

Geology Course Descriptions – Spring 2022

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 course to make it an elective with a lab section. It is also offered online through Global Campus. K-State 8 tags Historical Perspectives, Natural & 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 course to make it an elective with a lab section. It is also offered online through Global Campus. K-State 8 tags Historical Perspectives, Natural & 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 riverbeds 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 & Physical Sciences

GEOL 105: Oceanography

The oceans: their boundaries, contents, and processes.

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 offered online through Global Campus. K-State 8 tag Global Issues & Perspectives, Natural & Physical Sciences

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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 course to make it an elective with a lab section. It is also offered online through Global Campus. K-State 8 tag Natural & Physical Sciences, and Social Sciences.

GEOL 503: Petrology

In Petrology, you will learn to recognize common igneous, metamorphic, and sedimentary rocks in both hand specimen and by using microscope techniques. In addition, you will learn to interpret parts of the geologic history of the rocks. A rock's mineralogy, mineral textures, mineral chemistry, and bulk chemistry provide a language that we can read and ultimately interpret as a way of understanding the geologic history of a particular location or time period on the Earth.

GEOL 540: Geologic Record of Climate Change

Introduction to the major forcing and feedback mechanisms responsible for climate change. Reconstructing past climates using various geologic indicators including climate-sensitive sedimentary facies, paleosols, fossil species distributions, the microfossil record, and stable isotopes.

GEOL 605: Introduction to Geochemistry

Knowledge you can gain from this course has a lot of practical value for all areas of Earth and environmental science and engineering. In this course, we will build on the concepts you learned in undergraduate chemistry courses and learn how to apply them to geological environments. From this course you will gain an understanding of controls on the distribution of elements and chemical reactions of significance in geological environments. Furthermore, you will be able to apply geochemistry concepts to evaluate compositions of Earth materials and analyze geochemical processes.

GEOL 611: Hydrogeology

You will understand the physical processes underlying the movement of fluids through the subsurface. You will also understand the transport of particulates and solutes, including contaminants, within flow regimes. You will learn more than concepts and terminology; you will develop the ability to quantitatively solve problems encountered in professional practice. You will learn how these problems arise in addressing contaminated sites, remediating subsurface pollution, and managing and protecting groundwater resources. You will also understand how to extend the concepts toward understanding the flow of fluids (oil, water, gas) in aquifers and reservoirs.

GEOL 625: Introduction to Engineering Geology and Petrophysics

This course will give you an overview of geological engineering including basic rock properties, petrophysical tools and interpretation concepts. Lectures and associated class projects provide a practical understanding of the interpretation of tools and techniques, such as the determination of porosity, fluid content and its

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movement. Both, qualitative (quick look) and quantitative analysis methods are covered. Practical aspects of geological engineering will also be addressed. Practical examples are used throughout and case histories are used to demonstrate specific aspects. The course also covers more recent technologies and techniques, such as nuclear magnetic resonance (NMR) as used for permeability estimation. At the end of the course, you will be able to integrate data to characterize a formation and its fluids.

GEOL 630: Sedimentology and Stratigraphy

Sedimentary rocks cover up to 75% of the Earth's surface, recording the evolution of life and telling the story of how the environments have changed through time. This course will introduce the basic principles of Sedimentology, which deals with how sediments are transported and deposited, and Stratigraphy, the study of the spatial and temporal relations between sedimentary layers that record many of the details of the Earth's history: effects of sea level change, global climate, tectonic processes, and geochemical cycles. By learning about the processes that take place in modern environments, you will be able to interpret and reconstruct past sedimentary environments. In this course, you will develop the skills necessary to describe and interpret sedimentary rocks and stratigraphic successions, so you can understand the geologic history of a region.

GEOL 642: Field Geophysics

This course provides hands-on training in the area of applied geophysics, comprising field and data acquisition and processing experience with applications to near-surface environmental and engineering applications. The syllabus covers several geophysical methods, including seismic reflection and refraction, gravity, analysis of surface seismic waves, electrical resistivity tomography, and ground-penetrating radar. This course enables students to learn how to utilize geophysical equipment and methods to characterize the subsurface, from tens of inches to hundreds of feet, in order to answer questions pertaining to groundwater studies, environmental mapping, and/or engineering site characterization.

GEOL 650: Geomicrobiology

Microorganisms are very small but they have a big impact the world around us. They affect the quality of our water resources, the composition of the atmosphere, the fertility of soils, the abundance and properties of energy resources, and more. This course includes lab and lecture components and will help you learn basic information about microbes and the major biogeochemical cycles, how natural environments influence the activities of microbes, and how microbes, in turn, impact natural environments. Because this course covers basic information about microorganism, you will not need to have much prior experience with microbiology prior to the course. Note that this course satisfies the College of Arts and Sciences Life Science requirement.

GEOL 702: Economic Geology

Do you want to understand how economic mineral deposits form on Earth? This course is a 3-credit hour course focused on how ore deposits, including elements critical to the ongoing energy transition and modern society, form in magmatic, hydrothermal, and sedimentary environments? We will focus on the fundamental concepts of ore-forming processes and the techniques used to decipher how these deposits form (and are found) from a global-tectonic scale to the nanoscale.

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GEOL 740: Regional Geology

Interpretations of structural, stratigraphic, igneous, and tectonic history of selected sites in North America. The course focus is on the geology of the southwestern United States and adjacent parts of Mexico, including Paleozoic tectonics, the Laramide Orogeny, Trans-Pecos magmatism, ongoing Basin and Range extension, and modern processes (e.g., fluvial and desert geomorphology).

GEOL 747: Introduction to MatLab

This course will provide you with a general introduction to MATLAB, including data processing (curve fitting, interpolation, statistics, signal processing), data visualization (2D, 3D graphs), programming, and data export/import. It is an introductory course designed for students who are new to MATLAB, including those who have little experience with other programming languages, although students with experience of programming in other languages will benefit from this course.

GEOL 770: Subsurface Methods

If you have ever been curious how petroleum prospects were generated, or how drill sites are selected, this class is perfect for you. This class is a 3-credit hour geology combination lecture and hands-on lab that covers how subsurface maps are constructed from well data. In this class, you will learn about the reliability of well data, how to construct and evaluate subsurface maps, including structural, stratigraphic, and fault maps. You will learn to estimate potential reserves, create cross-sections, and decide when seismic surveys are appropriate. Real data from the oil and gas industry are used.

GEOL 805: Advanced Igneous and Metamorphic Petrology

The course covers advanced topics in igneous and metamorphic petrology. Over the first half of the course, students explore the geochemical and petrographic characteristics of the common igneous rocks. Main topics to be covered include equilibria relations of the main silicate systems, petrogenesis of the principal igneous rock types and their relation to plate tectonic regimes, and generation and source of magmas. Advanced concepts in metamorphic petrology are covered over the second half of the semester. Topics include review of the principal metamorphic assemblages, phase system projection, phase equilibria, geothermobarometry, and estimation of metamorphic gradient.

GEOL 825: Advanced Engineering Geology and Petrophysics

Advanced Engineering Geology and Petrophysics will provide you with insights into fundamental concepts and theories, combined with practical applications in the area of geological and petroleum engineering. In this quantitative course, you will learn to characterize pore space in rocks and soils via various conventional and unconventional techniques, such as mercury intrusion porosimetry, nuclear magnetic resonance, and image analysis. You will also learn about fundamental terms and concepts such as porosity, fluid saturation, permeability, stress-strain relationship, and geo-mechanical moduli, frequently used to characterize geological formations and reservoir rocks. You will also become familiar with real-world problems faced by environmental consulting companies as well as the oil and gas industry. You will analyze and interpret actual experimental data.

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GEOL 835: Advanced Petroleum Exploration, Imperial Barrel Award Competition

Evaluation of exploration prospects in frontier and underdeveloped petroleum provinces using borehole-derived and geophysical data. Team taught courses that use industry provided datasets and current data management and interpretation software to reach drill or no-drill decisions based on science, risk analysis, and economics.