GEOL 1011K Introductory Geosciences I
4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
This course covers Earth materials and processes.

GEOL 1121 Introduction to the Earth
4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
An introductory study of the origin and structure of Earth materials and the processes which modify Earth's interior and exterior. The laboratory component of this course offers hands-on exercises related to Earth materials, interpretation of topographic and geologic maps, principles of geologic time, and plate tectonic processes.

GEOL 1122 General Historical Geology
4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
Discusses the origin and geological history of Earth. Methods of interpretation, fossils, geologic time measurements, time scales, physical and organic development of Earth are taught.
Prerequisite(s): GEOL 1121 (may be taken concurrently with permission of instructor).

GEOL 1310 Environmental Geology Lab
1 Credit Hour. 0 Lecture Hours. 2 Lab Hours.
A series of laboratory components that involve hands-on exercises with earth materials and processes which modify the Earth's interior and exterior.
Prerequisite(s): GEOL 1340 or a minimum grade of "C" in GEOL 1011K.

GEOL 1340 Environmental Geology
4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
An introduction to using geologic principles and knowledge to address problems arising from the interaction between humans and the geologic environment. One major component of the course examines geologic hazards, including flooding, earthquakes, volcanic eruptions, and coastal erosion. The other component explores important geologic resources, including water, soils, mineral, and energy, and the way modern society depends on these resources. The laboratory portion of the course consists of hands-on data collection, analysis, and problem solving of geologic and environmental problems related to natural hazards and society's use of Earth resources.
Prerequisite(s): GEOL 1310.
Cross Listing(s): GEOL 1310.

GEOL 1430 Dinosaurs, Extinctions and Disasters
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A review of the dynamic processes of extinction, evolution, and change in ancient animal assemblages. Particular attention will be paid to the unique terrestrial communities that were dominated by dinosaurs, mammoths, and other megafauna. We will focus on the effects of meteorite collisions, ice ages, and mass extinction events.

GEOL 1530 Principles of Oceanography
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is a survey course dealing with the physical, geological, and ecological features of ocean basins and coastlines, as well as chemical composition of ocean water and oceanic circulation processes.
Cross Listing(s): GEOL 1530H.

GEOL 3220 Data Management for Geologists
2 Credit Hours. 2 Lecture Hours. 0 Lab Hours.
This course introduces students to quantitative geological data. Students will be expected to produce professional-looking tables and graphs, and learn how to properly present geological information clearly in written and oral form.
Prerequisite(s): A minimum grade of "C" in GEOL 1011K or GEOL 1121.

GEOL 3520 Field Methods
2 Credit Hours. 0 Lecture Hours. 0 Lab Hours.
Instruction in the tools and techniques used in the collection of field data, compilation of geologic maps and cross sections. Students will construct topographic and geologic maps and write geologic reports and abstracts. The course will consist of three main areas; data sources, data collection, and post-processing. Two weekend field trips are required.
Prerequisite(s): GEOL 1122 and MATH 1112 or MATH 1113.

GEOL 3541 Mineralogy
4 Credit Hours. 3 Lecture Hours. 3 Lab Hours.
An introduction to morphological crystallography, physical properties and the optical characteristics of the common minerals. Examines the genesis, occurrence, and uses of minerals. Laboratory work consists of study of common crystal forms, hand specimen identification and optical study via the petrographic microscope.
Prerequisite(s): CHEM 1211K and a minimum grade of "C" in GEOL 1121 and GEOL 1122.

GEOL 3542 Petrology and Petrography
4 Credit Hours. 0.3 Lecture Hours. 0.2 Lab Hours.
An introduction to the origin, occurrence, and classification of common igneous and metamorphic rocks. Laboratory work consists of combined microscopic and megascopic study of rocks. A three day field trip across the southern Appalachians provides a field study component.
Prerequisite(s): GEOL 3541 and GEOL 1122.

GEOL 3741 Remote Sensing
4 Credit Hours. 2 Lecture Hours. 4 Lab Hours.
Introduction to the concepts, theory, collection, analysis and applications of remotely sensed spatial information. Prerequisite(s): Permission of instructor required.
Cross Listing(s): EOG 3741.

GEOL 3790 Teaching Internship in Geology
1-3 Credit Hours. 0 Lecture Hours. 0 Lab Hours.
Student interns in Introduction to the Earth (GEOL 1121), General Historical Geology (GEOL 1122), or Environmental Geology (GEOL 1340) will participate in teaching the course under the mentorship of a faculty member. Student interns will attend an introductory workshop immediately prior to the start of the semester, will intern in one of the above courses, and meet with the faculty mentor one hour each week. One credit hour is awarded per laboratory section in which the student interns.
Prerequisite(s): A minimum grade of "B" in GEOL 1121 or GEOL 1122 or GEOL 1340.

GEOL 4120 Introduction to Research
2 Credit Hours. 2 Lecture Hours. 0 Lab Hours.
The process of research will be studied from the scientific method through the process of writing a scientific proposal. Construction of a technical paper and the technical oral presentation will be examined and practiced. Usages of geologic terms will be explained and learned. A proposal for a research paper will be selected or assigned, a proposal written and an oral presentation of the proposal research will be made. A minimum grade of "B" is required to continue in the research sequence. Prerequisite(s): Permission of instructor required.

GEOL 4530 Tectonics
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Processes, structures, and land forms associated with the deformation of the earth's crust are studied including the changes that take place on structures and landforms over time. Scales ranging from local, to regional, to global are incorporated.
Prerequisite(s): GEOL 1121 or GEOL 1011K.
GEOL 4610 Senior Seminar
1 Credit Hour, 1 Lecture Hour, 0 Lab Hours.
The process of scientific communication will be investigated and practiced. A final paper on the student's senior research topic will be written and an oral presentation made in a formal "Technical Session" format. The student will learn to prepare visual aids to illustrate his/her paper and talk. The "Technical Session" will be organized and run by students.
Prerequisite(s): GEOL 4830.

GEOL 4790 Internship in Geology
1-6 Credit Hours, 0 Lecture Hours, 0 Lab Hours.
The internship allows students to work in a professional setting related to their chosen concentration in the field. Undergraduate students can earn between one and six credits for internships approved by their academic advisor and the Department's Internship Director. Students must maintain contact with the Internship Director through the course of the internship work, and must submit a written report and a work product at the end of the project. Internship credits can be used for elective credit only and may not substitute for specific degree requirements. Prerequisite(s): Permission of Geology and Geography Internship Director is required.

GEOL 4830 Senior Thesis Research I
3 Credit Hours, 0 Lecture Hours, 0 Lab Hours.
Students will complete a literature review and evaluation and conduct independent research as outlined in their research proposal formulated during Introduction to Research (GEOL 4120). Research is conducted under the direction of a faculty advisor and will lead to the completion of the senior thesis.
Prerequisite(s): A minimum grade of "B" in GEOL 4120 and minimum GPA of 3.0.

GEOL 4831 Senior Thesis Research II
3 Credit Hours, 0 Lecture Hours, 0 Lab Hours.
The process of scientific communication will be investigated and practiced through completion of a senior thesis project. This project includes both a written thesis and research presentation. Students will format a thesis manuscript suitable for publication in a professional journal, and design and deliver an oral presentation suitable for a professional conference.
Prerequisite(s): A minimum grade of "B" in GEOL 4830.

GEOL 5090 Selected Topics
1-9 Credit Hours, 0-9 Lecture Hours, 0-9 Lab Hours.
This course provides a means by which new courses can be offered for experimental purposes.
Prerequisite(s): Permission of instructor required.
Cross Listing(s): GEOL 5090G.

GEOL 5090G Selected Topics
1-9 Credit Hours, 0-9 Lecture Hours, 0-9 Lab Hours.
This course provides a means by which new courses can be offered for experimental purposes. Graduate students will complete an individual term project or special report.
Prerequisite(s): Completion of GEOG 3542 or permission of instructor required.
Cross Listing(s): GEOL 5090.

GEOL 5131 Economic Mineralogy
3 Credit Hours, 2 Lecture Hours, 3 Lab Hours.
An introduction to the origins of industrial and metallic mineral resources, and the exploration, discovery and use of such resources. Laboratory work includes identification and evaluation of mineral resources and visits to mines.
Prerequisite(s): GEOL 3541.
Cross Listing(s): GEOL 5131G.

GEOL 5131G Economic Mineralogy
3 Credit Hours, 2 Lecture Hours, 3 Lab Hours.
An introduction to the origins of industrial and metallic mineral resources, and the exploration, discovery and use of such resources. Laboratory work includes identification and evaluation of mineral resources and visits to mines. Graduate students must complete a paper on an assigned topic.
Prerequisite(s): Completion of GEOL 3541.
Cross Listing(s): GEOL 5131.

GEOL 5132 Regional Field Geology
3 Credit Hours, 3 Lecture Hours, 0 Lab Hours.
A field expedition involving geological investigation of a major geologic region of North America. Students will be expected to make geological observations through such techniques as mapping, measuring sections, collecting scientific samples, or other standard techniques, then to analyze and interpret their observations or measurements. A scientific journal or notebook will be used by each student to record data and observations. A final report will be required. Students usually will bear tuition, travel, and living expenses in the field.
Prerequisite(s): GEOL 1011K or GEOL 1121.
Cross Listing(s): GEOL 5132G.

GEOL 5132G Regional Field Geology
3 Credit Hours, 3 Lecture Hours, 0 Lab Hours.
A field expedition involving geological investigation of a major geologic region of North America. Students will be expected to make geological observations through such techniques as mapping, measuring sections, collecting scientific samples, or other standard techniques, then to analyze and interpret their observations or measurements. A scientific journal or notebook will be used by each student to record data and observations. A final report will be required. Graduate students will complete an individual term project or special report.
Prerequisite(s): Completion of GEOL 1121.
Cross Listing(s): GEOL 5132.

GEOL 5140 Vertebrate Paleontology
4 Credit Hours, 3 Lecture Hours, 2 Lab Hours.
A study of the morphology, classification and geologic significance of vertebrate fossils. Prior completion of GEOL 5142 strongly recommended.
Prerequisite(s): GEOL 1122 or permission of instructor.
Cross Listing(s): GEOL 5140G.

GEOL 5140G Vertebrate Paleontology
4 Credit Hours, 4 Lecture Hours, 0 Lab Hours.
A study of the morphology, classification and geologic significance of vertebrate fossils. Graduate students will complete an individual term project or special report.
Prerequisite(s): Completion of GEOL 1122 or permission of instructor; GEOL 5141 strongly recommended.
Cross Listing(s): GEOL 5140.

GEOL 5141 Paleontology
4 Credit Hours, 0 Lecture Hours, 3 Lab Hours.
A final paper on the student's senior research topic will be written and an oral presentation made in a formal "Technical Session" format. The student will learn to prepare visual aids to illustrate his/her paper and talk. The "Technical Session" will be organized and run by students.
Prerequisite(s): GEOL 1122.
Cross Listing(s): GEOL 5141G.
GEOL 5141G Paleontology
4 Credit Hours. 0,3 Lecture Hours. 3 Lab Hours.
This course provides an overview of the major principles, applications, and methods of paleontology. Topics covered in this course include, but are not limited to: the formation of fossils, fossil identification and classification, evolution and extinction, biostratigraphy, biogeography, paleoecology, and functional morphology. Labs utilize a diverse collection of invertebrate fossils and paleontology software. Graduate students will complete a special report, not required of undergraduates.
Prerequisite(s): Completion of GEOL 1122.
Cross Listing(s): GEOL 5141.

GEOL 5142 Stratigraphy and Sedimentation
4 Credit Hours. 3 Lecture Hours. 2 Lab Hours.
Introduction to the principles and application of stratigraphy and biostratigraphy, and principles of sedimentation. Emphasis is placed on concepts of time, time-rock, rock units, sedimentary facies, guide fossils and fossil range and description of rocks in time and space, their correlation and interpretation. Petrologic interpretation and basic laboratory techniques are also demonstrated. The origin and distribution of sedimentary rocks is examined from initial weathering through erosion and transportation, to environments and mechanisms of deposition.
Prerequisite(s): GEOL 3541.
Cross Listing(s): GEOL 5142G.

GEOL 5142G Stratigraphy and Sedimentation
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
Introduction to the principles and application of stratigraphy and biostratigraphy, and principles of sedimentation. Emphasis is placed on concepts of time, time-rock, rock units, sedimentary facies, guide fossils and fossil range and description of rocks in time and space, their correlation and interpretation. Petrologic interpretation and basic laboratory techniques are also demonstrated. The origin and distribution of sedimentary rocks is examined from initial weathering through erosion and transportation, to environments and mechanisms of deposition. Graduate students will complete an individual term project or special report.
Prerequisite(s): Completion of GEOL 3541.
Cross Listing(s): GEOL 5142.

GEOL 5230 Earth Science
3 Credit Hours. 2 Lecture Hours. 3 Lab Hours.
A systematic study of the earth as a planet, including aspects of its atmosphere, oceans, lithosphere, soils and physiography. The laboratory will emphasize the location and utilization of local, as well as regional materials for earth science teaching and learning. This course cannot be used for upper-level course credit in the Geology BA, Geology BS, or Geology Minor programs.
Prerequisite(s): Permission of instructor required.
Cross Listing(s): GEOL 5230G.

GEOL 5230G Earth Science
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A systematic study of the earth as a planet, including aspects of its atmosphere, oceans, lithosphere, soils and physiography. The laboratory will emphasize the location and utilization of local, as well as regional materials for earth science teaching and learning. Graduate students will complete an individual term project or special report. This course cannot be used for upper-level course credit in the Geology BA, Geology BS, or Geology Minor programs.
Prerequisite(s): Permission of instructor required.
Cross Listing(s): GEOL 5230.

GEOL 5231 General Oceanography
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an integrated approach to the study of oceans with special emphasis on geology, chemistry, and biology of ocean basins. Studies will include the ecological, physical, and geological features of ocean basins, as well as chemical composition of ocean water and oceanic circulation processes. This course cannot be used for upper-level course credit in the Geology BA, Geology BS, or Geology Minor programs.
Prerequisite(s): GEOL 1121 or GEOL 5230.
Cross Listing(s): GEOL 5231G.

GEOL 5231G General Oceanography
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
This course is an integrated approach to the study of oceans with special emphasis on geology, chemistry, and biology of ocean basins. Studies will include the ecological, physical, and geological features of ocean basins, as well as chemical composition of ocean water and oceanic circulation processes. This course cannot be used for upper-level course credit in the Geology BA, Geology BS, or Geology Minor programs.
Prerequisite(s): Completion of GEOL 1121 or GEOL 5230 or GEOL 5230G. Cross Listing(s): GEOL 5231.

GEOL 5340 Barrier Island Environmental Geology
4 Credit Hours. 2 Lecture Hours. 6 Lab Hours.
This course is an on site, direct observation study of the physical processes that create barrier islands and drive their geologic and environmental evolution. The course will cover principles of coastal geology and barrier island hydrogeology. Students will observe and document the diverse environments of a Georgia barrier island and the effects of coastal erosion and sea level rise on island environments and wildlife habitat. Students will also explore the anthropogenic impacts to these environments and resources, practice field science observation and documentation skills, and develop research and presentation skills through team research projects during an eight to ten day residence on St. Catherines Island.
Prerequisite(s): Permission of Instructor.
Cross Listing(s): GEOL 5340G.

GEOL 5340G Barrier Island Environmental Geology
4 Credit Hours. 2 Lecture Hours. 6 Lab Hours.
This course is an on site, direct observation study of the physical processes that create barrier islands and drive their geologic and environmental evolution. The course will cover principles of coastal geology and barrier island hydrogeology. Students will observe and document the diverse environments of a Georgia barrier island and the effects of coastal erosion and sea level rise on island environments and wildlife habitat. Students will also explore the anthropogenic impacts to these environments and resources, practice field science observation and documentation skills, and develop research and presentation skills through team research projects during an eight to ten day residence on St. Catherines Island. Graduate students can expect more comprehensive and rigorous assessments as well as additional work based on the graduate field of study.
Prerequisite(s): Permission of instructor.
Cross Listing(s): GEOL 5340.

GEOL 5431 Coastal Geology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Coastal Geology will comprise an introduction to a variety of coastal environments and landforms as well as the physical and geological processes that shape them. Coastal hazards and issues related to the ecology and management of the coast will also be discussed. The course will include two required weekend fieldtrips to coastal areas in the southeastern United States. Prior completion of GEOL 5142 strongly recommended.
Prerequisite(s): GEOL 1122 or permission of instructor. Cross Listing(s): GEOL 5431G.
GEOL 5431G Coastal Geology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Coastal Geology will comprise an introduction to a variety of coastal environments and landforms as well as the physical and geological processes that shape them. Coastal hazards and issues related to the ecology and management of the coast will also be discussed. The course will include two required weekend fieldtrips to coastal areas in the southeastern United States. Graduate students will complete an individual term project or a special report.
Prerequisite(s): Completion of GEOL 1122 or permission of instructor; GEOL 5142 strongly recommended.
Cross Listing(s): GEOL 5431.

GEOL 5440 Structural Geology
4 Credit Hours. 0.4 Lecture Hours. 0 Lab Hours.
A systematic study of geologic structures resulting from rock formation and deformation. Attention will be given to recognition and solution of structural problems.
Prerequisite(s): GEOL 3542 and MATH 1112 or MATH 1113.
Cross Listing(s): GEOL 5440G.

GEOL 5440G Structural Geology
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
A systematic study of geologic structures resulting from rock formation and deformation. Attention will be given to recognition and solution of structural problems. Graduate students will complete an individual term project or special report.
Prerequisite(s): Completion of GEOL 3542 and MATH 1112 or MATH 1113.
Cross Listing(s): GEOL 5440.

GEOL 5530 Geomorphology
3 Credit Hours. 0.2 Lecture Hours. 0.3 Lab Hours.
A systematic study of landforms and the processes which create and modify them.
Prerequisite(s): GEOL 1122 or GEOG 1111.
Cross Listing(s): GEOL 5530G.

GEOL 5530G Geomorphology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A systematic study of landforms and the processes which create and modify them. Graduate students will complete an individual term project or special report.
Prerequisite(s): Completion of GEOL 1122 or GEOG 1111.
Cross Listing(s): GEOL 5530.

GEOL 5541 Hydrogeology
4 Credit Hours. 3 Lecture Hours. 2 Lab Hours.
A survey of hydrogeology that includes the occurrence, distribution, movement and chemistry of subsurface waters. Emphasizes subsurface hydrology (hydrogeology), but will also include related aspects of surface systems. Major topics covered will include: 1) relationships between precipitation, runoff, and infiltration; 2) porosity and permeability of various earth materials; 3) subsurface movement of water through earth materials; 4) basic chemical characteristics of natural waters; and 5) current water resource issues such as supply, quality, contamination, and remediation. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): Completion of GEOL 3542. Cross Listing(s): GEOL 5541.

GEOL 5541G Hydrogeology
4 Credit Hours. 4 Lecture Hours. 0 Lab Hours.
A survey of hydrogeology that includes the occurrence, distribution, movement and chemistry of subsurface waters. Emphasizes subsurface hydrology (hydrogeology), but will also include related aspects of surface systems. Major topics covered will include: 1) relationships between precipitation, runoff, and infiltration; 2) porosity and permeability of various earth materials; 3) subsurface movement of water through earth materials; 4) basic chemical characteristics of natural waters; and 5) current water resource issues such as supply, quality, contamination, and remediation. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): Completion of GEOL 3542. Cross Listing(s): GEOL 5541.

GEOL 5542 Advanced Hydrogeology
4 Credit Hours. 3 Lecture Hours. 2 Lab Hours.
In-depth study of hydrogeologic and geochemical principles with emphasis on quantitative techniques. Various laboratory and field techniques will be covered, including the use of numerical models and aquifer testing.
Prerequisite(s): GEOL 5541.
Cross Listing(s): GEOL 5542G.

GEOL 5542G Advanced Hydrogeology
4 Credit Hours. 3 Lecture Hours. 2 Lab Hours.
In-depth study of hydrogeologic and geochemical principles with emphasis on quantitative techniques. Various laboratory and field techniques will be covered, including the use of numerical models and aquifer testing. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
Prerequisite(s): Completion of GEOL 5541.
Cross Listing(s): GEOL 5542.

GEOL 5740 Sea Turtle Natural History
4 Credit Hours. 2 Lecture Hours. 6 Lab Hours.
A field-based course in which students work as sea turtle conservation scientists by monitoring beaches and documenting and recording nesting activity during an 8 to 10 day residence on St. Catherines Island, Georgia. Students will prepare for field work with two days of lectures on the GSU campus as well as a training session on GA DNR nest monitoring protocols, prior to field work on St. Catherines Island. Students will keep a daily field journal and prepare a paper on loggerhead sea turtles, documenting nesting behavior, nesting habitat, hatchling emergences and threats to hatchlings and adults using images acquired during their daily monitoring activity.
Prerequisite(s): Permission of instructor.
Cross Listing(s): GEOL 5740G.

GEOL 5740G Sea Turtle Natural History
4 Credit Hours. 2 Lecture Hours. 6 Lab Hours.
A field-based course in which students work as sea turtle conservation scientists by monitoring beaches and documenting and recording nesting activity during an 8 to 10 day residence on St. Catherines Island, Georgia. Students will prepare for field work with two days of lectures on the GSU campus as well as a training session on GA DNR nest monitoring protocols, prior to field work on St. Catherines Island. Students will keep a daily field journal and prepare a paper on loggerhead sea turtles, documenting nesting behavior, nesting habitat, hatchling emergences and threats to hatchlings and adults using images acquired during their daily monitoring activity. Graduate students can expect more comprehensive and rigorous assessments as well as additional work based on the graduate field of study. Graduate students will also complete a resource notebook or term project.
Prerequisite(s): Permission of instructor.
Cross Listing(s): GEOL 5740G.

GEOL 5890 Directed Study
1-4 Credit Hours. 0-3 Lecture Hours. 0-3 Lab Hours.
Well prepared geology majors may be permitted to carry on independent study upon the recommendation of one of the geology/geography faculty.
Prerequisite(s): Permission of instructor. Cross Listing(s): GEOL 5890G.
GEOL 5890G Directed Study
1-3 Credit Hours. 1-3 Lecture Hours. 0 Lab Hours.
Well prepared geology majors may be permitted to carry on independent study upon the recommendation of one of the geology/geography faculty. Graduate students will be given an extra assignment determined by the instructor that undergraduates will not be required to do.
**Prerequisite(s):** Permission of instructor required.
**Cross Listing(s):** GEOL 5890.

GEOL 6097 Special Topics Geol Res & Envi
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
Detailed presentation of a selected topic in geological sciences. May be repeated for credit for a maximum of 6 credit hours, if topic is different.

GEOL 6100 Historical Geology
3 Credit Hours. 3 Lecture Hours. 0 Lab Hours.
A review of the history of the Earth. Determining geologic time, the history of life as revealed in the fossil record, reconstructing a chronology of events from associated rock bodies. This course is a survey of historical geology but is designed primarily for students enrolled in graduate education programs, and credit may not be earned in both GEOL 3100 and GEOL 6100.