROJECT CONTINUATION

0, 0/0

GES 722 THESIS/PROJECT EXTENDED

0, 0/0

GES 795 RESEARCH THESIS IN GEOSCIENCES

1-3, 0/0

Individual investigation of an original problem submitted in acceptable form according to directions given by the Graduate School.