

Geology Course Descriptions, Fall 2019

GEOL 100 Earth in Action

If you ever found a rock and wondered, what it was, or how it was formed or where it came from, this class is perfect for you. This class is a 3 credit hour introductory geology lecture that covers a variety of topics (topics may differ depending on instructor). In this class you will learn about: the scientific method, different spheres of the Earth and their interactions, theory of plate tectonics, basics of earthquake and volcanoes and the science of climate change. Various techniques of active learning and student engagement such as virtual reality field trips (and real field trips for First Year Seminar section) are used.

GEOL 103 (Geology Laboratory) may be taken with this lecture course to make it an elective with a laboratory section. It is also offered online through Global Campus. K-State 8 tags Historical Perspectives, Natural and Physical Sciences

GEOL 102 Earth through Time

The purpose of this course is to tell you the story about how the Earth came to be, how the planet and life on it evolved from its formation 4.5 billion years ago to the present, and to discuss the interconnectedness of the physical and biological realms. You will also learn how scientists know all that! By the end of the course, you should be able to (1) understand the internal and external processes in the Earth, (2) have a general notion of the techniques applied to historical geology, and (3) have an overall view of the history of the Earth, understanding the interrelationship between major events and the evolution of life, geologic time; plate tectonics and the evolution of continents, oceans; history of life as revealed in the geologic record; and past climates.

GEOL 103 (Geology Laboratory) may be taken with this lecture course to make it an elective with a laboratory section. It is also offered online through Global Campus. K-State 8 tags Historical Perspectives, Natural and Physical Sciences

GEOL 103 Geology Laboratory

This class is a 1 credit hour introductory geology laboratory that meets once a week for 2 hours. In this lab you will learn about basic geology topics in a hands-on active session. The topics include identification of rocks and minerals, geologic maps, topographic maps, streams and groundwater and landforms. During the lab session you will use an augmented-reality sandbox to learn about topographic maps, virtual reality field trips to learn about different landforms, a stream table to learn about evolution of river beds over time and many other hands on activities involving mineral and rock specimens, and different maps.

Prerequisite or co-requisite: GEOL 100, GEOL 102, or GEOL 125. K-State 8 tag Natural and Physical Sciences

GEOL 104:

This class is a 1 credit hour introductory geology laboratory that meets once a week for 2 hours. This course is designed to introduce you to the basic principles and tools of the geosciences and their applications, *without a prerequisite of a 3 credit hour intro-level geology lecture course*. In this class, you will have an opportunity to learn about fundamental concepts in geology and participate in labs that apply the tools used by working geologists. During the lab session you will use an augmented-reality sandbox to learn about topographic maps, virtual reality field trips to learn about different landforms, a stream table to learn about evolution of river beds over time and many other hands on activities involving mineral and rock specimens, and different maps.

K-State 8 tag Natural and Physical Sciences

GEOL 115 Environmental Geology

This course is intended to provide you with a scientific overview of geology as it relates to human activities and the interaction between human activity and geological processes. In particular, we will investigate (a) the physical constraints imposed on human activities by the near-surface and surface geological processes that are continually shaping the environment that we live in, (b) the resources that we utilize to sustain our lives on Earth, and (c) global environmental issues such as climate change, geologic hazards, natural resources and water use.

This course is also offered online through Global Campus. K-State 8 tag Global Issues and Perspectives, Natural and Physical Sciences

GEOL 125 Natural Disasters

This introductory lecture course introduces you to geological phenomena such as earthquakes, volcanic eruptions, tornadoes, hurricanes and floods, with particular emphasis on their causes, effects and significance as hazards. By enrolling in this course, you will learn about Earth's processes, gain an appreciation for natural forces that impact our lives in very significant ways, and become a better-informed citizen. This course meets natural and physical science and social science requirements of K-State 8.

Geology 103 (Geology Laboratory) may be taken with this lecture course to make it an elective with a laboratory section. It is also offered online through Global Campus. K-State 8 tag Natural and Physical Sciences and Social Sciences. A First-Year Seminar section is offered in the fall.

GEOL 360 Quantitative Geoscience

Learn quantitative and applied methods for collecting and analyzing data in geoscience as well as making decisions from a variety of datasets. Study geological issues and work on techniques to solve problems in science and industry-related topics from various areas such as environmental engineering, geochemistry, petrology, and geology. Understand the nature of

data and compile large databases to gain better insights. Develop computational skills through the use of Excel and MATLAB.

GEOL 502 Mineralogy

Minerals are the fundamental building blocks of the Earth and as you might imagine, if we want to understand how the Earth works, we have to understand minerals. As a society, we consume large amounts of minerals to perpetuate life as we know it. Furthermore, minerals have considerable significance on the quality of our environment (e.g., storing hazardous wastes), are used in many technological applications, and are often amazing to observe. This course will: (1) help you understand how matter is arranged in the solid Earth; (2) enable you to link the geological processes and the composition of minerals with atomic-scale processes; (3) learn to identify common minerals by macro- and microscopic techniques. The course includes both a lecture and lab component.

K-State 8 tag Natural and Physical Sciences and Empirical and Quantitative Reasoning

GEOL 520 Geomorphology

Geomorphology is the study of the processes shaping Earth's surface and the landforms and deposits that they produce. In this class we examine how earth materials are moved and generate landforms. We consider how rocks weather to produce soil and sediment and study the importance of water moving across and near Earth's surface. We look at the processes active on hillslopes and the landforms they produce, and flow through channels and down drainage basins. We also study the geomorphic processes dominated by the presence of ice and wind and the spectacular landscapes that are created. The geomorphology class has a lecture and lab component.

K-State 8 tag Natural and Physical Sciences

GEOL 530 Structural Geology

Structural geology is the field of geology that studies the deformation within the rocks. Tectonic forces within the crust are able to build mountains, form faults and to deform very strong rocks. All these deformation processes are important to understand because they are linked to human key questions such as hazard and environmental assessments, resources exploration and production and civil engineering. During this course, we will make an introduction to the fundamentals of structural geology with an emphasis on the rock mechanics and will review the different styles of deformation and structures observable in the crust in response to tectonic stresses. In addition, students will be introduced to the concept of structural geology applied to mapping and will learn how to measure the principal structures (planes, lines) through practical exercises in class and in the field as well as the common tools in structural geology such as stereographic projection and balanced cross-section.

K-State 8 tag Natural and Physical Sciences and Empirical and Quantitative Reasoning

GEOL 560 Field Methods

Geology is a field-based discipline that necessitates numerous field investigations either to produce geological maps, estimate natural hazards or to look for natural resources. For this, geologists make observations of the earth at different scales, from satellite imagery to an outcrop or rock. These observations are then plotted on maps using either paper or more sophisticated GIS software. In this class students will have the opportunity to learn different basic field methods and use their knowledge on specific problems. The primary goal of the course is to provide students the basic tools and skills for further field investigations. This class includes two 2-day mapping projects.

K-State 8 tag Natural and Physical Sciences and Empirical and Quantitative Reasoning

GEOL 581 Principles of Paleontology

If you like fossils, this course is the perfect opportunity to learn about how the remains of past life are preserved in the rocks and how fossils provide information about evolution and past life on Earth (and the past environments those organisms inhabited). You will also learn how to identify common fossil groups, especially those found in Kansas. You don't need to be a Geology major to learn all that; this course is accessible to all majors!

GEOL 640 Introduction to Geophysics

This course covers the various geophysical methods used for studying the subsurface (seismology, gravity, magnetic and electrical methods), and is designed to benefit students interested in a range of careers including the energy sector, mining industries, engineering and the environmental sector. It provides a fundamental and quantitative description of the physical and chemical processes occurring in the Earth, such as how the decay of radioactive isotopes contributes to the heat flow of the mantle and how this and the cooling of the Earth are at the origin of plate tectonics.

GEOL 711 Water Resources Geochemistry

This course is aimed at understanding in detail the fundamental (primarily thermodynamic) controls on the composition of natural waters and the response of natural waters to variations in various physico-chemical parameters. It also explores applications to environmental problems such as contaminant migration in waters (groundwaters, surface waters); weathering; oceanography; etc. It will develop skills in numerical solutions to problems related to the behavior of components in natural waters (including various water reservoirs- lake water, stream water, rain water, groundwaters and oceans). It encourages growing familiarity with simple analytical techniques for the characterization of natural waters.

GEOL 730 Petroleum Geology

This course is an introduction to petroleum geoscience, emphasizing the petroleum system and economic hydrocarbon origin, migration and accumulation.

GEOL 738 Formation Evaluation

This course aims to develop skills in methods used by industry to evaluate potential hydrocarbon reservoirs, emphasizing casing point decision making. It includes projects on well log interpretation, petro-physical calculations, log corrections, and post-drilling decision workflows through lectures, discussions, laboratory exercises and/or field trips.

GEOL 742 Seismic Data Interpretation

Seismic data is essential in exploration and development of hydrocarbon prospects. This course covers fundamentals of 3D seismic data interpretation and seismic modeling with emphasis on key stages in a seismic data interpretation flow. Those key stages include seismic-to-synthetic tie, horizon picking and seismic attributes extraction, seismic resolution analysis, thin-layer effects, structural interpretation, seismic stratigraphy, and seismic attributes analysis for reservoir-rock property prediction and hydrocarbon prospectivity assessment. An industry interpretation platform (currently Kingdom Suite from Seismic Mico-technology) is utilized during a 3D seismic data loading and interpretation project to enable hands-on experience.

GEOL 760 Geochemical and Biogeochemical Modelling

The overall objective of this course is to help you conceptualize the complex network of chemical and biological interactions that occur in geochemical systems and learn quantitative methods used to analyze them. To achieve this goal, you will use geochemical modeling software to work through a series of computer exercises. The write-up for each exercise will summarize some of the background geochemistry relevant to the exercise and also provide step-by-step instructions that guide your use of the software. Throughout each exercise, you will answer questions related to the model simulations and geochemistry concepts. Those questions will serve as the basis for in-class discussions.

GEOL 810 Isotope Geology

The principal goal of the course is to understand how variations in radiogenic and stable isotopic abundances can be used to understand Earth processes and their evolution over time. You will learn various techniques of radiometric dating and how to use these to determine the age of Earth materials and events; be able to explain how radiogenic isotopes are used as tracers of geologic processes, including evolution of the continental crust and mantle, but also near surface processes such as movement of groundwater; be able to explain how isotopes of carbon and nitrogen can be used to reconstruct the history of life and how they are used to infer such things as diet and the paleodiets of animals and humans; be able to explain how isotopes of oxygen and carbon are used to understand the water and carbon cycles and to reconstruct the Earth's climate history, including recent anthropogenic changes.