

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	100	1 units	Coral Reefs	Coral Reefs is an in-depth tour of the biological and physical processes active in modern reef systems to provide a detailed understanding of the ecology of the individual organisms and the complex nature of their interactions within the reef community. Evolution of the reef community is examined, ranging from the crude framework structures formed over one billion years ago by primitive algae to luxuriant and diversified reefs of the modern-day oceans. The implications of man's intervention in the Earth's hydrosphere and atmosphere on the character of future reef communities are also considered.		Mini course.
GEOSCI	101	1 units	Waves and Beaches			Mini course. Rarely offered
GEOSCI	102	1 units	Energy from the Earth	The nature, mode of occurrence, and the technology of exploration and exploitation of energy resources, and their relevance to the present and future world energy needs. Special attention is given to oil, gas, oil shale, tar sands, coal, uranium, and geothermal resources.		Mini course.
GEOSCI	103	1 units	Dinosaurs and Other Failures	This course will provide an introduction to our current understanding of dinosaurs and certain other reptilian groups of the Mesozoic Era. It is intended for students with an interest in geology, paleontology, or evolution, but does not require prior training in these fields. The course will deal with broad features of the evolutionary history of dinosaurs, methods of reconstructing dinosaur behavior and ecology, new developments in our interpretation of the biology of dinosaurs, and possible causes for the extinction of dinosaurs.		Mini course.
GEOSCI	104	1 units	Ice Ages, Past and Future	This course examines the effects of past glaciations on the landscape and on life, and on man in particular. Speculation on the causes of the ice ages that have dominated the Earth for the past million years and predictions of future ice ages, based on current geological research, are examined.		Mini course.
GEOSCI	105	1 units	Continents Adrift	The seemingly stable land masses of the world are in motion. Continental collision and fragmentation are only a few of the attendant processes associated with these motions. This course deals with the modern concept of plate tectonics and continental drift, the processes, and the products of this dynamic system.		Mini course.
GEOSCI	106	1 units	Fossils, Primates, and Human Evolution	The fossil record, particularly that of primates, is used to document the course of human evolution.		Mini course.

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	107	1 units	Volcanoes and Earthquakes	The earth in action; geography of earthquakes and volcanoes and catastrophic events in historic times; size and frequency of occurrence of earthquakes and volcanic eruptions; the products of volcanism, volcanic rocks, and volcanic and geologic activity through geologic time; volcanic exhalations and the evolution of the earth's atmosphere and oceans; the relationship of earthquakes and volcanoes to plate tectonics and the internal dynamics of the earth; and volcanism and geothermal energy, man-made earthquakes, and earthquake prediction and control.		Mini course.
GEOSCI	108	1 units	When Earth Attacks: The Science Behind Natural Disasters	Natural disasters, such as earthquakes, volcanic eruptions, tsunamis, landslides, floods, hurricanes, and tornados, can lead to thousands of fatalities and billions of dollars in economic damage. This course explores the science behind natural disasters, concentrating on our ability, or inability, to predict them, and how this affects public perception and policy. The course also addresses how natural disasters can lead to changes in both science and public policy.		Mini course.
GEOSCI	109	1 units	Water and Society	This course will present an overview of problems encountered through the unwise use of water resources and the resultant impact on society through the analysis of case studies. An introduction to the hydrological cycle and principles of surface and groundwater hydrology will be provided.		Mini course.
GEOSCI	110	1 units	History of the Oceans	The history of past oceanic life, events, and environments as recorded in seafloor sediments is examined and discussed.		Mini course.
GEOSCI	111	1 units	Climate and Humankind	This mini-course addresses topics concerning weather and climate factors, specifically how climate affects humans and how humans affect climate.		Mini course.
GEOSCI	112	1 units	Geological History of Michigan			Mini course. Rarely offered
GEOSCI	113	1 units	Planets and Moons	A current survey of the geology of the solar system in light of the extraordinary advances in planetary exploration during the past decade. Historical development of geological ideas about the solar system, including processes on earth and those of other bodies in the solar system.		Mini course.
GEOSCI	114	1 units	Global Warming	Review of the geological evidence for global warming including geochemistry of natural and anthropogenic greenhouse gases, global radiation balance, sediment and ice core records, and ancient hot climates with discussion of possible remediation methods and their economic and political context.	Advisory Pre-requisite: High School math, physics, and chemistry.	Mini course.

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	115	1 units	Earth and Life Through Time	General survey of geologic time, its measurement, dimensions and implications for rates of geological change. A review of the geological history of the earth and the solar system to provide a framework for discussions of the evolution of life and development of the continents through time.		Mini course.
GEOSCI	116	5 units	Introductory Geology in the Field	An introduction to geology in the field, this course is the equivalent of GEOSCI/ENVIRON 119/118 but is taught at Camp Davis, the University's Rocky Mountain Field Station near Jackson, Wyoming. Principles and processes involved in the evolution of the earth are stressed. The course includes rigorous laboratory exercises in which students study minerals, rocks, fossils and structures in their natural settings. Lectures are given both in camp and in the field, but much time is spent outdoors in the nearby Teton, Hoback, Gros Ventre, and Snake River Ranges. Other trips of special significance include the Wind River Range. Craters of the Moon, and Yellowstone Park.		Offered at Camp Davis in Jackson, Wyoming. See the GeoSci web site for details.
GEOSCI	118	1 units	Introductory Geology Laboratory	A one-term laboratory course covering the laboratory portion of Introduction to Geology. The laboratory provides hands-on experience with minerals, rocks, and maps. Participants will learn to identify common minerals and rocks, use topographic and geologic maps, and draw and interpret geologic cross sections. Examples will be drawn from areas of recent glaciation, volcanism, and earthquakes to show how these features are depicted in maps.	Advisory Pre-requisite: Prior or concurrent enrollment in GEOSCI 119, or 205 and 206, or 135.	
GEOSCI	119	4 units	Introductory Geology Lectures	GEOSCI 119 is a basic single-term course in introductory geology concentrating on the evolution of the Earth in physical and chemical terms. Reference to the interaction of the external biosphere—atmosphere—hydrosphere with the earth's interior is an essential component of the course.	Advisory Pre-requisite: Concurrent enrollment in ENVIRON or GEOSCI 118 for the lab	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	120	4 units	Geology of National Parks and Monuments	This course approaches Earth history by examining the geology of places rather than by taking a process approach. It is designed for all interested undergraduates at the University of Michigan. The course format consists of three lectures each week and one two-hour demonstration-laboratory period, for four credits. Lecture material deals with the geologic history of selected national parks and monuments, which are chosen and scheduled so that those in which the oldest rocks are exposed (thus relating to the earliest portions of Earth history) are covered first. In so doing, we cover Earth history in a temporal progression, but do so by discussing different geographic areas. The demonstration-laboratory portion of the course will give you first-hand experience with rocks, minerals, and fossils; and an opportunity to discuss these in small groups.		
GEOSCI	122	3 units	Extreme Weather	This course provides an introduction to the physics of extreme weather events. The course uses examples of the thunderstorms, jet stream, floods, lake-effect snowstorms, lightning, thunder, hail, hurricanes, and tornados to illustrate the physical laws governing the atmosphere. Participants apply these principles in hands-on storm forecasting and weather analysis assignments.		
GEOSCI	125	3 units	Evolution and Extinction	The course examines the concepts of evolution and extinction, stressing the role that the fossil record has played in their development. The broad patterns in history of life are presented starting with earliest evidence of life on earth. Basic geological principles necessary for reconstructing earth history are introduced. Readings are drawn from a variety of sources, including primary scientific literature.		Usually offered Winter Term
GEOSCI	130	4 units	The Physical World	The physics, chemistry, and pre-calculus (algebraic) concepts of comprehensive Earth and planetary science will be covered for those students who feel less than fully prepared for existing college-level science classes. The course is aimed at students in need of a science course, particularly those who will not readily select more than one physical science course as undergraduates at UM.	Advisory Pre-requisite: High-school algebra.	
GEOSCI	135	3 units	History of the Earth		Advisory Pre-requisite: High school chemistry, physics, and mathematics recommended.	Rarely offered

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	140	3 units	Science and the Media	In this the technological century, nothing is more important than the effective communication of scientific and technical problems and progress. We will examine the relationship between science and the media through a series of case studies of recent and important scientific breakthroughs, primarily from earth and environmental sciences.	Advisory Pre-requisite: High school science highly recommended. Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	141	3 units	How to Build a Habitable Planet		Advisory Pre-requisite: Only first-year students (including first-year students with sophomore standing) may pre-register for this course. All other students need permission of instructor.	First year seminar
GEOSCI	142	3 units	From Stars to Stones	This seminar starts from stellar evolution and the formation of the elements in stars, and ends at the formation of terrestrial planets from these elements and their early evolution (especially the Earth). Students learn cosmochemical and geochemical concepts and methods and apply them to several theme topics. Though factual knowledge is an important part of the course, emphasis is on how scientists study and solve problems and how science progresses using historical examples.	Advisory Pre-requisite: High school math and science. Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	143	3 units	Gems and Gem Material		Advisory Pre-requisite: Only first-year students (including first-year students with sophomore standing) may pre-register for this course. All other students need permission of instructor.	First year seminar Rarely offered
GEOSCI	144	3 units	Climate Change: Peril or Pork?	This course explores climate change. Topics include surface validation, political significance, and air/water pollution.		First year seminar Rarely offered
GEOSCI	145	3 units	Evolution of the Earth		Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	146	3 units	Plate Tectonics	Two hundred million years ago the Earth's continents were joined together to form one gigantic super-continent, called Pangea. Plate tectonic forces broke Pangea apart and caused the continents to drift. We study the evidence for plate tectonics and the large-scale dynamics of the Earth's interior that is responsible for mountain building, earthquakes faulting, volcanic eruptions, changes in Earth's magnetic field and much more.	Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	147	3 units	Natural Hazards	This seminar examines the geologic origin, as well as economic and societal impact of natural hazards such as earthquakes, volcanoes, landslides, floods, tsunamis, climate change, and meteorite impacts through lectures, discussion, student presentations, and research projects.	Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	148	3 units	Environmental Geology	This seminar will focus on a wide spectrum of possible interactions between people and their physical environment. Fundamental principles important to the study of environmental geology will be presented followed by readings of case histories and discussions of selected environmental problems, in particular those of anthropogenic origin.	Advisory Pre-requisite: High school math and science. Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	149	3 units	Contemporary Dinosaurs		Advisory Pre-requisite: Only first-year students (including first-year students with sophomore standing) may pre-register for this course. All other students need permission of instructor.	First year seminar
GEOSCI	150	3 units	Dinosaur Extinction and Other Controversies	Geological observations have had a profound impact on our understanding of the origin and evolution of life on Earth. This course seeks to provide the broad historical and conceptual background required to critique geological and evolutionary theory.	Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	151	3 units	The Ice Ages: Past and Present		Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	152	3 units	Coastal Systems and Human Settlements		Advisory Pre-requisite: Only first-year students (including first-year students with sophomore standing) may pre-register for this course. All other students need permission of instructor.	First year seminar
GEOSCI	153	3 units	Earthlike Planets		Advisory Pre-requisite: High school science and math recommended. Only first-year students (including first-year students with sophomore standing) may pre-register for this course. All other students need permission of instructor.	First year seminar
GEOSCI	154	3 units	Ocean Resources	Survey of oceanography and the resources of the ocean. Consideration of conflicts arising from overexploitation and competing uses of the ocean and its resources.	Advisory Pre-requisite: High school science and math recommended. Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	155	3 units	Evolution of North America	Concepts about earth history based on ancient rock record. 4-day field trip around Lake Huron to examine roots of a mountain belt, a meteorite impact site, glacial deposits, rock formed during continental flooding due to global warming. Students master a geological framework from which to examine rocks in the field.	Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar
GEOSCI	156	3 units	Coral Reef Dynamics		Advisory Pre-requisite: High School natural science or Biology.	First year seminar Rarely offered
GEOSCI	157	3 units	History of Earth Science	This course will explore the development of ideas in the history of earth science and the evolution of our understanding of the earth and its environment, from the classical scholars to the plate tectonic revolution. Students will learn central geological concepts and develop a sense for the nature of science and the scientific method within the historical context.	Advisory Pre-requisite: Enrollment restricted to first-year students, including those with sophomore standing.	First year seminar

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	170	1 units	Matter, Life, and Environment	A world that is increasingly pervaded and influenced by science demands a basic knowledge of the natural world and an understanding of the human role in shaping our environment. This minicourse explores critical aspects of science in a changing world, including matter, life, energy and climate effects of today's economies.	Advisory Pre-requisite: No credit granted to those who have completed or are enrolled in Global Change I.	
GEOSCI	171	4 units	Introduction of Global Change: Physical Processes	Students learn about the evolution of the universe, Earth, our changing environment and our planets living organisms. Global Change I, which is part of the GC curriculum, assumes no prior science background. Homework and laboratories use computer-based systems modeling and analysis, and includes a group presentation.		
GEOSCI	172	4 units	Introduction to Global Change: Human Impacts	An introduction to the evolution of life and the human species on earth, with focus on problems of global change produced by recent human advances in technology and institution.		
GEOSCI	175	4 units	The Microbial World: How Unseen Organisms Shape Our Planet	This course examines how microorganisms shape the world around us, both throughout the Earth's history and today. Major topics include the origin and evolution of life, the interplay between microbes and the environment, roles of microbes in global warming, and applications of microbiology in biotechnology and energy.		
GEOSCI	201	3 units min / 4 units max	Introduction to Physical Geography: The Earth System	This introduction to physical geography emphasizes the nature and dynamics of the earth system including the atmosphere, hydrosphere and solid earth, along with their interactions. Topics include weather systems, climate change, biogeography, soils, plate tectonics, erosion, fresh water resources, landforms, and ice ages, all of which are discussed in the context of Earth Systems Science.		Usually offered Fall Term
GEOSCI	204	3 units	The Planets: Their Geology and Climates		Advisory Pre-requisite: High school mathematics through plane geometry and trigonometry.	
GEOSCI	205	2 units	How the Earth Works: The Dynamic Planet			
GEOSCI	206	2 units	How the Earth Works: The Water Cycle and Environment	Earth surface processes as they affect water and the global biogeochemical environment. Quantifies rates of water and elemental exchange between major earth surface reservoirs. Surface rock weathering and geochemical exchange described.		

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	207	2 units	How the Earth Works: A Hands-On Experience	A two-credit, 200-level 'practicum' for students that combines a one-hour lecture with a two-hour hands-on laboratory session on environmental geology issues. The class is aimed at non-science students, but may be used as a pre-concentration lab requirement in environmental geology.	Advisory Pre-requisite: Completed or enrolled in GEOSCI 205 or 206	
GEOSCI	208	1 units	Hot Topics in the Earth Sciences	Seminar participants attend the weekly Smith Lectures, read the posted topical articles, and post a weblog entry each week discussing the lecture. Topics include the hottest debates in science such as climate, global change, natural hazards, water and resources, evolution and origin of life, and the future of the planet.		
GEOSCI	210	3 units	Scientific Discovery in Earth Sciences: A Research Experience	This course allows students to participate in scientific discovery by collecting and analyzing data, testing hypotheses, reaching potential conclusions, and writing the prototype of a scientific paper within a research topic of their interest (e.g., study of helium in the crust, lakes in Antarctica, reconstruction of past climate).		
GEOSCI	222	3 units	Introductory Oceanography	The oceans of earth, their circulation, biology, chemistry, geology of the sea floor, and marine resources. Emphasis is on understanding the oceans as a single ecosystem.		
GEOSCI	223	1 units	Introductory Oceanography, Laboratory	Laboratory course to be elected concurrently with Geology 222/Environ 232. One three-hour lab each week.	Advisory Pre-requisite: Concurrent enrollment in GEOSCI 222/ENVIRON 232	
GEOSCI	231	4 units	Elements of Mineralogy	General survey of properties of inorganic solids including elementary crystallography and crystal chemistry, with emphasis on application to mineralogical and geological problems. Laboratory study of mineral properties and an introduction to optical properties of the more important minerals. Field trip required.	Advisory Pre-requisite: Prior or concurrent enrollment in CHEM 125/126/130 or 210/211.	Usually offered Fall Term
GEOSCI	232	4 units	Earth Materials		Advisory Pre-requisite: Prior or concurrent enrollment in CHEM 125/126/130 or 210/211.	Rarely offered
GEOSCI	239	4 units	Zoom: A History of Everything	This interdisciplinary course in "Big History" integrates the human story with its terrestrial and cosmic surroundings. It uses the notion of "powers of ten" to shift perspectives in space and time. It proceeds logarithmically, "nesting" each topic (and disciplinary perspective) within its predecessor, from astrophysics to history and back again.		
GEOSCI	241	2 units	Gems&Gem Materials			Rarely offered
GEOSCI	284	4 units	Environmental Geology	Deals with interactions between people and Earth. It begins with an introduction to geologic materials and processes and goes on to specific topics such as soil, surface and groundwater, natural hazards (volcanism, landslides, earthquakes, floods, coastal processes), geomedicine, and waste disposal.		

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	305	4 units	Sedimentary Geology	Properties of sediments and their origin, transportation, desposition, lithification, and diagenesis followed by ecology and environmental analysis, paleoecology, facies analysis, and an introduction to stratigraphic methods and principles.	Advisory Pre-requisite: An introductory geological sciences laboratory course.	Usually offered Fall Term
GEOSCI	310	4 units	Petrology	Principles of partial melting, crystallization, magma eruption, and responses of deep-seated rocks to changes in pressure and temperature. The unifying theme is the role of magmatism, volcanism, and metamorphism in the formulation and evolution of oceanic and continental crust within a plate tectonic context. Microscopic study of rock suites with the polarizing microscope in the lab.	Advisory Pre-requisite: GEOSCI 231 and permission of instructor	Usually offered Winter Term
GEOSCI	311	3 units	Geology of Michigan	This course is suitable for students with a limited background in science and geology. Basic principles of geology are outlined in the course and used to explore the 4 billion years of geologic evolution of the Upper Great Lakes region by way of lectures and interpretation of geologic maps.		Usually offered Spring Half-Term
GEOSCI	320	4 units	Earth Systems Evolution	Introduction to the physics and chemistry of Earth, Gravitational energy, radiative energy, Earth's energy budget, and Earth tectonics are discussed along with chemical evolution and biogeochemical cycles. The connections among the carbon cycle, silicate weathering, and the natural greenhouse effect are discussed.	Advisory Pre-requisite: MATH 116	
GEOSCI	321	4 units	Earth Systems Dynamics	This course will describe the major wind systems and ocean currents that are important to climate studies. The primary equations will be developed and simple solutions derived that will explain many of these motions. The relations among the dynamics and other parameters in the climate system will be illustrated by examples from both paleo and present day systems.	Advisory Pre-requisite: Preceded or accompanied by MATH 215 or 216.	Usually offered Winter Term
GEOSCI	325	3 units	Environmental Geochemistry	This course deals with the geochemistry of our environment. It focuses on the geochemistry of the lithosphere, hydrosphere and atmosphere and the ways in which they affect the biosphere. Applications of these principles to present-day problems in environmental geochemistry are discussed.	Advisory Pre-requisite: Introductory chemistry.	Usually offered Winter Term

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	331	4 units	Climate and Climate Change	This course examines the physical and chemical processes influencing Earth's climate, and methods for quantifying past and present climate change. Emphasis will be placed on understanding the mechanisms of climate change from ice ages through the near future. The evidence of human-caused changes in climate will also be discussed. Students with interests in global change and the environment are encouraged to enroll. A background in college science is not required.	Advisory Pre-requisite: Working knowledge of high school algebra and physical sciences.	
GEOSCI	341	5 units	Ecosystem Science in the Rockies	This is a 4-week course taught at Camp Davis, WY using the Rocky Mountains as a field laboratory to gain field-based knowledge and experience while developing an understanding of geological and meteorological processes and the distribution and function of grasslands, forests, and alpine ecosystems of the region. This course is designed for majors in geological and environmental sciences, natural resources and other students who have a general interest in this subject matter.	Advisory Pre-requisite: Introductory course in Geology, Ecology, or Global Change.	Offered at Camp Davis in Jackson, Wyoming. See the GeoSci web site for details.
GEOSCI	344	3 units	Sustainable and Fossil Energy: Options and Consequences	This course introduces students to concepts and environmental consequences of sustainable and fossil energy sources. Students conduct hands-on experiments using alternate energy systems at Camp Davis. In addition, the class travels throughout Wyoming and Idaho visiting and investigating facilities important for power generation.	At least one previous course in Physical Sciences or Engineering and permission of Instructor.	Offered at Camp Davis in Jackson, Wyoming. See the GeoSci web site for details.
GEOSCI	351	4 units	Structural Geology	Description and analysis of geological structures in the Earth's crust and introduction to global tectonics. Three lectures and one laboratory session weekly. The following topics are covered: the description of geological structures; the kinematics and dynamics of folding and faulting; stress, strain, deformation and rheology; introduction to dislocation theory; micro-structural analysis; principles of plate tectonics; selected orogenic systems of the world.	Advisory Pre-requisite: One introductory geological sciences laboratory course	Usually offered Winter Term
GEOSCI	380	4 units	Mineral Resources, Economics, and the Environment	This course deals with mineral resource-related problems in a complex society. The course discusses the origin, distribution, and remaining supplies of mineral resources in terms of the economic, engineering, political, and environmental factors that govern their recovery, processing, and use. Topics covered in the course include nuclear waste disposal, strip mining, continent-scale water transfers, mineral profits and taxation, and estimation of remaining mineral reserves.	Advisory Pre-requisite: No previous courses in Geology or other sciences are required.	Usually offered Fall Term

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GEOSCI	408	2 units	Introduction to GIS in the Earth Sciences	This course provides an understanding of the fundamental principles of Geographic Information Systems (GIS) and their application in the broad realm of earth sciences. Through a combination of lectures, laboratories, and field exercises, students are exposed to GIS theory and application, and develop competencies with conventional GIS software.	Advisory Pre-requisite: Intro Geology course	Rarely offered
GEOSCI	409	4 units	Earth System Modeling	Introduction to Earth System Modeling; Discussion of energy balance models, carbon cycle models, and atmospheric chemistry models with multiple time scales; Methods for numerical solution and practice building and analyzing results from models.	Advisory Pre-requisite: GEOSCI 320 and 321; or AOSS 320 and 321	
GEOSCI	410	3 units	Field Studies in Volcanology	This field course (taught from Camp Davis, WY) will focus on the nature and products of both explosive and effusive volcanic eruptions. Students will learn to recognize different volcanic deposits in the field and how to infer the magnitude and style of eruption, as well as mechanisms of emplacement.	Advisory Pre-requisite: One introductory GEOSCI laboratory course	Rarely offered
GEOSCI	415	4 units	Introductory Economic Geology		Advisory Pre-requisite: GEOSCI 310	Rarely offered
GEOSCI	416	4 units	Organismal Function and Evolution	Organisms must obey the basic laws of physics, thus their morphology is governed or constrained by them. The course introduces the relevant principles of physics and explores how organisms can be understood in terms of the environment they encounter.	Advisory Pre-requisite: BIOLOGY 162 or 171 or 172, or GEOSCI 418; MATH 115; PHYSICS 125.	
GEOSCI	417	2 units	Geology of the Great Lakes	Geologic history of the late-glacial and post-glacial Great Lakes of North America, with emphasis on evaluation of evidence. Related topics such as lake circulation, bedrock setting, and physical environment of sedimentation, and paleoclimate records are examined.	Advisory Pre-requisite: An introductory course in Geology (GEOSCI 116, 119, 120 or 205/206/118), BIOLOGY 162 or 171 or 172, or Oceanography (GEOSCI 222/223), OR permission of instructor.	
GEOSCI	418	3 units	Paleontology	Introduction to the principles, methods of analysis and major controversies within paleontology; familiarization with the fossil record and its use in problems involving evolutionary biology, paleoecology, and general earth history.	Advisory Pre-requisite: An introductory course in Geology (GEOSCI 116, 119, 120 or 205/206/118) or BIOLOGY 162 or 171 or 172.	Usually offered Winter Term
GEOSCI	419	1 units	Paleontology Laboratory	This laboratory course involves observation, analysis and interpretation of fossil material. Its goal is to give students experience dealing with paleontological problems and to develop a familiarity with the morphology, systematics, ecology, and evolutionary history of important groups of fossil organisms.	Advisory Pre-requisite: Prior or concurrent enrollment in GEOSCI 418.	
GEOSCI	420	3 units	Introductory Earth Physics		Course Pre-requisite: MATH 116 or 156 or 176 or 186 or 295	Usually offered Fall Term

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	421	3 units	Principles of Physical Oceanography	This course examines the fundamentals of physical oceanography; the physical properties of the ocean and water masses; circulation of the atmosphere, sea surface and deep waters; the behavior of light and sound in the ocean; surface and internal waves; tides; and coastal oceanography including the circulation of estuaries and lagoons.	Advisory Pre-requisite: GEOSCI 222 and 223; MATH 115 and 116.	
GEOSCI	422	3 units	Principles of Geochemistry	Instruction is directed toward how geochemical methods, such as stable isotope and trace element analysis, radioactive age dating, determination of phase relations of minerals and melts at low to high temperature and pressure, and computation of or experimentation on equilibria in the hydrosphere, hydrothermal solutions, and metamorphic and igneous systems, can unravel and provide insight into the origin and chemical evolution of the earth and its parts (core, mantle, crustal rocks).	Advisory Pre-requisite: GEOSCI 231, 305, 310 and CHEM 125/126/130.	
GEOSCI	424	3 units	Introductory Cosmochemistry and Early Evolution of Planets		Advisory Pre-requisite: MATH 116, PHYSICS 126, and CHEM 130. Knowledge of mineralogy, petrology and geochemistry preferred, but not required.	Rarely offered
GEOSCI	426	3 units	Mineral Physics	The course provides a foundation in the physics of major earth-forming materials and the role of mineral physics in the interpretation of the structure, composition, and dynamics of the earth. Essential concepts from thermodynamics, statistical mechanics, and quantum mechanics are introduced and applied in the context of minerals of the solid earth.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	427	3 units	Environmental and Technological Applications of Mineralogy	This course will introduce basic principals in mineralogy and materials science with their application to environmental and technological problems. Topics will include phase transitions, corrosion and alteration, trace element behavior, colloids and surfaces. Materials discussed will include clays, soils, cement, zeolites, and actinide/toxic metal phases.	Advisory Pre-requisite: GEOSCI 231/232, comparable courses in the solid-state, or permission of instructor	
GEOSCI	428	3 units	Mineral Surface Chemistry	This course will introduce the surface sensitive techniques to determine the composition, atomic and electronic structure of material surfaces. Examples will be studied on fundamental processes such as surface stability and reactivity in environmental mineralogy or in catalytic processes in the atmosphere, in soils, in sediments, and in technical applications.	Advisory Pre-requisite: One course in mineralogy, petrology, solid state chemistry, solid state physics, or materials science.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	429	4 units	Computational Mineralogy	This course will introduce molecular simulation techniques to simulate the atomic and electronic structure of bulk minerals and mineral surfaces. Fundamental properties such as structure, thermodynamics, electronic and magnetic behavior, reactivity and dynamic processes will be studied. These are important in environmental mineralogy, petrology, and in environmental and technical applications.		
GEOSCI	430	3 units	Depositional Environments		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	431	1 units	Introduction to Optical Mineralogy		Advisory Pre-requisite: Graduate standing and permission of instructor.	
GEOSCI	433	1 units min / 4 units max	Field Studies in Economic Geology		Advisory Pre-requisite: Permission of instructor.	Rarely offered
GEOSCI	434	1 units min / 4 units max	Field Studies in Geophysics, Tectonics, and Structure		Advisory Pre-requisite: Permission of instructor.	Rarely offered
GEOSCI	435	1 units min / 4 units max	Field Studies in Mineralogy, Petrology, and Geochemistry		Advisory Pre-requisite: Permission of instructor.	Rarely offered
GEOSCI	436	1 units min / 4 units max	Field Studies in Stratigraphy, Paleontology, and Sedimentology		Advisory Pre-requisite: Permission of instructor.	Rarely offered
GEOSCI	437	4 units	Evolution of Vertebrates	Lectures and laboratory exercises on the anatomy, ecology, and phylogeny of fishes, amphibians, and reptiles in the fossil record, with emphasis on adaptation and evolution.	Advisory Pre-requisite: GEOSCI 125 or BIOLOGY 162 or 171 or 172.	
GEOSCI	438	4 units	Evolution of the Primates		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	439	4 units	Fossil Record and Evolution of Mammals	Contribution of fossil record to our understanding of the evolutionary process and the origin, radiation, and systematic relationships of mammals. Emphasis on functional anatomy, origin of modern mammalian orders in the Paleocene and Eocene, and the Cenozoic faunal history of mammals.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	440	8 units	Field Course in Geology	In this broad, in-depth field course, students are trained to recognize distinct lithological units and their 3-D relationships. Mapping projects include deformed and faulted sedimentary, regional metamorphic, and igneous complexes. Digital mapping techniques and modern geophysical tools supplement traditional field observations.	Advisory Pre-requisite: Successful completion of courses in two or more of the following topics: mineralogy, sedimentary geology, igneous and metamorphic petrology, and structural geology.	Offered at Camp Davis in Jackson, Wyoming. See the GeoSci web site for details.
GEOSCI	442	4 units	Earth Surface Processes and Soils	Study of processes resulting in landforms on the Earth's solid surface and the formation of soils on these landforms. Emphasis includes present-day processes as well as the evolution of landforms over geologic time. Several required field trips will examine landforms and processes in southern Michigan.	Advisory Pre-requisite: MATH 115, CHEM 130, and GEOSCI 231 or 232.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	443	4 units	Climate, Tectonics, and the Earth's Surface	This course focuses on interactions and coupling between climate, the Earth's surface, and tectonic processes. This course emphasized a process-oriented approach to quantifying how climate, tectonics, and topography are coupled through erosion. Geomorphic, geochemical, and computational methods for quantifying paleoclimate, tectonic and erosional processes are investigated.	Advisory Pre-requisite: MATH 115 or equivalent and GEOSCI 117 or 119 or equivalent	
GEOSCI	444	3 units	Soils and Their Development		Advisory Pre-requisite: An introductory geological sciences course.	Rarely offered
GEOSCI	445	3 units	Biogeography	The goal of this course is to provide students with an understanding of how evolution proceeds through time in relation to geography. The course explores the limitation of distributions of organisms by barriers, including climate, effects on species formation and extinction, species abundance and richness, dispersal, and vicariance.	Advisory Pre-requisite: GEOSCI, BIOLOGY 162. Historical Geology is recommended.	
GEOSCI	446	3 units	Principles of Paleoclimatology	Throughout its history Earth's climate has varied tremendously on timescales ranging from millions to tens of years. This course deals with the fundamental physics and dynamics that have controlled these changes in climate. Many of the concepts will be explored through simple models.	Advisory Pre-requisite: MATH 115 and 116 or permission of instructor	
GEOSCI	447	3 units	Archaeological Geology		Advisory Pre-requisite: GEOSCI 442 or 448; and one 300-level (or higher) course in anthropological or classical archaeology.	Rarely offered
GEOSCI	449	3 units	Marine Geology		Advisory Pre-requisite: GEOSCI 222/223 or introductory physical geology (GEOSCI 116, 117, 120 or 205/206/118)	
GEOSCI	451	3 units	Introductory Earth Structure	Interpretation of geological structures in the Earth's crust, and introduction to global plate tectonics. This course is aimed at all who have an interest in the Earth's physical properties beyond the introductory level, which may include graduate students. Geology and oceanography majors should elect GEOSCI 351.	Advisory Pre-requisite: Permission of Instructor.	
GEOSCI	452	3 units	Paleoceanography	This course focuses on global earth system changes over a wide range of spatial and temporal scales. Major climatic events occurring over the last 60 million years and their interaction with biota, ocean, and atmospheric chemistry and sediments are examined.	Advisory Pre-requisite: GEOSCI 117/119, GEOSCI 222	
GEOSCI	455	4 units	Determinative Methods in Mineralogical and Inorganic Materials		Advisory Pre-requisite: One term of Chemistry and Physics	
GEOSCI	458	3 units	X-ray Analysis of Crystalline Materials		Advisory Pre-requisite: GEOSCI 455 or permission of instructor.	Rarely offered

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	465	3 units	Biogeochemical Cycles	Biogeochemical cycles describe how carbon, nitrogen, sulfur, and other elements cycle through not only the atmosphere, the oceans, and the landmasses of the earth. This course is useful to students in many fields including engineering, atmospheric science, chemistry, biology, geology, natural resources, and public health. The biogeochemical cycles of water, carbon, nitrogen, and sulfur; the atmosphere and oceans as reservoirs and reaction media; the fate of natural and human-made sources of carbon, nitrogen, and sulfur compounds; the interactions among major biogeochemical cycles and resultant global change: greenhouse gases, acid rain, and ozone depletion.	Advisory Pre-requisite: MATH 116, CHEM 210, and PHYSICS 240 (or 260).	
GEOSCI	467	3 units	Stratigraphy		Advisory Pre-requisite: GEOSCI 305, 310, and 351.	
GEOSCI	468	2 units	Data Analysis and Model Estimation	This course introduces Earth and physical science students to data analysis techniques and methods for constraining model parameters. Emphasis is placed on learning conceptual approaches to data analysis and applying these approaches in homework and computer exercises.	MATH 115. Advisory Pre-requisite: Knowledge of, or willingness to learn, a programming language (e.g., Matlab, Mathematica).	
GEOSCI	469	3 units	Experimental Microclimatology		Advisory Pre-requisite: GEOSCI, MATH 115 and 116 and PHYSICS 140 (or 160) and 141.	
GEOSCI	473	3 units	Fundamentals of Organic Geochemistry		Advisory Pre-requisite: GEOSCI, GEOSCI 305 or CHEM 215/216.	Rarely offered
GEOSCI	477	4 units	Hydrogeology	Introduction to physical hydrogeology with particular emphasis on processes and direct applications to geological settings and problem solving. The hydrologic cycle, physical rock framework, and properties of aquifer systems are described and quantified. Groundwater flow and mass transport equations are covered, as well as pump test design and analysis. Natural tracers and groundwater dating are discussed.	Advisory Pre-requisite: High school knowledge of PHYSICS, CHEMISTRY, and GEOSCI or equivalent. MATH 116.	Usually offered Fall Term
GEOSCI	478	4 units	Geochemistry of Natural Waters	Chemical compositions of natural waters, emphasizing both chemical and biogeochemical processes operating near Earth's surface; equilibrium vs. kinetic controls on chemical weathering; solute sources and mass balances in watersheds, groundwater, and river/ocean mixing zones. Hands-on field and lab experience provides training in methods of applied geochemistry.	Advisory Pre-requisite: College Chemistry.	
GEOSCI	479	3 units	Marine Geochemistry		Advisory Pre-requisite: GEOSCI, CHEM 125/126/130.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	483	4 units	Geophysics: Seismology	Elastic properties of rocks, elastic waves, seismological instruments and data, use of body wave travel times, surface wave dispersion, and periods of free vibrations to infer the structure and composition of the earth's interior; earthquake intensity and magnitude scales; spatial, temporal, and magnitude distribution of earthquakes, earthquake source mechanisms, seismological contributions to understanding of earth dynamics and global tectonics, moonquakes, underground nuclear explosions and "man-made" earthquakes, and earthquake prediction and control. Lectures and laboratory.	Advisory Pre-requisite: Prior or concurrent election of MATH 215 and PHYSICS 240 (or 260).	
GEOSCI	484	4 units	Geophysics: Physical Fields of the Earth		Advisory Pre-requisite: Prior or concurrent election of MATH 216 and PHYSICS 240 (or 260).	
GEOSCI	486	3 units	Geodynamics		Advisory Pre-requisite: GEOSCI 420 and prior or concurrent election of MATH 215 and PHYSICS 240 (or 260).	
GEOSCI	487	1 units	Seismology Laboratory		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	488	1 units	Physical Fields Laboratory		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	489	1 units min / 6 units max	Geological Sciences Honors	Readings, discussions, and special work in geological sciences for undergraduate Honors students. May be taken as a one-term or two-term sequence with GEOSCI 490.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	490	1 units min / 6 units max	Geological Sciences Honors	Readings, discussions, and special work in geological sciences for undergraduate Honors students. May be taken as a one-term or two-term sequence with GEOSCI 489.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	496	3 units	Special Topics in the Geological Sciences	A seminar on topics in Geological Sciences. Content varies by term and instructor.		
GEOSCI	497	1 units	William T. Smith Lecture Seminar	Focuses on current earth science research presented in the Dept Geological Sciences Department's W.T. Smith Lecture Series. Students attend a group seminar and the W.T. Smith Lecture each week and read a paper by the weeks' speaker. The seminar group also critically evaluates the substance and style of each presentation.	Advisory Pre-requisite: Two required Geological Sciences concentration core courses.	
GEOSCI	498	1 units min / 6 units max	Research or Special Work	Research or special work in geological sciences for undergraduate or graduate students. May be taken as a one-term or two-term sequence with GEOSCI 499.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	499	1 units min / 6 units max	Research or Special Work	Research or special work in geological sciences for undergraduate or graduate students. May be taken as a one-term or two-term sequence with GEOSCI 498.	Advisory Pre-requisite: Permission of instructor.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	500	2 units	Introduction to Computer Programming in the Geological Sciences	Computational methods in the geological sciences have become increasingly important for graduate students. This course provides an introduction to computer programming. The course is hands-on with the grade determined by computational problem sets.		
GEOSCI	501	3 units	Element Micorpaleo		Advisory Pre-requisite: GEOSCI, GEOSCI 119 and 118 or equivalent; GEOSCI 418	
GEOSCI	503	2 units	Advanced Computational Methods in the Geological Sciences	Computational methods in the geological sciences have become increasingly important for graduate students. This course continues the survey of the most important computational techniques begun in GEOSCI 500. The course is hands-on with the grade determined by weekly computational problem sets.	Advisory Pre-requisite: GEOSCI 500 recommended or permission of instructor	
GEOSCI	504	3 units min / 4 units max	Sources and Cycling of Inorganic Nutrients and Pollutants	This course will explore the chemical, physical, and biological processes that result in the release, transport, and fate of inorganic nutrients and pollutants in the environment.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	506	3 units	Building a Habitable World	This course provides an overview of the long-term evolution of the Earth's tectosphere, hydrosphere, and atmosphere and examines how changes to those systems have affected and been affected by the biosphere over the whole of Earth's 4.6 billion year history.	Advisory Pre-requisite: CHEM 130, MATH 116, and GEOSCI 422; or permission of instructor.	Usually offered Winter Term
GEOSCI	507	4 units	Igneous Petrography and Petrogenesis		Advisory Pre-requisite: GEOSCI 310	
GEOSCI	508	4 units	Metamorphic Petrology	Comprehensive examination of metamorphic processes and laboratory analogues. Evaluation of metamorphosed rock types and metamorphic facies. Coverage of recently discovered high pressure assemblages from deep mantle. Laboratory exercises on rock suites with microscope with introduction to SEM, microprobe. Required field trip.	Advisory Pre-requisite: GEOSCI 231 and 310 or GEOSCI 431; Graduate standing.	
GEOSCI	510	4 units	Paleobiology	This course emphasizes theory, quantitative methods, and hypothesis testing as applied to paleontological questions at scales from the subparts of individuals to the entirety of the fossil record. Topics include systematics, morphometrics, evolutionary rates, stratigraphic ranges, stratigraphic completeness, biomechanical, and functional morphology. Laboratories provide exposure to introductory programming, relevant software, and biomechanical equipment.	Advisory Pre-requisite: GEOSCI 418, 437, 438, 439, or BIOLOGY 351, MCDB 413, BIOLOGY 443. Graduate standing.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	511	4 units	Paleobiology	This course in paleontology, part of a 2 course sequence that includes GS 510, emphasizes theory, quantitative methods, and hypothesis testing rather than particular groups of organisms. Its subject matter comes from several general areas of paleontology with the focus being methods applicable to many, if not all groups of organisms, at scales ranging from the subparts of an individual to the entirety of the fossil record and life on earth. A variety of problems will be explored including those dealing with ecology, taphonomy, biogeography, systematics, evolutionary rates, stratigraphic ranges, stratigraphic completeness, biomechanics, and functional morphology. Students will be given hands-on experience with introductory programming, uses of existing programs and software, and experimental equipment for biomechanics.	Advisory Pre-requisite: BIOLOGY 171 and PHYSICS 127; Introductory paleontology (GEOSCI 418) and evolutionary biology (EEB 516 or 390); and graduate standing. GEOSCI 510 is recommended.	
GEOSCI	513	2 units min / 4 units max	Microbial Biogeochemistry	This course examines how and why microorganisms (primarily bacteria and archaea) drive geochemical processes. Emphasis is placed on the integration of cellular physiology/metabolism with cycling and transformation of elements. Topics include biomineralization, mineral dissolution and weathering, and critical evaluation of molecular biogeochemical approaches.	Advisory Pre-requisite: Graduate standing.	Usually offered Fall Term
GEOSCI	515	4 units	Tectonics of Oceans and Continents			Usually offered Fall Term
GEOSCI	516	2 units min / 4 units max	Orogenic Systems	This course investigates mountain building and basin formation processes. Emphasis is placed on interdisciplinary techniques for quantifying these processes in active orogenic systems. The course consists of lectures, discussions, student presentations, and hands-on computer exercises where concepts from lectures are implemented.	Advisory Pre-requisite: Calculus I (Math 115 or equivalent), Genreal Physics(Physics 140, 240 or equivalent), an introductory course in geology, graduate student status, or permission of instructor.	
GEOSCI	525	4 units	Tectonophysics		Advisory Pre-requisite: GEOSCI,A basic knowledge of mathematics and physics is required; Permission of instructor.	
GEOSCI	530	3 units	Sediment Diagenesis		Advisory Pre-requisite: Graduate standing and permission of instructor.	
GEOSCI	531	1 units min / 3 units max	Seminar in Geologic Problems		Advisory Pre-requisite: Permission of instructor.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	532	1 units min / 2 units max	Seminar in Climate, Tectonics, and Surface Processes	This seminar discusses the coupling and interactions between climate, tectonics, and Earth surface processes. This interdisciplinary seminar integrates concepts and readings from the fields of paleoclimate, neotectonics, tectonic geomorphology, lithospheric geodynamics, and process geomorphology. Emphasis is placed on learning how to critically analyze various methods, data sets, and arguments presented in the literature. Participants are expected to read and actively discuss current scientific papers.	Advisory Pre-requisite: Permission of instructor.	
GEOSCI	533	1 units min / 2 units max	Seminar in Economic Geology		Advisory Pre-requisite: Permission of instructor.	Rarely offered
GEOSCI	534	1 units min / 2 units max	Seminar in Geophysics, Tectonics, or Structure		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	535	1 units min / 2 units max	Seminar in Mineralogy, Petrology, or Geochemistry		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	536	1 units min / 2 units max	Seminar in Stratigraphy, Paleontology, or Sedimentology		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	537	1 units min / 2 units max	Macroevolution		Advisory Pre-requisite: Graduate standing and permission of instructor.	Rarely offered
GEOSCI	538	3 units	Quantitative Analysis in Geology and Biology		Advisory Pre-requisite: High school math, elementary statistics, and elementary computer skills. Graduate standing.	Rarely offered
GEOSCI	539	1 units min / 2 units max	Seminar in Paleomammalogy		Advisory Pre-requisite: GEOSCI 439 or permission of instructor. Graduate standing.	
GEOSCI	541	1 units min / 2 units max	Seminar in Biogeochemistry	This seminar will provide an in-depth investigation of biogeochemical processes that occur at the Earth's surface. The field is inherently interdisciplinary and will include concepts and readings from ecology, geology, and geochemistry. Participants will be expected to read and actively discuss current scientific papers.		
GEOSCI	542	1 units min / 2 units max	Seminar in Environmental Geochemistry	This seminar will provide an in-depth investigation of various topics in environmental geochemistry. The field is inherently interdisciplinary and will include concepts and readings from environmental engineering, atmospheric chemistry, geology, and geochemistry. Participants will be expected to read and actively discuss current scientific papers.	Advisory Pre-requisite: Graduate standing.	
GEOSCI	552	3 units	Advanced Earth Structure		Advisory Pre-requisite: Undergraduate course in structural geology or permission of instructor.	

	Catalog Number	Number of Credits	Course Title	Description	Prereqs	Notes
GEOSCI	553	3 units	Thermodynamics and Phase Equilibria	Introduction to thermodynamics, phase equilibria and experimental techniques applies to crystalline solids and fluids. Survey of simple inorganic systems at high pressures and temperatures.	Advisory Pre-requisite: GEOSCI 231 and 310; CHEM 468 recommended. Graduate standing.	
GEOSCI	555	3 units	Kinetics of Geochemical Processes		Advisory Pre-requisite: Math through differential equations and GEOSCI 553. Graduate standing.	
GEOSCI	580	3 units	Isotope Geology		Advisory Pre-requisite: Graduate standing.	
GEOSCI	582	4 units	Advanced Mineral Deposits		Advisory Pre-requisite: GEOSCI 415 and 461. Graduate standing.	Rarely offered
GEOSCI	583	3 units	Intermediate Seismology		Advisory Pre-requisite: GEOSCI 483, MATH 450 or permission of instructor.	
GEOSCI	606	4 units	Tectonic Elements		Advisory Pre-requisite: Graduate standing.	
GEOSCI	607	3 units	Tectonics - Advanced Topics		Advisory Pre-requisite: GEOSCI 515 or permission of instructor. Graduate standing.	
GEOSCI	608	3 units	Advanced Isotopes		Advisory Pre-requisite: GEOSCI 580. Graduate standing.	
GEOSCI	622	3 units	Principles of Paleontology		Advisory Pre-requisite: GEOSCI, GEOSCI 418 and 419 or GEOSCI 437. Graduate standing or permission of instructor.	
GEOSCI	650	3 units	Quaternary Stratigraphy		Advisory Pre-requisite: GEOSCI 448 or permission of instructor. Graduate standing.	
GEOSCI	663	3 units	Seismology: Advanced Topics		Advisory Pre-requisite: GEOSCI 483, MATH 450 or permission of instructor. Graduate standing.	
GEOSCI	664	3 units	Gravitational and Magnetic Fields: Advanced Topics		Advisory Pre-requisite: GEOSCI 484, MATH 450, PHYSICS 405 or permission of instructor. Graduate standing.	
GEOSCI	709	1 units min / 6 units max	Thesis Research-A.M., M.S.		Advisory Pre-requisite: Graduate standing and permission of instructor.	
GEOSCI	763	3 units	Heat and Mass Transfer in Geologic Environments		Advisory Pre-requisite: GEOSCI 484, MATH 450 or permission of instructor. Graduate standing.	
GEOSCI	764	3 units	Planetary Interiors		Advisory Pre-requisite: GEOSCI 663, 664 or permission of instructor. Graduate standing.	
GEOSCI	886	2 units	Quaternary Seminar		Advisory Pre-requisite: Permission of instructor.	
GEOSCI	929	1 units min / 6 units max	Investigations in Geology and Mineralogy		Advisory Pre-requisite: Graduate standing and permission of instructor.	
GEOSCI	990	1 units min / 8 units max	Dissertation/Precandidate		Advisory Pre-requisite: Election for dissertation work by doctoral student not yet admitted as a Candidate. Graduate standing. Permission of instructor.	
GEOSCI	995	8 units	Dissertation/Candidate		Course Pre-requisite: Candidate status.	